

**COUNTY GOVERNMENTS' INTERVENTIONS IN ENHANCING FOOD
SECURITY IN KAJIADO COUNTY, KENYA**

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**A THESIS REPORT SUBMITTED TO THE SCHOOL OF LAW, ARTS AND
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AWARD OF THE DEGREE OF DOCTOR OF PHILOSOPHY (PUBLIC POLICY
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SEPTEMBER, 2025

DECLARATION

I confirm that this thesis is my own work and has not been previously submitted to any other educational institution for an award or credit. No part of this research should be presented without my consent or that of Kenyatta University.

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DEDICATION

This thesis is dedicated to my husband Mr. Macharia, My daughter Staisy and my two sons Trevis and Melvis for their unwavering support throughout my studies.

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ACRONYMS AND ABBREVIATIONS

A.I	Artificial Insemination
ASAL:	Arid and Semi-Arid Land
FAO:	Food and Agricultural Organization
GOK:	Government of Kenya
ICESCR	International Covenant on Economic, Social and Cultural Rights
IFIs:	International Financial Institutions
KIAMIS:	Kenya Integrated, Agricultural Management Information systems
NGOs:	Non-Governmental Organizations
SMS:	Short Message Service
SSA:	Sub-Saharan African
VIF:	Variance Inflation Factor
WFP:	World Food Program

OPERATIONAL DEFINITIONS OF TERMS

- Agricultural extension interventions:** This refers to the interventions offered to the farmers by officers who equip farmers with information on crops and animal management, marketing, pests and diseases
- Agricultural extension officer:** This refers to an officer employed to equip farmers with information on crops and animal management, marketing, pests and diseases
- Credit availability interventions:** These are steps/strategies used by county governments to avail credit and financial support to farmers within Kajiado County for purposes of improving farming or starting a agricultural based business.
- Farmer** Refers to any person who owns or manages crops and or livestock
- Food accessibility** This refers to the ability to acquire ample food for a functional and healthy life both physically and financially.
- Food availability** Refers to the ability to have adequate food of high standard either via production or importing it from outside the country.
- Food security** This refers to having all people accessing physically and economically, sufficient and nourishing food that meeting their needs and preference at all times leading to a functional life.
- Food stability** Refers to obtaining and accessing food all the times with no risk of losing it.
- Food utilization** This refers to the ability of the body to absorb, process, and utilize the nutrients in the food to meet body's need for energy, growth, and overall health
- Government policy** Refers to the law, regulation or procedures of government towards a certain agenda. It's the starting point for change

Information Flow	Refers to the exchange of information among people, processes and systems in an area
Moderating effect	Change of the relationship between the variables brought about by another variable known as the moderator.
Political will	Commitment of decision-makers to support and implement specific policies aimed at addressing a particular problem.
Research	Refers to the systematic investigation into the factors, policies, interventions, and outcomes that influence the ability of individuals or communities to obtain sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life.
Research interventions	These refers to strategies that work towards improving outcomes and making a difference in what matters the most.
Technological interventions	Refers to the use of scientific knowledge for practical purposes especially in animals and crops production.

ABSTRACT

Despite the many attempts to enhance food security in Kenya, insufficiency of food and food items remain a challenge in many parts of the country. Many interventions have been instituted in the past with limited results despite heavy investments and government spending both at policy and implementation levels. The main research objective of the study was to establish the effectiveness of county governments' interventions in enhancing food security in Kajiado County, Kenya. The particular objectives was to Determine how technology application interventions has enhanced food security in Kajiado County, to assess the agricultural extensions interventions extent to enhance food security in Kajiado County, to examine how credit availability interventions has enhanced food security in Kajiado County, to determine how the research interventions has enhanced food security in Kajiado County and to establish the moderating effect of government policies on the County government interventions in enhancing food security in Kajiado County. Three theories informed the study namely theory of access, Diffusion of innovation theory and stakeholders theory. Pragmatic research philosophy was used to establish the effectiveness of county governments' interventions in achieving food security in Kajiado County, Kenya. This study used a mixed research design with descriptive and explanatory being employed. The target population comprised of the registered farmers, the agricultural extension officers, and County government officers. A total population of this study was 29,572 respondents which comprised of 29,514 registered farmers, 47 agricultural extension officers and 11 county government officials. The study used a sample size of 411 respondents, employing Nassiuma (2000) formula to get 356 registered farmers and a census of all 47 agricultural officers and 11 County government officers. The study utilized semi structured questionnaires for registered farmers and agricultural extension officers and face to face interview for the County government officials to collect quantitative and qualitative facts. The questionnaire was administered physically with a help of research assistant who was able to understand the local dialect of the community around the county and helped fill the information in google forms. In addition to these, the study used 10 interview schedule questions to collect qualitative data from County government officials. The internal consistency was measured using Cronbach's alpha, where an alpha value of $0.7 \leq \alpha < 0.9$. Data was analyzed descriptively and was subjected to an inferential statistics at 0.05 significance levels and was facilitated by SPSS statistical software, version 21. Content analysis was used to analyze qualitative data involving outlining the useful responses and presenting them in themes in prose form. Diagrams like bar graphs and pie charts together with tables were used to present the findings to easily understand and interpret. The regression model measured the relationship between variables. The diagnostic tests were conducted to ascertain that all the assumptions regarding the multiple linear regression analysis were not violated. The study recommended facilitation of extension officers creating awareness, promotion of policies that incentivize adoption of drought-resistant crops, water harvesting, and sustainable grazing practices to build resilience against climate variability. The study also recommends there should be policy frameworks for flexible loan products aligned with agricultural cycles and non-traditional collateral. It also recommends development of solar-powered irrigation and water storage technologies.

CHAPTER ONE: INTRODUCTION

1.1 Background to the Study

Globally, food is considered as a fundamental right. It is contained in the International Covenant on Economic, Social and Cultural Rights (ICESCR). Article 11 of the ICESCR (1976) acknowledges that food accessibility is a universal human right thus requiring countries to enhance food practices, preservation as well as circulation. It therefore indisputably acknowledges that having food is a fundamental right. The population of people in the world is estimated to grow to 8.5 billion in the year 2030 growing from 7.7 billion in 2021, it is essential to understand the effectiveness of interventions put in place to ensure that food security go hand in hand with population. Despite the global efforts pinpointing and employing suitable policy interventions like enhancing agriculture and distribution of food, food security has remained a great challenge (FAO, 2019). Globally, constant chronic and acute food crisis, show that more and more people are becoming vulnerable to different shocks either economically, politically or even climatically endangering food security (FAO, 2019).

Food insecurity was enhanced by COVID-19 pandemic. Wang and Huang, (2021) argue that even before COVID-19, famine, diminishing incomes and interfered supply chains increasing hunger were rising due to factors, including climate change, pests, conflict, natural hazards and social economic conditions.

The world's most biggest challenge is to feed the ever-growing number of people by increasing production of food with minimal energy and water with limited resources, little fertilizers and pesticides by 2030 (Shukla & Shankar, 2015). Utilizing the existing technology and discoveries of new technologies led to such arrangements. Technology has been used globally to enhance food production. Since mid 1990s, Biotechnology has been used to produce genetically modified organisms (GMOs) (Oloo *et al.*, 2020).

India is among the severely impacted food insecure countries in the world. Its escalating population has exerted pressure on the financial systems. Its government is utilizing biotechnology to achieve desired characteristics in plants and animals to try and boost its food production however; it has not effectively mitigated hunger. The government of India is also focusing on research to enhance food production. Its target is to reinstate 26

million ha of destroyed state, by 2030 to increase food production (Kumar & Sharma, 2020). Different States universities have been engaged to come up with different strategies and new technologies towards the same. The research has had great achievements especially on understanding salinity and water dynamics (Mashal *et al.*, 2021). This means that such research interventions should be emulated by other countries facing various challenges leading to food insecurity.

Bangladesh is a developing country dealing with food insecurity too. Its government has invested in technology which has helped farmers increase their production and income. Digital GeoPotato advisory platform has been effective in helping farmers to receive instant SMS messages informing them when favorable climatic conditions are expected, and how to control pests and diseases. (Singha, 2019). Bangladesh is a small country but it is now among the highest world's potato producer. Further using agricultural extensions the government is trying to provide drought resistant crops which could be planted in the areas that receive unpredictable rainfall with prolonged drought period. This has enhanced food security and reduced drought impact especially to the smallholder farmers (Saha *et al.*, 2019).

In the UK, the failure of UK's welfare state to provide food security to vulnerable citizens in 1920s has been recorded. (Barker *et al.*, 2019). British government has set ways of increasing food security by setting a National Agricultural Research and Extension Institute which has been successful in increasing agricultural productivity (Sukhna *et al.*, 2022). They report that Agricultural extension increased farmers' profitability and production in the local communities. In Guyana, a British colony which depends on agriculture, effective agricultural extension service has been successful in improving food security and reducing poverty. Tsolakis and Srai (2017) reported that small scale farmers were supported by interventions like successful policy making and good governance resulting to industrial development and environmental sustainability in the UK.

In 2022 it was reported that estimated 140 million Africans were acutely food insecure. Andam *et al.*, (2020) reported that in Nigerian many households face food insecurity due to challenges including unemployment, malnutrition and poverty especially among

vulnerable groups. Food insecure population remains intolerably high. In Nigeria, nearly 25 million of the population are estimated to lack food and urgent action need to be taken (Cadre Harmonisé, 2022). The Nigerian government has tried to lay down policies to try increase food production. Agricultural Transformation Agenda (ATA 2012) was set to develop value chains to increase agricultural production for cotton, cassava, cocoa, rice and sorghum. Agricultural Promotion policy was also developed in 2016 whose objectives was that Nigeria should become self-reliant in food production and exports (Elomu *et al.*, 2020). These policies have not brought much significant solution for Nigeria food security and therefore the government ought to come up and implement better policies. Kehinde and Kehinde (2020) did a study in western Nigeria to investigate how credit accessibility impacted food security and they reported a positive impact. They suggested that microcredit scheme should be emulated in other food insecure countries.

Ethiopia was among the worst hit with famine worldwide at the end of the year 2022 WFP says. By the December, 2022 approximately 22.6 Ethiopians (18% of the total population) were suffering from food insecurity across Ethiopia. Interventions on technologies in water harvesting have been minimal in ASALs though some irrigation was done (Gebru *et al.*, 2021) However, there was a constraint of applying the technology in many areas. Ethiopian government gave incentives in areas that agriculture was doing better to encourage farmers to shift from subsistence to commercial agriculture through various means including boosting agricultural, orientation of certain crops for markets and promoting coffee production (Manlosa *et al.*, 2019. Ethiopian government is working together with Technologies for African Agricultural Transformation (TAAT) and seed companies to produce varieties of wheat seeds that are heat tolerant which has been availed to lowland farmers. This intervention has been successful .The land in which the wheat was irrigated increased rapidly. In 2018/19 not more than 5,000 ha were cultivated which increased in the year 2020/21 to 187,240 ha, and to 650,000 ha in 2021/22. The wheat production increased from approximately 2.0 t/ha to 4 t/ha (Tadese, 2022)

Right to food is among the rights guaranteed by the 2010 constitution of Kenya article 43 among others which include proper housing, medical care, education and social security

(GoK, 2010). According to WFP (2022), 4.4 million Kenyan lack food due to extreme drought causing a deteriorating drought in the most affected areas. Kenya has been having delayed and below average rainfall leading to reduced agricultural production for vulnerable agro pastoral and farming households. Most farmers practice small-scale rain fed agriculture. 88% of Kenyan landmass consists of ASAL. This consists of 23 counties that is 9 counties as arid and 14 counties as semi-arid (NDMA, 2016). The Kenyan government interventions on food security include credit accessibility to farmers to enhance their production. One of such initiatives is under the Public Private Partnership framework whereby the government partnered with Equity Bank through the Kilimo Biashara Partnership. According to Equity bank Sustainability report (2021), KShs 8.2 billion was provided to 81,074 farmers through the Kilimo Biashara Loan. 40,000 small scale farmers benefitted, their productivity and profitability increased because of adoption of value added agricultural practices. Training on agricultural practices, agribusiness and financial skills among 65,060 farmers and 3,719 MSMEs was done under the Programme. However, this intervention was not totally effective because not all farmers could access the Kilimo Biashara loan. In spite of the challenges that were experienced, the researcher examined how the government can provide easy loans and cooperatives to enable small scale farmers enhance their food security.

National Agricultural and Livestock Extension Programme (NALEP) was developed by the Kenyan government to offer extension services like facilitating linkages between research institutions and extensions by introducing and distributing grafted fruit crops and other seeds (Borter &Malik, 2023). The study examined how effective such services can be. Kenyan government has also provided subsidized fertilizers to enhance food production. According to Mulupi (2022) who examined how maize production in Kakamega was affected by low cost fertilizers subsidized by the government and reported the average maize productivity increase from 1.97 to 2.265t/ha however it had not been able to attain the potential production level which is 5.5t/ha. The researcher examined the effectiveness of such subsidies and their potential of enhancing food security. Water has been a major challenge in food production in Kenya and the government tried to look into it through ministry concerned. For the MTEF period 2023/2024, 28,732 water pans were constructed across 31 counties by the Kenyan government in the year 2022 to try boost

the food production by irrigation. The effectiveness of this intervention has not been determined.

Kajiado County is among the 29 counties classified as ASALs in Kenya. It has low and erratic rainfall, intense heat and frequent droughts. Activities carried out in the region include pastoralism, livestock herding, tourism and agriculture (Mudekhere *et al.*, 2023). Thousands of residents are food insecure because of prolonged drought and Covid- 19 pandemic effects. Data from the National Drought Management Authority (NDMA Kenya) in the year 2022 shows more than 400,000 families in Kajiado County were facing starvation and that more than a million animals died while many more were starving and required urgent feed and water. NDMA 2022 survey showed that the whole county was adversely affected. The governor declared it as an emergency which needed urgent action to prevent more death of residents and livestock. The County government and other stakeholders offer relief food to the sub-counties affected by the drought. Food and Agricultural Organization also supports the communities affected by the drought (Mutua, 2021).

The County government has been drilling boreholes but due to prolonged drought many of them have dried up (Keega *et al.*, 2023). According to the county's Agriculture, Livestock and Veterinary Services Departmental Scorecard 2017-2022, the county had vaccinated 2,979,445 cattle, trained farmers, constructed 2 daily milk coolers, Borehole were drilled and equipped ; solar panel installed, 135M³ water tank constructed, masonry water kiosk and cattle trough at a Cost: Ksh14.3 Million (Mburu *et al.*, 2023). The county has done these interventions among others which the researcher examined their effectiveness.

Kimaru *et al* (2021) sought to establish the effectiveness of policies involved in drought risk reduction. This was done by scrutinizing the Hay Production in Kajiado County. They reported that legal instruments has been adopted in the country to support disasters specifically droughts. The involved strategies are not well elaborated resulting to poor implementation. It involved building infrastructure on the government farms, without supporting the actual hay farmers. They recommended that implementation should be reviewed to address the hay enterprise's profitability and establish strategies that can be

easily rolled out. Public-private partnerships were also recommended to stabilizing the hay markets, maintaining good-quality hay and provide storage.

Kemboi *et al* (2021) sought to establish Socioeconomic Impacts of drought among Pastoral Community in Kajiado County and their coping mechanisms and adaptation methods. They reported measures like water pans, self-help groups raised capital, Tourism the motor cycle (*boda boda*) transport businesses, milk marketing cooperative and borehole drilling for water adaptive mechanisms. Veterinary services provision and education were the reported drought mitigation measures. Their recommendation included adequate funding to ease drought mitigation, integrated natural resources management to improve coping abilities to drought, and the establishment of vocational and technical trainings to enhance different types of livelihood rather than pastoralism.

Ngugi *et al.*, (2025) emphasizes the importance of provision of agricultural inputs in strengthening household food security in Murang'a County. The study highlights the need for supportive policies and services to overcome existing challenges to ensure that all farmers can benefit from these resources. It advocates for policies that facilitate easy access to agricultural inputs, including subsidies and credit facilities. It recommends strengthening of the extension services and improving infrastructure to support farmers in utilizing inputs effectively. Agricultural extension services play a pivotal role in educating farmers about the effective use of inputs and training programs that focus on best practices for input application which can lead to more efficient use of resources, thereby enhancing food security (Njeru, 2024).

Hoffmann and Jones (2021) on their study on improving food safety on the farm provided compelling evidence that combining subsidies with market incentives can effectively enhance food safety practices among smallholder farmers in Kenya. The study highlights the necessity for policies that integrate both subsidies and market incentives to promote the adoption of food safety technologies among smallholder farmers. The current study examined the effectiveness of agricultural extension in Kajiado County. Wanzala *et al.*, (2024) did a study on impact of agricultural credit on coffee productivity in Kenya and stresses that offering credit facilities can influence agricultural outcomes. It provided

compelling evidence that crediting small farmers can enhance agricultural production. However, the realization of these benefits depends on addressing existing challenges through targeted policy interventions and context-specific strategies. By fostering an enabling environment, smallholder farmers can effectively engage in food production, leading to improved food security outcomes.

Ndungu *et al.*, (2021) on the food insecurity coping strategies and determinants of households' choice of specific coping strategies in Kitui County one of the ASAL counties in Kenya investigated the coping mechanisms employed by households facing food insecurity in Kitui County. It highlighted the socio-economic factors influencing the selection of these strategies across different agro-ecological zone. It advocated for tailored interventions that consider the unique socio-economic characteristics and agro-ecological contexts of different regions within the county. Such targeted approaches can enhance the effectiveness of food security programs and support sustainable livelihoods for affected households. Current study assessed how national government policies influence county interventions in food security.

1.2 Statement of the Problem

In spite of the many attempts to improve food security in Kenya, food insufficiency remains a challenge in many parts of the country. Many interventions have been instituted in the past with limited results despite heavy investments and government spending both at policy and implementation levels. Agriculture being a devolved function has made county governments largely responsible in the execution of food security interventions within their jurisdictions. Despite these interventions, many farmers continue to bear the brunt of adverse climatic conditions, limited access to credit facilities, low-yielding livestock breeds and seeds, limited research interventions as well as ineffective and limited access to extension services (Mutua, 2021). Farmers face challenges accessing the much needed credit services to buy essential farming inputs like seed and fertilizer for planting, installing irrigation systems to supplement rain fed agriculture and for improving livestock breeds as well as providing sufficient feeds for the livestock. While there have been specific increases in certain agricultural programs,

the overall budget for agriculture in Kajiado, as a percentage of the total budget, has been declining in the last five years, despite the total development budget for the sector increasing. In the financial year 2019/2020 Kajiado allocated Ksh 513 million to agriculture, livestock and fisheries which has declined to Ksh 175,361 million in the year 2023/2024 (Kajiado County Fiscal Strategy Paper, 2023).

Studies have been done on the effectiveness of interventions put in place by various governments to enhance food security including Qureshi *et al.* (2015) who examined whether food and nutrition security was improved by public policies that Australia had implemented but did not research on their effectiveness. Bidisha *et al.* (2017) in their study in Bangladesh revealed that the borrowers had increased production since they practiced quality farming after accessing credit. The researcher studied the effectiveness of credit availability interventions in enhancing food security in Kajiado County, Kenya. By doing so, policy makers may formulate and improve food security policy by making the credit available to small scale farmers. Shafiee and Cai (2016) investigated the use of technology in minimizing food waste and enhancing food security in America. The current study established that the technology was effective in enhancing food security in Kajiado County Kenya which is food insecure. Migika (2013) did a study in Nyamira on how agricultural extension services influenced food security. It is against this background that the researcher sought to explore the gaps in an effort to promote effectiveness of interventions to enhance food security.

1.3 Research Objectives

The study specifically sought to:

1. Determine the effectiveness of technology application in enhancing food security in Kajiado County.
2. Evaluate the effectiveness of agricultural extension services in enhancing food security in Kajiado County.
3. Examine the effectiveness of credit availability in enhancing food security in Kajiado County.

4. Determine the effectiveness of research interventions in enhancing food security in Kajiado County.
5. Establish the moderating effect of the national government policies on the County government interventions in enhancing food security in Kajiado County.

1.4 Research Hypothesis

The study was premised on the following hypothesis.

1. H₀₁: Technology application interventions by county government are not significantly effective in enhancing food security in Kajiado County.
2. H₀₂: Agricultural extension services intervention by County government does not significantly enhance food security in Kajiado County.
3. H₀₃: Credit availability interventions are not effective in enhancing food security in Kajiado County.
4. H₀₄: Research interventions are not effective in enhancing food security in Kajiado County.
5. H₀₅: National government policies do not have a moderating effect on food security interventions in Kajiado County.

1.5 Justification and Significance of the study

People of Kenya have continuously faced food insecurity, 4.5million people were food insecure in the year 2022 particularly within the ASAL areas and the urban slums. According to FAO (2022) 3.1million people in ASALs of Kenya were estimated to be food insecure in the year 2022 68% of the food insecure population lived in ASAL areas. Data from NDMA (2022) shows more than 400,000 families in Kajiado County were facing starvation and that more than a million animals had died. The researcher has seen the sufferings that people and animals go through due to food insecurity and that has necessitated the need to examine the interventions that the County government could put in place to avoid the reoccurrence of the menace and break the vicious cycle of hunger. The researcher opted to focus on Kajiado County because it is peri-urban, its proximity to central business district is of interest since flow of information is expected to be faster than other ASAL areas far from towns. Kajiado is predominantly pastoralist region and the rapid land subdivision and privatization are altering traditional land management

practices, impacting grazing areas and access to resources, which can exacerbate food insecurity (Nanyamal, 2023). The County is expansive and farming is practiced both in rural and urban areas. Few interventions features have been put in place and would like to research more on other mitigation features that could be practiced. Another reason is that Kajiado is cosmopolitan with both rural areas where agriculture and pastoralism is practiced and urban areas where many people face food insecurity. This study is justified by the gap in other scholarly work where food insecurity in relation to government interventions has not been significantly addressed. The study focused on the ASAL region of Kenya because it has had the problem of hunger for a long time. It also gave insights to be used by policymakers to come up with policies that appropriately deal with food insecurity menace. As a result policies can be devised to help the governments to implement interventions to help increase food production and distribution.

It also contributed to the mitigation features knowledge by the county governments. It developed new data and interpretations to enhance food security. The study also laid foundations for scholars and researchers to come up with future research. The strategies and methodologies used in this study will aid future researchers interested in pursuing more research in this field. The study demonstrated how government policies influence the interventions done by the county governments to enhance food security. The County officials and the citizens in general will be well equipped and empirically informed on how they can enhance food security as a result of these findings. The study also provided different way of thinking on how things can be done differently to alleviate hunger. It provided recommendations for further studies. Other scholars will be able make criticism and references from it.

1.6 Scope of the Study

Kajiado County is among the Kenyan ASALs regions was the main focus under investigations in this study. It extends to an area of 21,292km² it has 1,117,840 people as of 2019 census (KNBS, 2019). It borders Nairobi, Machakos, Makueni and Taita Taveta to the north and Arusha and Kilimanjaro areas of Tanzania to the south. It consisted of five sub counties and twenty-five county assembly wards. This study used four variables: Technological interventions, agricultural extensions, credit facilitation and research

interventions (Independent variables), Food security (dependent variable) and government policies (moderating variable).

1.7 Study Limitations

The researcher met some people who gave insufficient information for the fear that their challenges might challenge the County ruling party/ leaders. To address this shortcoming, the researcher guaranteed anonymity and confidentiality to the respondents. They were also assured that the findings were only to be used for academics. Kenyatta University and NACOSTI provided an introductory letter which was also provided to ensure that the data was authentic and used for academic reasons. Only willing respondents participated. Moving around in Kajiado County was challenging due to poor road networks in rural areas but the motor bikes means of transport helped a lot in accessing farmers in those areas. Network challenges were experienced in some lower areas, this was overcome by moving to higher grounds

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This section evaluates relevant written works related to the research objectives. As such it covers the Kajiado County government interventions; technological interventions, agricultural extension interventions, credit availability intervention, research interventions and the moderation of government policies. It also includes the theoretical and empirical review and a critique of existing literature and the conceptual framework.

2.2 Empirical Review

2.2.1 Food Security

World Food Summit (1996) defined food security as availability of adequate, safe and nutritious food every time with economic and physical accessibility which must fulfil dietary needs and food preferences for a functional and healthy life (Grote *et al.* 2021) Food security encompasses four key dimensions that is availability, access, utilization and stability (Garcia-Diez *et al.* 2021) These notion are seen as inherently hierarchical, whereby food availability does not necessarily mean it is adequate or accessible neither does it mean it is effectively utilized. Accessibility is related to the individual or household well-being such as the range of food choices, household income and the prevailing prices, safety nets through which food can be accessed (Andam 2020).

Pawlak and Kołodziejczak (2020) in their study on developing countries agriculture and its relation to food security found out that, households' purchasing power, is key in ensuring food availability and accessibility. The two authors argue that countries' technology transfer and productivity enhance high-yielding varieties ensuring food availability. However, the study was done outside Africa and the study filled the gap by studying the effectiveness of government interventions in Kajiado which is one of the ASAL counties in Kenya.

Alabi and Ngwenyama (2023) in their study on the world wide food supply chains disruptions during COVID-19 pandemic reported that the it had a negative effect on food security with regard to impoverished economy, scarcity of worker, food accessibility limitation, transport restriction, closure of food production facilities, unpredictable food

safety and quality and restriction of food trade policies. They provided appropriate strategy have resilient food supply chain like digitizing global food security and food. The researcher did the study in the developed countries US and Canada. The study filled the gap by examining the interventions put in place to enhance food security Post Covid-19 pandemic in Kajiado County which is in a developing country Kenya.

Food availability is all about adequacy of food to all members of the society. It is attained through production, imports, storage, and food aids. Grote *et al.* (2021) revealed that agriculture plays a strategic role in enhancing food availability. Water is also a key resource required for food production. Population growth has put exceeding pressure on existing natural resources. Land degradation has resulted due to climate change degrades land and lack of farming water lead to losses of livelihoods (Lin *et al.* 2022)

Kogo *et al.* (2021) on their climate change study and how it varies revealed the impact of agriculture on food availability and found out how it has been hostile to food production in Kenya. They argue that high population and speedy urbanization which has reduced crop production increasing food insecurity, adaptation to climate change is paramount. They came out with various strategies geared towards improving food production. However the study did not establish how effective those strategies were, the study established effectiveness of the interventions put in place by Kajiado government in increasing food availability to fill the gap left.

Food accessibility is more on having the purchasing power to access the food physically. Food availability does not give assurance of individuals' food security. Concerns about food inaccessibility have made the policymakers focus on how to increase people's incomes and reduction of prices in achieving food security goal (Seligman & Berkowitz 2019). Food accessibility focuses on the peoples' purchasing power to obtain sufficient quantity and quality of nutritious diet. O'Hara and Toussaint (2021) on their study titled food access in crisis reported that food access depends normally on the food prices, available income and access to market. Clapp *et al.* (2022) on their study on dimensions of food security revealed that accessibility answers the question of environment whether socially, physical or political. They indicated that severe droughts and floods are currently more frequently resulting to reduced harvest volume and thus increased food

prices leading to low food accessibility. The current study did not examine the reasons for food inaccessibility but established the effectiveness of interventions to enhance food security thus filling the conceptual gap.

Fraval *et al.* (2019) on their study on food access deficiencies in Sub-Saharan Africa revealed that high proportion of rural population greatly lacked food because of poverty which affected food accessibility. The study was done in Sub Saharan Africa creating a contextual gap which the researcher examined how various interventions put in place by county government can effectively enhance food security in Kajiado County.

Food Utilization is conceptualized to be how the nutrients get to the body and are used. Niu *et al.* (2022) on their study on food waste and its embedded resources reported that the nutritional status is determined by how the food was utilized .They indicate that despite the accessibility and availability of nutritious food the household decides what to purchase and how to prepare it. Misiou and Koutsoumanis (2022) on their study on food safety and spoilage as a result of climate change addressed an overlooked aspect of climate change; the duo addresses the post-harvest handling of food to ensure it's safe for consumption. However the current study addressed the effectiveness of interventions to enhance food security.

Food stability ensures food is accessible by individuals at all times. Even if an individual has sufficient food currently, does not guarantee food security in some periods if it's not available. Diez *et al.* (2021) on their study on how food security is determined by food stability reported that, human and technical resources are paramount in achieving food security. They argue that food stability assurance depends on crop and livestock production and use of their fresh or processed products which provides the population with sufficient food for a healthy life. Generally, there are scanty studies on food security in Kenya and ASAL regions especially in Kajiado County. The current study looked into the effectiveness of interventions put in place in Kajiado County to enhance food availability and accessibility and well utilization and hence food stability.

2.2.2 Technology Application Interventions and Food Security

The information and communication technology (ICT) revolution has had unstoppable effect, cell phones are owned by most farmers where they access advises in agriculture and other agricultural services at low-cost within no time (Norton & Alwang, 2020). ICT is a vehicle which offers farmers information on better input management, improved technologies and better farming techniques. Farmers get knowledge on better markets, higher sales opportunities for their products and thus more efficiency on agricultural markets and thus food availability (Hudson *et. al*, 2017). The growing use of cellular phone technology in both developed and developing countries has provided a significant development opportunity worldwide. Nakasone and Torero (2016) on their study on enhanced food security through ICTs in developing countries pointed out that farm management practices were improved through ICTs leading to the growth of agricultural extension services. They also found out that through technology farmers were acknowledged on prevailing market prices and made informed decisions on when to sell their products.

Since mid-1900s, biotechnology has been around in terms of genetically modified organisms (GMOs) and Genetic Engineering (GE) technology. Oloo *et.al* (2020) on their study on advancing adoption of GMOs in Africa found many restriction factors in Africa specifically Kenya including unfounded fears regarding effect of GMO. According to Hallerman and Grabau (2016) on their study on crop biotechnology reported why societies resist new technology. The duo reported that U.S, saved hundred thousand tons of soils though the adoption of GMO technology, no-tillage agriculture and herbicide tolerant crops. It has also resulted in the development of seeds that are resistant to pests, diseases, and environmental stressors.

Sinyolo (2020) on the study in South Africa among rural households investigated how small scale maize producers in South Africa used technology to enhance food security. Eighty-one percent (81%) of the sampled 513 farmers reported increased harvest during the time of the study. However, the study did not focus on effectiveness on technology in enhancing food security. The current study examined the effectiveness of technology application enhancing food security in Kajiado County.

Kumar *et al.* (2020) studied solar powered irrigation systems and found out that high cost electricity and fuel restrict supply of water for irrigation requirements and converting sun rays to energy play a key role in solving the problem. The solar powered water pumping system increase the sprinklers and water bikes' and make them rotate to its maximum speed and hence spray to a larger area. It also helps in storage of water in tanks for later use. The current study focused on the effectiveness of the technology intervention on supporting irrigation systems to enhance food security in Kajiado County. There are scanty studies on technology and food security in Kenya and especially ASAL regions of Kenya as well as Kajiado County.

2.2.3 Agricultural Extensions Interventions and Food Security

Agricultural extension interventions involve the transfer of awareness in agriculture and technology to farmers to improve their productivity and livelihoods. Maake and Antwi (2022) studied how effective agricultural extension services were perceived by farmers in South Africa. The study established that agricultural extension services require funding to ensure that farmers access latest technologies and practices to enhance food security. Training and capacity building of extension agents was among the requirements to ensure that they possess knowledge to effectively deliver extension services. In support, Toma *et al.* (2021) researched on small-scale farming and food security in Central and Eastern Europe. The survey revealed that between 66% and 80% of the sampled population had minimal education and 3.2% of the farmers were trained implying that the most farmers lacked the necessary knowledge required by the European Union. The study concluded that to enhance food security, more knowledge on agriculture and innovation is paramount. The current study filled the contextual gap created by examining effectiveness of training done as a food security intervention in Kajiado County in Kenya.

Bizikova *et al.*, (2020) studied agricultural interventions for food security enhancement and Sustainable Development Goal number two (2) using literature published between 1990-2017. They indicated that input subsidies and food vouchers plays a great role in enhancing food security among the less fortunate. This research examined the public center only. It was based on the county government of Kajiado and its effectiveness of the intervention put in place to enhance food security.

Kyambo, (2023) investigated the impacts of devolving the agricultural sector on the delivery of extension services and agricultural productivity in Kitui County which is also an ASAL region in Kenya. The challenges of accessing agricultural support services, which are crucial for enhancing productivity and livelihoods was also looked into. Despite the devolution of agricultural services, many challenges hinder effective service delivery. Extension officer's challenges included inadequate transport, delayed salaries, lack of staff promotion, undefined duties leading to duplication, and an un conducive work environment. These challenges resulted in insufficient performance in extension service provision by the county government. The study recommended the need for targeted awareness campaigns, particularly focusing on women and elderly farmers, to ensure equitable access to extension services. This study examined how effective extension officers are in enhancing food security in Kajiado County.

2.2.4 Credit Availability Interventions and Food Security

Availability of credit is among the important factors which lead to more production and higher Gross Domestic Product (Denkyirah *et al.*, 2016). Uaiene *et al.*, (2019) on their study in Mozambique studied the technical efficiency and technology adoption and reported credit led to high farm production and maintained adequate flow of agricultural inputs, modern technologies and modern practices which farmers without credit access could not acquire. Credit accessibility has the ability to enhance food security, reduce poverty and welfare improvement. It is noteworthy that credit availability is still a challenge in underdevelopment countries.

Kehinde and Kehinde (2020) did a study in Nigeria on the impact of credit accessibility on food security and established that credit access enhanced food security. Ankara *et. al.*, (2020) examined the small holders farmers access to credit and effect of savings mobilization in Ghana and found that savings mobilization helped in building access to credit since it would be a collateral in credit accessibility. However, the two studies did not focus on the effectiveness of credit availability. The current study established how effective the county government has made the credit available for small scale farmers without the collateral in Kajiado County to enhance food security.

Karaivanov and Kessler (2018) examined disadvantages and advantages of informal loans KP province in Pakistan and reported that most poor farmers have little access to credit and therefore use informal loans especially from friends and relatives leading to poor investments. The study established that credit accessibility is critical in adoption of improved agricultural technology while lack of it lead to low productivity (Elahi *et al.*, 2018). Failure to access credit facilities eventually incapacitates farmers in obtaining resources thus poor farmers' welfare and income. The study filled the contextual gap by examining the availability and effectiveness of credit to Kajiado farmers.

Adewale *et al.* (2022) used data from World Bank Development Index (WDI in Nigeria to study the effect of farmers accessing credit and crop production in Nigeria. The study established that the access to credit increased agricultural production. It found out that the bank credit had positively affected the agricultural productivity in Nigeria. The study emphasized and recommended that credit facilities should be provided to the farmers. The current study focused in Kajiado County, Kenya, a rural and semi-arid set up and in a developing country to fill the contextual gap.

Obagbemi *et al.* (2022) studied Micro-Credit Scheme influence on small scale rice farmers in Abuja and reported that credit accessibility increased rice production remarkably among the 70% of the respondents. The study recommendation was that the governments should ensure that commercial banks provide agricultural loan as a priority, to small scale farmers to enhance rice production in quality and quantity. The current study explored the credit accessibility by farmers to enhanced food security in Kajiado County.

Odhiambo and Upadhyaya (2021) researched on the flexible loans and access to agricultural credit for smallholder farmers in Kenya and found that the level of flexibility in loan products offered to smallholder farmers is low. Despite the theoretical benefits of flexible loans, such as grace periods and adjustable repayment schedules, which are not commonly available to farmers in the region. The study indicated that the level of loan flexibility is not significantly correlated with increased access to credit. This suggests that other factors may play a more crucial role in determining credit access for smallholder farmers revealed that specific elements of flexible loans, such as refinancing options and

lines of credit, are more likely to improve access to credit. However, these benefits are more pronounced among affluent farmers.

Munguti (2023) examined the challenges faced by organic small-scale agri-business enterprises in Kajiado County, Kenya. The study identified access to finance as a critical factor influencing the growth and development of organic small-scale agri-business enterprises in Kajiado County. However, it remained a significant challenge for farmers and agri-business owners in the region. These financial constraints hindered the ability of enterprises to invest in essential resources and adopt sustainable practices, thereby limiting their growth and development. The study recommended developing tailored financial solutions, providing comprehensive financial literacy training and implementing supportive policies. This study examined the effectiveness of credit availability in enhancing food security in Kajiado County.

2.2.5 Research Interventions and Food Security

In various countries research has been done to develop new crop varieties which repel diseases and pests while surviving in challenging conditions leading to higher crop productivity. Badigannavar *et al.*, (2022) examined how food security is enhanced by induced mutagenesis and improved crop varieties and established that the variation led to agricultural productivity improvement. The study established ways of enhancing genetic variability to achieve higher productivity. It was reported that agricultural research plays a crucial role to upgrade the crops and hence attaining national food security. Widyas *et al.* (2022) studied ways to improve local beef breeds and promote sustainable utilization in Indonesia and established that extensive research in eastern Indonesia led to high reproduction, beef production, growth of cattle numbers, and farm profitability. These studies have been done away from Africa particularly Kenya. The study filled the gap by examining the effectiveness of research as an intervention to enhance food security in Kajiado County.

Prioritizing research for global food security under extreme conditions was a study done by Mehrabi *et al.* (2022) who found out that policymakers and research teams are advancing solutions to enhance the food systems resilience. The study established that unresolved governance challenges threaten the harmonized research which is helpful in

adoption of governance systems towards resilience to extreme future events. This requires funding and coordination towards accessing valuable information for imposing change. The funding also necessitated prioritization of efforts to enable great transformations towards enhancing food security. The current study examined the effectiveness of the researches done on the interventions to enhance food security after the county government fund the researchers.

Ben and Hanana (2021) studied how Artificial intelligence can be applied to enhance agricultural production. The study established that production cannot be done as it has been normally and thus more research intervention on Artificial intelligence is vital. The study established that different stages of agriculture supply chain can be improved using digital technologies. Gideon, (2024) addresses the challenges faced by Kenya's agri-food sector, particularly focusing on post-harvest losses and inefficiencies in logistics. It explores how Artificial Intelligence (AI) can be harnessed to enhance the sustainability and efficiency of the supply chain. The study emphasizes on the importance of adopting AI technologies to overcome existing challenges in Kenya's agri-food supply chain, promoting sustainable agricultural practices and enhancing food security. The current study examined the effectiveness of research interventions that has been employed to enhance food security in Kajiado County.

2.2.6 Government Policies and Food Security

Government policies moderate the interventions that are put in place; they can either promote or hinder the development and adoption of technology, extension services, research and credit availability to enhance food security. The government in place must have the political will to ensure these interventions are implemented and without commitment, programmes funding priorities get focused on other issues. Norton & Alwang (2020) studied agricultural extension practices changes and found out that financing for agricultural extension by government and international donor in the 1970s and 1980s was strong in many countries but kept on declining. The World Bank funded training and field visits extension in many countries. However, during the 1990s, it was considered to be cost ineffective because of public debt crisis in several countries and the donors pushed governments to reduce their spending, and thus funding for extension programs reduced. This meant that with little to no funding training and field visits

reduced, farmers' subsidization for inputs and credit reduced and research grants were not available.

Hudson *et al.* (2019) studied Policy failure and the policy-implementation gap and reported that policy makers are not held responsible for their policy outcomes when they fail they will have moved on or moved out. Most politicians prefer short-term results hence their policies push through faster, rather than involving themselves in the dirty, irritating fact of long term effects. Peters *et al.* (2018) studied the designing for policy effectiveness and found out that political will is an important factor for success in driving policies. Governors are praised for policies they make than implementing the problems that have been avoided by the previous governments. The current study filled the gap by studying how effective the interventions that have been put in place by previous governments and the current government of Kajiado County are implemented.

Boulanger *et al.* (2022) investigated the effectiveness of fertilizer policy reforms to enhance food security in Kenya. The study emphasizes that increasing fertilizer production alone is insufficient to enhance food security evenly across the population and recommends that complementary measures, such as improving market access and providing extension services, are critical to reducing disparities and ensuring that smallholder farmers can effectively utilize fertilizers.

Government policies also play a crucial role in moderating credit availability to small-scale farmers especially by providing subsidies and guarantees, establishing credit programs and working with financial institutions to guarantee small-scale farmers have easy credit needed to enhance productivity and profitability. The current study examined the effectiveness of credit availability to small scale farmers in a specific area in Kajiado County.

2.3 Theoretical Review

With the purpose to analyze the effectiveness of interventions to achieve food security in Kenya the theory of access, diffusion of innovation theory and agency theory were employed to guide the study. Combining these three gave a comprehensive analysis and a better overview from all levels.

2.3.1 Theory of Access

The study adopted theory of access to explain and analyze the unequal dissemination of resources, opportunities, and privileges that have contributed to food insecurity that need to be addressed in Kajiado County. Penchansky and Thomas came up with the theory of access in 1981 in relationship to customer satisfaction. The duo recognized that not all individuals or groups access resources like opportunities, food and other privileges equally. This theory informed the credit availability objective. This unequal access is often influenced by various social, economic, and political factors. The study sought to examine how Kajiado County government influences and shape the distribution of resources and opportunities towards enhancing food security. The theory of access recognizes that various disparities exist in accessing the resources required. It calls for recognizing and addressing these disparities by advocating for policies and practices that promote equal access to resources, opportunities, and privileges. It encourages the removal of barriers that limit access and emphasizes the importance of understanding and addressing it.

The theory of access also informed this study by providing a framework to understand and analyze the different aspects that influence food accessibility. It suggests that access to food is not just about production but also encompasses economic, social, physical factors that determine a person's ability to acquire and consume food. By applying the theory the study explored the extent of effectiveness of interventions and how they can be improved to enhance food security in Kajiado County. Understanding the multiple dimensions of access helped to inform policy recommendations and the design of more holistic and effective interventions to have food security. The theory has its limitations since it focuses more on economic factors that influence food availability and affordability though its important doesn't focus on other factors like political, social dynamics, cultural preferences and natural resource management. It also doesn't fully consider the impacts of environmental factors that affect food security.

2.3.2 Diffusion of Innovation Theory

The study also adopted the Diffusion of Innovation (DOI) theory to explain how technology interventions effectiveness helps in enhancing food security. E.M. Rodgers came up with DOI theory in 1962.

It reveals how technologies, products or new ideas spread through a society or social system. This theory was chosen because it can be applied to food security to help understand how new ideas, technologies, and practices can be adopted to improve food production, distribution, and access. It showed how innovations in agricultural practices, food processing, storage, and distribution can be adopted to enhance food security and help identify the barriers that prevent innovations from being adopted and develop targeted interventions to address these barriers. The role of early adopters is one of the most important aspects of the diffusion of innovation theory who are often influential in promoting the adoption of new ideas or technologies. Early adopters may include farmers who are willing to try new agricultural practices or technologies, as well as businesses or organizations that are willing to invest in new food processing or distribution systems. The importance of communication and information-sharing is also considered an important aspect of the theory. Effective communication and information-sharing are essential for promoting the adoption of new ideas and technologies, and for building trust and credibility among potential adopters. It has helped identify the different stages of adoption, including awareness, interest, evaluation, trial, and adoption. This can help policymakers and practitioners develop targeted interventions to support the implementation of new technologies and ideas.

The diffusion of innovation theory can help identify the inhibiting factors towards use of new technologies. These factors may include shortage of credit, inadequate infrastructure, limited education or training, and cultural or social barriers.

This theory has its limitation, it has been criticized because it tends to focus too heavily on technology and overlooks the social issues that can affect the adoption of new ideas and practices. It also does not pay enough attention to power dynamics within social systems, such as the influence of elites or dominant groups on the adoption of new ideas or practices.

The theory has also been criticized due to its simplistic view of the adoption process, and may show the complexity of social change and the multiple factors that can influence the adoption of new ideas and practices yet it does not give enough attention to the contextual factors that can affect the use of new ideas such as political, economic, and cultural factors. It also does not pay enough attention to equity concerns, such as ensuring that new innovations are accessible and beneficial to those in ASALs.

2.3.3 Agency Theory

The agency theory was developed by Barry Mitnick from the institution perspective and Stephen Ross in economic perspective in 1960s and 70s. The theory suggests that when a principal in this case County government delegates tasks to an agent in this case the county agricultural officers, agricultural extension officers and farmers there may be a conflict of interest between the two parties. The agent's self-interest and pursuit of personal goals may not align with the objective of the principal. The Kajiado residents as the principal need to carefully monitor and regulate the action of the county government as the agents involved in food production and accessibility. Different intervention measures can be used to address the agency problem including research and development by promoting innovation in agriculture, improving farming techniques, developing crop resilient varieties and high quality animal genes and generally contribute to sustainable practices. By monitoring and surveying the markets the government can develop a mechanism to monitor and assess the behavior of different areas in food production, distribution and accessibility. This can include conducting inspections, audits and market surveillance to identify any fraudulent and ethical practices in the county that can compromise food security. The county government can address the agency problem by providing financial support to farmers and food related businesses especially by providing cheap financing.

The agency theory provides insight into the need of county government interventions that enhance food security. By addressing the potential conflicts that can arise in the food supply chain, the policy makers can design effective measures to monitor the agents to ensure principal objective of food security is met. This theory has its own limitation including the assumption that individual always want to enhance their comfort and

happiness at sacrificing the others which may not hold in all situations. The costly monitoring of agents is also time consuming.

2.4 Summary of the Literature and the Research Gaps

Table 2.1 Summary of Reviewed Literature

Author and Year	Title of the Study	Results	Research Gaps	Focus on current study
Alabi, & Ngwenyama, (2023)	Food security and interruptions of supply networks during COVID-19 pandemic.	By use of Literature review the study Proposed digitizing global food supply chains	-Methodological gap -Contextual gap	Secondary data was used. The current study used primary data. It was done in US & Canada the this time the researcher focused on Kajiado County, Kenya
Pawlak & Kołodziejczak (2020)	Agriculture production role in enhancing food security	Enhancing purchasing power of the livelihood, in rural areas, is a key driver for food security.	Contextual gap	The context covered was in Malaysia the current study was done in Kajiado Kenya.
Fraval, Hammond, Bogard & Wijk, (2019)	Malnutrition in sub-Saharan Africa	Cross sectional research design was used and the findings were that Rural household had food access deficiencies Increased income doesn't necessarily result to healthy dietary choice without nutritional	-Contextual Gap -Methodological Gap	The study is done in South Africa and current study was done in Kajiado county, Kenya - The researcher used qualitative approach; current researcher analyzed quantitative and qualitative data.

		education.		
Nakasone, &Torrero (2016)	ICTs enhancing food security	-By use of Literature review the study found that Technology improved farming techniques and input management. -Better crop sales opportunities	-Methodological gap	The study used secondary data/ reports from studies that had already been carried out while the current study the researcher carried out the research in the field.
Hudson, Leclair, Pelletier & Sullivann (2017)	Using radio and interactive ICTs to improve food security	-Literature was reviewed and concluded that Technology provided information to smallholder farmers on innovative agricultural practices to increase production	-Contextual gap -Methodological gap	The study used secondary data in Sub-Saharan Africa the current researcher focused on Kajiado county in Kenya using primary data.
Sinyolo, (2020)	Technology use to enhance food security	Descriptive statics was done and concluded that Technological innovations helped to improve	-Contextual gap	South Africa was the study area while current study filled the gap by doing the study in Kajiado county

		food security.		
Oloo, Maredia, & Mbazazi (2020)	Push on use of GMOs in Africa	- Qualitative research was done and concluded that there are many obstructions towards adopting of GMOs in Kenya.	-Methodological gap	The study applied involved qualitative approach while the current study used both quantitative and qualitative approach.
Kehide (2020)	Effect of Credit access in Nigeria on food security	They used simple random sampling of the six states in western Nigeria and revealed that credit access benefits food security.	-Contextual gap	The study was carried out in South Western Nigeria currently the focus was on Kajiado County, Kenya.
Ankrah <i>et al.</i> , (2020)	The role of credit access mobilization in Ghana	Descriptive research design was used and revealed that Farmers secured loans secured by savings.	- Conceptual gap -Contextual gap	The study focused on how savings increases a chance of individual loan accessibility to loan while the current study focused on how the government can avail interest free loans to people without collateral. -The research was in Ghana as opposed to Kenya in the current study.
	Changes in	Literature was	-Methodological gap	Secondary study was used in

Norton, & Alwang, (2020).	agricultural extension Changes and impact on farmers.	reviewed and found out that Decline of agricultural funding was due to debt crisis		the study while The current study used primary data.
Widyas, Widi, Prastowo, Sumantri, Hayes & Burrows, (2022)	Promoting local beef breeds in Ghana by improving Genetics.	Literature was reviewed and revealed that Agricultural research improves the crops production and hence food security	-Methodological gap -Contextual gap	The study used secondary data while primary data was used in this study. India was the study area while currently the focus was Kenya.
Mehrabi, Delzeit, Ignaciuk, Levers, Braich, Bajaj & You (2022)	Research for worldwide food security.	Study revealed that coordinated research is needed to compose and implement resistant systems of governance for food security.	Methodological gap	The current study used the face to face survey rather than online surveys that was used in the reviewed study.

Source: Researcher (2023)

2.5 Conceptual Framework

This conceptual model was obtained from the literature review. It highlights the researcher's schematic interpretation of the relationships of the study variables. It explains how food security (as the dependent variable) and the effectiveness of interventions (as components of the independent variable) relate as moderated by government policies

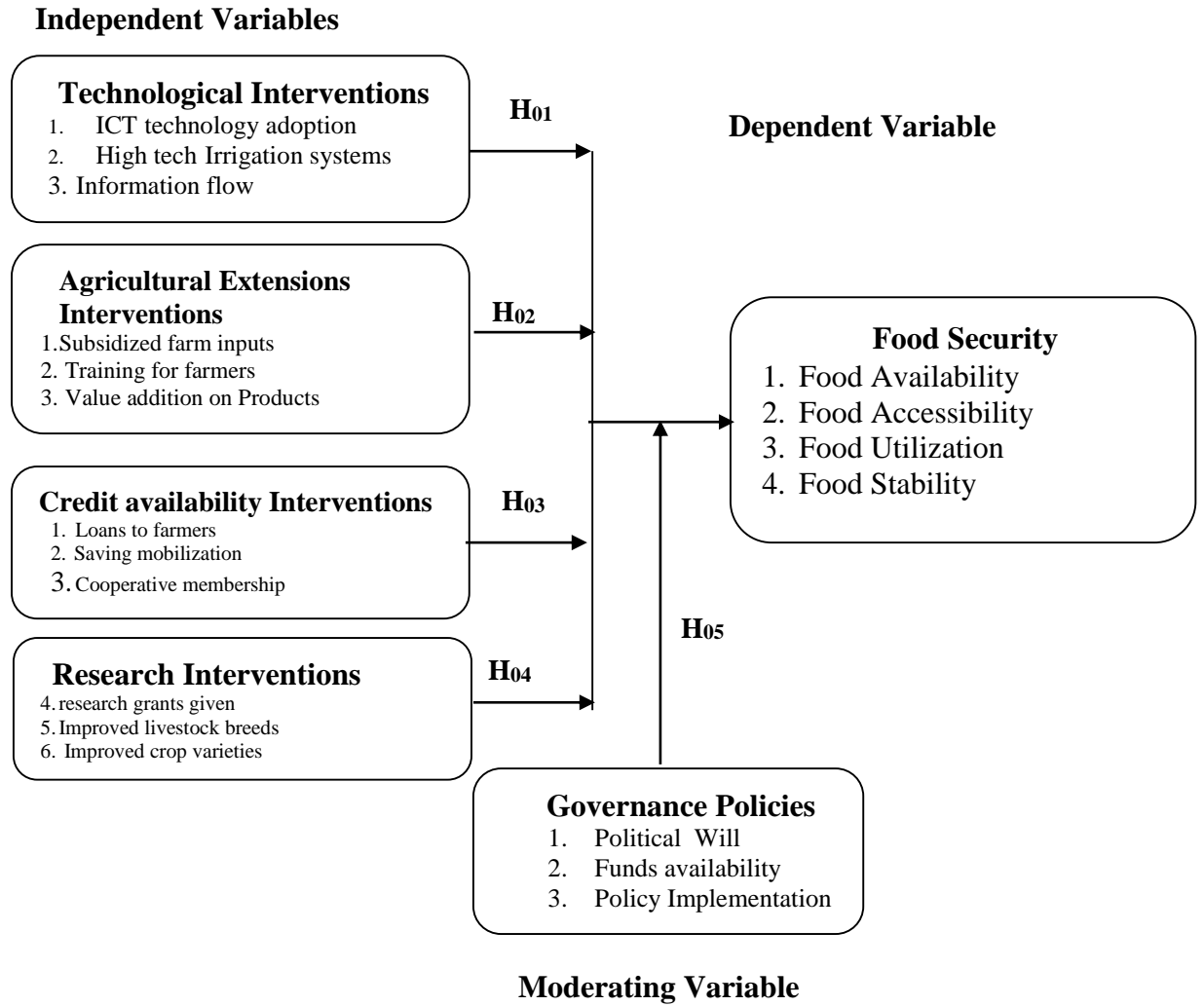


Figure 2.1: Conceptual Framework

Source: Researcher (2024)

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

The chapter consists of the approaches, tools and methods that were used to collect and analyze data. It outlines the research philosophy, the research design, the target population of the study, the sample size, operationalization and measurement of variables, the data collection instruments and procedures, the validity and reliability of the instruments, data analytical procedures, and statistics used in the analysis.

3.2 Research Philosophy

The study adopted pragmatism philosophy since it allowed use of integrated multiple and mixed research designs, data collection methods, data analyses approaches and multiple modelling approaches. The philosophy also allowed the combination of both quantitative and qualitative methodological paradigms (Kaushik & Walsh, 2019). Creswell (2014) argues that pragmatism is all about “what works”. The study used this philosophy as it seeks to establish what would work best for Kajiado County as it implements various food security interventions. The philosophy also allowed the application of both deductive and inductive reasoning. Creswell and Hall (2014) argues that pragmatism is oriented towards diversity of methods in resolution of real-world problems rather than pure assumptions about knowledge as it focuses on extent of experience unlike other philosophies that stress the nature of reality.

3.3 Research Design

The study applied descriptive and explanatory research design. The descriptive design enhanced the establishment of correlation between the study variables, putting emphasis on studying a problem and analyzing variables relationship (Saunders, Lewis & Adrian, 2009). Descriptive also helps in determining “what exists” and thus analyzing the situation rather deeply with a view of generalizing about a wider population. Baran (2022) explains that explanatory design is helpful in the analysis of the qualitative data. This was generated from the county government officials’ interview. The design provided a narration of the issues surrounding food security interventions as implemented by the County Government of Kajiado.

3.4 Description of Variables

Table 3.1 Description of Variables

Independent variables			
Variable	Indicator	Measurement Level	Analysis
Technological Interventions	ICT technology adoption	Nominal	Descriptive analysis Multiple regression
	High tech Irrigation systems	Ratio	
	Information flow	Nominal	
Agricultural Extensions Interventions	Subsidized farm inputs	Nominal	Descriptive analysis Multiple regression
	Training for farmers	Nominal	
	Value addition on Products	Nominal	
Credit availability Interventions	Loans to farmers	Ratio	Descriptive analysis Multiple regression
	Saving mobilization	Ratio	
	Cooperative membership	Ratio	
Research Interventions	Research grants given	Ratio	Descriptive analysis Multiple regression
	Improved livestock breeds	Ratio	
	Improved crop varieties	Ratio	
Dependent Variable			
Food Security	<ul style="list-style-type: none"> ● Food Availability ● Food Accessibility ● Food Utilization ● Food Stability 	Nominal Nominal Nominal	Multiple regression
Moderating Variable			
Government Policies	<ul style="list-style-type: none"> ● Political Will ● Funds availability ● Policy Implementation 	Nominal	Multiple regression

Source: Researcher (2023)

3.5 Study Locale

Kajiado County was the study area; it is one of the 29 ASAL counties in Kenya. Study focused on the farmers in the county who have registered themselves in the ministry of

Agriculture. It occupies an area of 21,292.7 km². It is the 9th largest County in Kenya in terms of landmass. It is characterized with uncertain rainfall patterns, dry spells and droughts. The County most of the times receives little rain. (Gitau & Mwangi, 2024). Most people in the region are small scale subsistence farmers and/or livestock keepers whose livelihood primarily depends on rainfall. The county borders the capital city of Kenya Nairobi to the North and Arusha and Kilimanjaro regions in Tanzania to the south. Going by 2019 Census there are 1,117,840 citizens residing in Kajiado County distributed in 316,179 households. It has 5 sub-counties and 25 Wards .Kajiado north is the smallest in terms of land area and Kajiado West is the largest. Most farmers practice rain fed agriculture but few use irrigation. Most livestock farmers keep Cattle, goats and Sheep.

3.6 Target Population

The target population comprised of 29,572 respondents which included 29,514 registered farmers in all the five sub counties in Kajiado County (Kenya Integrated, Agricultural Management Information systems (KIAMIS report, 2023), 47 agricultural extension officers and 11 County government officers in Kajiado County including County Executive committee members and County Directors. Considering the enormous area under study, the study was restricted to the registered farmers. The farmers are expected to be aware of the interventions by the county government to enhance food security.

Table 3.2: Registered Farmers in Kajiado County

Category per Sub-County	Population	Proportion
Kajiado East	5153	17.6%
Kajiado West	2403	8.1%
Kajiado Central	6614	22.4%
Kajiado North	8067	27.3%
Kajiado South	7277	24.6%
Total	29,514	100%

Source: KIAMIS Report (2023)

Table 3.3: Total Target Population

Category	Target Population
Registered farmers	29,514
County government officials	11
Agricultural extension officers in the County	47
Total	29,572

Source: Researcher (2023)

3.7 Sampling Technique and Sample Size

This study employed disproportionate stratified random sampling techniques due to the extensive population. To arrive at the study sample for the registered farmers in the County, Nassiuma (2000) formula was employed:

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

Where :

n represents sample size,

N is the population size,

C is the coefficient of variation at (95%) confidence limit,

e is the standard error of 5%.

$$= \frac{29514 (0.95*0.95)}{(0.95*0.95)+(29514-1)(0.05*0.05)}$$

= 356 farmers

Additionally, the study used purposive sampling in identifying the 356 farmers from across the County while the census of all County officials and the agricultural extension officers was studied. This provided a total sample size of 414.

Table 3.4: Sampling and Sampling Size

Category	Sample Size
Registered farmers	356
County Government officers	11
Agricultural extension officers in the County	47
Total	414

Source: Researcher (2023)

Table 3.5: Disproportionate Stratified sampling Per Sub County

Sub-County	Frequency	Sampling ratio	Sample Size
Kajiado East	5153	0.17	61
Kajiado West	2405	0.08	29
Kajiado Central	6614	0.23	82
Kajiado North	8067	0.27	95
Kajiado South	7277	0.25	89
Total	29514	1	356

Source: Researcher (2023)

The researcher used purposive sampling to identify the sampled farmers

3.8 Data Collection Instruments

This primary data was collected using both semi-structured questionnaires and face to face interviews.

3.8.1 Questionnaires

The semi-structured questionnaires were administered to sampled registered farmers and all the Agricultural Extension officers. It had closed-ended and open-ended questions. The researcher distributed the questionnaire physically with a help of research assistant who understood the local dialect of the community around the county and helped to fill the information in google forms. Questionnaire was appropriate because it gave uniform data and allowed the study to reach a large diverse population within a short time. Additionally, questionnaires allowed for relevant statistical analysis of the phenomena of interest. Further, questionnaires are easy to interpret and suitable for descriptive and explanatory research.

3.8.2 Interviews

The researcher interviewed the Kajiado County government officers, these included County Executive committee members, Director of crops, Director of livestock among others. The study only considered the CECs and Directors who could help in answering research questions. It involved collecting data through the presentation of oral-verbal stimuli and replies obtained verbally. The instrument gave the researcher the ability to control the sequence and content of the questions. Interviews also gave the researcher freedom to ask probing questions that drew more on the study objectives.

3.9 Pilot Study

The pilot study helped refine the instrument, improve its reliability and reduce errors during data collection and processing. Piloting also ensured objective articulation of items in the research instruments and simultaneously increased the likelihood of successful data collection. Saunders *et al.*, (2009) recommends that results from the pilot study should help adjust the instruments ensuring it measures what was intended. Lancaster, Dodd and Williamson (2010) recommend that pilot studies should constitute between one (1) per cent and ten (10) per cent of the sample size to increase accuracy. The pilot sample was drawn from Machakos County which is also an ASAL county which depicts relatively similar climatic characteristics with Kajiado County (Nyariki & Amwata 2019). This study carried out pilot testing on the questionnaire involving 36 registered farmers which is 10% of sample size and 5 agricultural extension officers as

respondents, representing 10% of the sample size. The researcher also interviewed one of the Machakos County government officer. The pilot study is carried out to discover the deficiencies in design and instrumentation and provides representative data from which a probability sample is got (Cooper and Schindler 2011). Babbie (2004) argues that a pilot study helps in pre testing the instruments, done when the questionnaires are answered by a few people. Tests for validity and reliability were done as follows:

3.9.1 Validity

Validity tests whether the instrument accurately measures what was envisioned to measure, the content, face and construct validity (Sekaran & Bougie, 2010). The researcher's subjective evaluation tested the Face validity which was done by measuring the extent to which the researcher believed in its appropriateness. To test for face validity the researcher sought the experts' opinion. The content validity was tested by discussing with the supervisor and peer; it reviewed and proposed adjustments to the research tool that was necessary. Construct validity ensured by operationalization of terms, reviewing empirical and theoretical literature while consulting the experts' viewpoint to portray the theoretical assumptions guiding the development of conceptual framework.

3.9.2 Reliability

Reliability involves consistency of scores over time (Malhotra, Chan, Malhotra & Ostbye, 2012). It was tested using Crobach's Alpha. Roberts and Priest (2006) suggests that a reliability level of 0.70 is enough for measurement. To be considered acceptable, the researcher adopted 0.7 as the threshold. That means values above 0.7 indicated reliability, and below stipulates that the research instrument is not reliable.

3.9.3 Reliability Tests Results

The internal consistency of the research instruments was measured using Cronbach's Alpha and the results are as tabulated in table 3.6 below.

Table 3.6 Reliability Test Results

Variable	No of Items	Standardized coefficient	Decision
Technology interventions	9	0.7514	Reliable
Agricultural Extension interventions	10	0.7493	Reliable
Credit availability Interventions	9	0.9292	Reliable
Research Interventions	10	0.8281	Reliable
Government policy interventions	8	0.8368	Reliable

Source: Research Data (2024)

Table 3.6 shows the Cronbach's alpha values for technological interventions, agricultural extension interventions, credit availability interventions, research interventions and government policy interventions as 0.7514, 0.7493, 0.9292, 0.8281 and 0.8368 respectively. Cooper and Schindler (2014) argue that a Cronbach's Alpha value of 0.7 or higher is acknowledged as an acceptable threshold indicating satisfactory reliability, thus the results affirmed that the instruments were reliable to be used to collect the primary data.

3.10 Data Collection Procedures

The researcher used the google forms to distribute the questionnaires for easier analysis while saving time and money. The unstructured questions, on the other hand, encouraged the respondent to give comprehensive responses without hesitating or feeling guilty in revealing details (Feng *et al.*, 2022). The researcher coded the questionnaires meaning that only the researcher and research assistant know who responded. Coding helped match the answered and the administered questionnaires. The researcher sought authorization from Kenyatta University Graduate School and (NACOSTI) to guide the research. Kajiado County Commissioner and County secretary authorization was sought.

3.11 Data Analysis and Presentation

Descriptive statistics analyzed quantitative data by using calculations of the mean and the standard deviation with the help of SPSS software. These statistics helped in describing the nature of the data generated from the respondents. Content analysis analyzed

qualitative data by outlining the important responses and dispensing them in themes in prose form.

Inferential statistics was also done to determine the relationships between the study variables and to test the hypotheses in the study. The study used the multiple regression model. The research hypothesis was tested at 5% level of significance.

3.11.1 Empirical Model

The section provided the empirical model estimated and used for inferential analysis, as informed by the conceptual framework. The relationship between independent variable (interventions) and dependent variables (Food security) as well as the moderating effect by government policies was tested. Objectives one through four were addressed using multiple regression model 3.1.

$$FS = \beta_0 + \beta_1TC + \beta_2AE + \beta_3CA + \beta_4RE + \varepsilon \dots \dots \dots \text{Model 1}$$

Where:

FS=Food Security

TC =Technology

AE= Agricultural extensions

CA = Credit availability

RE = Research

ε = Error Term

The coefficients β_1 , β_2 , β_3 , β_4 and ε measure the effect of TC, AE, CA and RE respectively. The significance of β 's was used to test the corresponding hypotheses specified in Chapter One. The study sought to determine whether government policies had a moderating effect on the relationship between interventions and food security in Kajiado County, Kenya. The multiple regressions Model 1 was estimated as the base model to determine the relationship between the dependent variable and the independent variables.

3.11.2.2 Multicollinearity

Multicollinearity was tested using variance inflation factor (VIF) to check for correlated variables. Presence of multicollinearity is indicated by a VIF value of above 10 and a tolerance of less than 0.1 (Hair *et al.* 2010). In case of multicollinearity, the variable in question is excluded from analysis.

3.11.2.3 Heteroscedasticity

The Breusch-Pagan test was conducted to test for the homogeneity of variance, where the Breusch-Pagan null hypothesis shows that there is constant of error term (Warner, 2008). Warner (2008) recommends that to meet the homoscedasticity assumption probability value greater than 0.05 is required. So, if $p < 0.05$, the relationship was to be considered to have heteroscedasticity.

3.12 Ethical Considerations

The first approval sought by the researcher was from Kenyatta University Graduate School to allow collection of data. The second approval was from NACOSTI to allow the study to be conducted. Lastly the approval of County Commissioner of Kajiado County, to conduct the research in the county was sought. The researcher guaranteed confidentiality to the participants, and assured them that the information was to be used only for academic purposes; this was taken as informed consent. The participants did have an option to participate voluntarily or not. The consent form was filled by the willing participants before answering the questions.

CHAPTER FOUR: DATA ANALYSIS AND DISCUSSION

4.1 Introduction

This chapter outlines the findings, its interpretation and discussion based on pragmatic research philosophy so as to best answer the research questions. The study objectives were to determine the effectiveness of technology application in enhancing food security in Kajiado County, to evaluate the effectiveness of agricultural extensions in enhancing food security in Kajiado County, to examine the effectiveness of credit availability in enhancing food security in Kajiado County and to determine the effectiveness of research interventions in enhancing food security in Kajiado County. The study also established the moderating effect of the national government policies on the County government interventions in enhancing food security in Kajiado County. Descriptive statistics shown the profiles and characteristics of the respondents and the inferential statistics showed the direction and magnitude of relationship between variables. The comparison and or contrast between the findings of each objective were presented. Both qualitative and quantitative findings were incorporated to facilitate the understanding of study variables in the effectiveness of interventions done by the county government to enhance food security in Kajiado County.

4.2 Response Rate

To ascertain the representation of the responses, the response rate was established and the results tabulated below.

Table 4.1: Response rate

Research Instrument	Number of respondents	Percentage
Questionnaires	256	65.1%
Interviews	9	81.8%
Total	265	64.0%

Source: Research Data (2024)

From table 4.1 above, a response rate of 65.1% was achieved among the famers and another 81.8% among the interviewees. The total response rate from the total of 414 respondents was 265 which made a total response rate of 64.0% which is adequate to

allow further data analysis. According to Mugenda and Mugenda (2003) and Saunders *et al.* (2016) a response rate of 50% is adequate, 60% is good and 70% is excellent hence a response rate of 64% is good enough to represent the opinion of the respondents to represent the population that was targeted making it acceptable for further analysis of the study. A total of 256 duly filled questionnaires (221 registered farmers and 35 extension officers) and 9 out of 11 county government officials were interviewed, making 81.9% response rate.

4.4 Demographic Characteristics

Initially, the demographic information of respondents was recorded including gender, age, level of education, size of the farm, type of farming and the length of time the farming had been practiced.

4.4.1 Sex of Respondents

The study sought to determine the sex of the respondents. The results are shown in table 4.3 below.

Table 4.2 Sex of Respondents

Sex	Frequency	Percent
Female	70	31.7
Male	151	68.3
Total	221	100.0

Source: Research Data (2024)

The results as indicated in table 4.2 show that 68.3% of the registered farmers were male while 31.7% were female. The results indicate that most of the registered farmers were male. These results imply that majority of the registered farmers were male. This implies that women are yet to participate fully in farming, this maybe because of the existence of cultural issues on ownership of land and other forms of wealth or even lack of capital to run farming activities. This agrees with the work of Doss *et al* (2018) on the study of gender inequalities in Africa’s land ownership and control which established that the diversity of land ownership systems and relationships in Africa are deeply rooted in the cultural contexts, social contexts, and economic contexts of different regions. Where land

is inherited, in most cases only men are connected with inheritance when women are overlooked. There are unwritten rules that govern land ownership and use in Africa.

Among the extension officers, 48.6% were male while 51.4% were female. Results indicate majority of the extension officers were female. The findings imply that the County has employed more female extension officers than the male. This is in contrast with the work of Reshi and Sudha, (2023) study on economic empowerment of women which established that women in Africa often face significant gender disparities in employment opportunities compared to men. Women also tend to be overrepresented in low-wage and vulnerable forms of employment. The results also contradict with the work of Shrestha and Manesh, (2020) on the study done in construction industry investigating the employment and wage distribution. The study established that women face various barriers to accessing decent and productive employment. Among the barriers were limited access to education and skills training, cultural norms and stereotypes imposing limit to women's involvement in the workforce, lack of childcare support, and discriminatory practices in the labor market.

4.4.2 Age of the respondents

The age of respondents, was also of interest to the study since most farmers are considered old and the young populace are considered to avoid farming activities. Thus the need to establish the age of those who participated in the study. The results of this are as tabulated below.

Table 4.3 Age of the respondents

Age Bracket	Frequency	Percent
0-20 years	8	3.6
21-30 years	62	28.1
31-40 years	63	28.5
41-50 years	60	27.1
>51 years	28	12.7
Total	221	100.0

Source: Research Data (2024)

The results show that the majority of the registered farmers were the young aged between 31-40years at 28.5% followed by 21-30 years at 28.1% and 41-50 at 27.1%. Only 8 respondents (3.6 %) indicated that their age was below 20 while the remaining 28 respondents (12.7%) were aged above 51 years. The implication of these findings was that majority of the registered farmers were middle aged between 21 to 50 years, implying that the most of the registered farmers were not only young, but agile, ready to take on farming and participate in enhancing food security within their households and County at large. The findings are in tandem with the works of Balezentis *et al* (.2020), who while studying on the support offered by young farmers in the rural regions under the Common Agricultural Policy and sustainability, established that having young farmers often bring fresh perspectives, innovative ideas, and technological savvy to the agricultural sector. Their willingness to experiment with new practices and technologies can lead to increased productivity, efficiency, and sustainability in farming operations. Young farmers can drive entrepreneurship, create new markets, and add value to agricultural products. They are often more attuned to sustainability practices, environmental conservation, and climate-smart agriculture.

The majority of the extension officers (40%) were aged between 31 and 40 years, while 28.6 were aged between 41 and 50 years. Another 20% of the respondents indicated that they were aged between 21 and 30 years while the remaining 11.4% were aged below 20 years and above 51 years cumulatively. These results imply that the majority of the extension officers employed by the county were between 31-50 years meaning that they had the strength and experience needed for the study. Liontakis and Tzouramani (2021) assertions were in agreement with the findings, they studied innovation adoption of agricultural activities by the start-up aid for young farmers. The study established that having a diverse and dynamic farming community that has young and strong working community can contribute to economic development, job creation, food security, and poverty reduction. Young and strong workers are very important since they can help build resilience in the agricultural sector by diversifying skills, knowledge, and approaches to farming.

4.4.3 Level of Education

The study sought to determine the highest level of education among the respondents and the resultant figures are tabulated below.

Table 4.4 Level of Education

Level	Number of respondents	Percent
Primary	58	26.2
Secondary	55	24.9
Tertiary	18	8.1
University	78	35.3
Others	12	5.4
Total	221	100.0

Source: Research Data (2024)

The findings show that 35.3% of the registered farmers had university education while 26.2% had attained only primary education. The ones who had reached secondary level made 24.9% of the respondents, tertiary level at 8.1% and those below primary made 5.4%. These results imply that all the respondents could read and write and it was therefore easier for the study to be done. Having majority of farmers having attained university level of education means that many educated farmers have accepted farming as a source of livelihood. It is important to have well-educated farmers since it implies that they are equipped with the skills and knowledge to facilitate modern agricultural practices adoption, techniques, and technologies that can boost productivity on the farm. They are more likely to make informed decisions about crop selection, soil management, pest control, irrigation, and other factors that contribute to higher yields and better quality produce. This is in agreement with the work of Eche-Enriquez and Vivas (2022) study on farming, education and migration. The study established that education can help farmers understand the principles of sustainable agriculture and environmental stewardship. Well-educated farmers are more likely to implement practices that conserve natural resources, protect biodiversity, reduce chemical inputs, and promote soil health. They can contribute to more resilient and environmentally friendly farming systems that can withstand the challenges of climate change.

Among the extension officers, majority had attained tertiary level of education at 48.6% while 40% had attained university level the remaining 11.4% had attained secondary education and none of them had primary level or lower. These results imply that the county employed extension officers who had attained tertiary level of education who could understand their responsibility to help the farmers increase the food security level. The findings agreed with the work of Tamsah and Yusriadi (2022) on farmers' productivity improved by agricultural extension quality. It established that education can help farmers understand the principles of sustainable agriculture and environmental stewardship. Well-educated farmers are more likely to implement practices that conserve natural resources, protect biodiversity, reduce chemical inputs, and promote soil health. They can contribute to more resilient and environmentally friendly farming systems that can withstand the challenges of climate change. Educated extension officers can mentor and train farmers, passing on valuable knowledge about crop management, soil health, animal husbandry, and other aspects of farming. In return, farmers can bring new insights, technologies, and approaches to the farm.

4.4.4 Size of the farm

The study sought to determine the size of the farm of the respondents. The results are as shown in the table 4.5

Table 4.5 Size of the farm

Farm Size (acres)	Number of respondents	Percent
less than 1	19	8.6
1-3	49	22.2
4-5	52	23.5
Above 5	101	45.7
Total	221	100.0

Source: Research Data (2024)

The findings show that majority of the farmers had above 5 acres of land at 45.7% followed by 4-5acres at 23.5%, 1-3acres at 22.2% and less than 1 acre made the 8.6% of the respondents. These results imply that most registered farmers owned larger pieces of

land and only a few of them had less than 1 acre of land. Large pieces of land if well managed comes with a lot of benefits including crops/ animals diversification, mechanization and efficiency, investment capacity and scaling sustainable practices among others.

Meyfroidt *et al* (2022) assertions were in agreement with the findings, their study on sustainability and land systems facts. The study established that having large pieces of land can benefit from economies of scale. This is because larger farms can spread fixed costs (such as machinery, infrastructure, and labor) over a larger production base, reducing the average cost of production. Large farms can afford to diversify their crops more effectively. They can rotate crops, practice intercropping, or grow multiple types of crops simultaneously, which can improve soil fertility, reduce pests and diseases, and optimize land use efficiency. The study recommended that farm size is not the sole determinant of high food production. Factors such as agronomic practices, access to markets, government policies, and environmental considerations also play crucial roles in achieving sustainable and efficient food production.

4.4.5 The farming Activity

The study sought to assess the farming activities that the respondents were involved in. The results are as indicated in figure 4.1

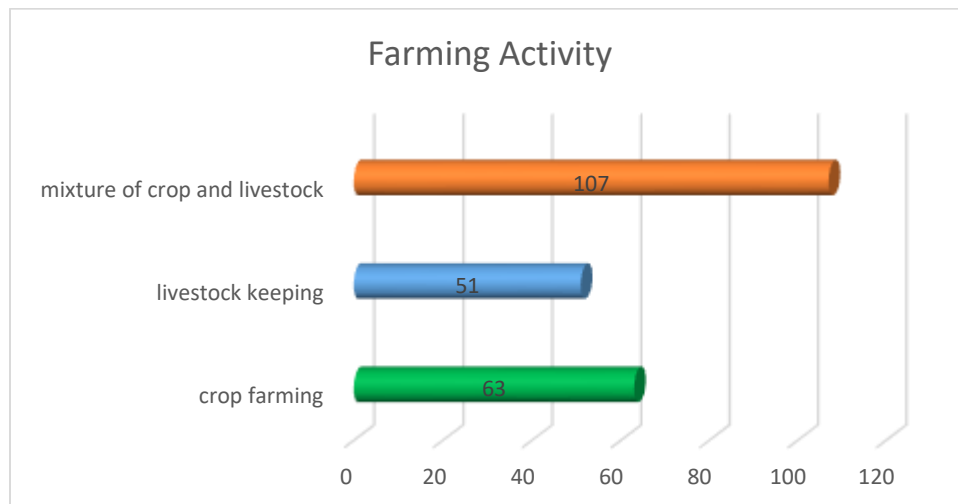


Figure 4.1 Farming activity

Source: Research Data (2024)

The findings indicated that almost half of the respondents at 48.4% had a mixture of crops and livestock while 28.5% did crops farming alone and 23.1% did livestock keeping alone. The researcher was to determine the relationship of the farming activities done and food security. The results implied that most farmers preferred to diversify and kept both crops and animals. The findings concur with the work of Ma *et al* (2022) on the study on the combination of livestock and crop farming can reduce negative environmental effects and enhance livestock production benefits. The study established that mixed farming enables farmers to benefit from diversified income sources by selling both crops and livestock product. This improves soil structure and overall soil health. Diversification helped spread risks associated with weather fluctuations, market prices, and pest/disease outbreaks. If one enterprise (crops or livestock) faces difficulties, the other may provide a buffer.

The findings conform with the works of Leroy *et al* (2022) on the study on animal source foods in healthy, sustainable, and ethical diets who despite establishing many benefits of mixed farming also reiterates on the challenges that managing both crops and livestock requires diverse skills and knowledge yet the farmers must balance the needs of multiple enterprises, potentially increasing management complexity and labor requirements. Livestock and crops may compete for resources such as water and land. The study emphasizes that overgrazing by livestock degrades pastureland and impact soil quality, affecting crop productivity. It also states that setting up and maintaining infrastructure for both livestock (shelters, fencing, watering systems) and crops (irrigation, storage facilities) can be costly, particularly for small-scale farmers. The study also recommends that farmers practicing mixed agriculture may need to comply with regulations governing both crop production such as pesticide use and livestock management including animal welfare standards, which can be challenging and costly to implement.

4.4.6 The duration of farming activity

The study assessed how long the respondents had done the farming activities and the results are as indicated in table 4.6

Table 4.6 Duration of farming activity

Duration	Number of respondents	Percent
less than 5 years	52	23.5
5-10years	83	37.6
10-15years	86	38.9
Total	221	100

Source: Research Data (2024)

The results indicated that slightly higher than third of the respondents at 38.9% had practiced farming for 10-15 years followed by 5-10years at 37.6%. The remaining respondents at 23.5% had practiced farming for less than 5 years. These results implied that the majority of the respondents had practiced farming for a long period of time that means they had enough experience and well informed information on food security. It is expected that the more the farmer has practiced farming, the more experience one gets towards enhancing food security. The findings were in agreement with the assertions of Fahad *et al* (2020) on climate change perceptions and awareness level by farmers. The study established that experienced farmers have valuable knowledge, skills, and wisdom acquired over years of working on the land. Their experience can help guide other farmers and provide insights into traditional farming practices that have stood the test of time. Balezentis and Toma (2020) on the study of the support offered by young farmers in the rural regions under the Common Agricultural Policy and sustainability study also reiterated that exchange of knowledge and skills between new and experienced farmers is crucial for the transfer of traditional wisdom, best practices, and innovative techniques. Experienced farmers can mentor and train new farmers, passing on valuable knowledge about crop management, soil health, animal husbandry, and other aspects of farming. In return, new/young farmers can bring new insights, technologies, and approaches to the farm while experienced farmers can offer insights into managing risks, coping with challenges, and adapting to changing conditions

4.5 Descriptive Analysis

This section discussed the results, interpretations and discussions of the findings regarding the county's interventions of enhancing food security in Kajiado County. The keys used were 1 to 5 such that 1 = Strongly Agree (SA); 2 = Agree (A); 3= Neutral (N); 4=Disagree (D); 5= Strongly Disagree (SD).The results are indicated in the tables below.

4.5.1 Technological interventions

Technology intervention was one of the independent variables of the study. The study sought to determine the effectiveness of technological interventions on enhancing food security in Kajiado County. The results are as analyzed in tables 4.7 and 4.8

Type of technology

The study aimed to establish the specific type of technology that was used to enhance food security among Mobile Apps, Automated feeding, High-tech Irrigation or none

Table 4.7 Type of technology

Type of Technology Applied	Number of respondents	Percent
None	42	19.0
Mobile App	109	49.3
High Tech Irrigation	63	28.5
Automated Feeding	7	3.2
Total	221	100.0

Source: Research Data (2024)

Table 4.7 the type of technology that the respondents used, majority of farmers at 49.3% of the respondents used mobile apps, 28.5% used high tech irrigation, 3.2% used automated feeding and 19% did not use technology. These results imply that majority of the respondents used mobile apps that helped them increase their production. Those who used high tech irrigation for their farming followed. The results further imply that the respondent would wish that the county increase their access to various types of technology to help them more in enhancing food security. Majority of the extension

officers too used mobile phones in providing information to farmers. The study done by Mandi and Patnaik (2019) on the study titled mobile apps in agriculture and allied was in agreement with the findings. It established that mobile apps empower farmers by providing tools and information that improve productivity, profitability, and sustainability in agriculture. Mobile apps provided quick access to weather forecasts, agricultural techniques, and government policies, which are crucial for making informed decisions. It also helped farmers track crop health, pest outbreaks, soil conditions, and irrigation schedules, optimizing yields and reducing costs. It streamlined administrative tasks such as record-keeping, order management, and logistics, saving time and effort

The 19% of the respondents that did not use technology cannot be ignored and this is a challenge to the county that training and empowerment is much required if technology was to be effective in enhancing food security. These results were affirmed by the opinion of respondent R4 who said that:

“Technology in Kenya has evolved rapidly, and the country is at forefront of technology innovation and it would benefit the country and Kajiado county too if everyone could be empowered to use technology, this would lead to enhanced food security and that would make the world a better place to live in”

The study sought to determine the effectiveness of technology application in enhancing food security in Kajiado County. The respondents were expected to indicate their level of agreement or otherwise with the statements in the table 4.9.

Table 4.8 Descriptive statistics for Technology Interventions

1 = Strongly Agree (SA); 2 = Agree (A); 3= Neutral (N); 4=Disagree (D); 5= Strongly Disagree (SD).

Statements	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree	Mean	Std Dev
	%	%	%	%	%		
The implementation of technology has positively impacted your food production	14.5	67.4	11.8	4.5	1.8	2.12	0.77
Your crop yields / Livestock production has increased as a result of using technology	10.0	66.5	10.4	10.4	2.7	2.29	0.88
Mobile phones have helped you get information on county provision of inputs/ subsidies like fertilizers.	12.7	67.9	5.4	11.3	2.7	2.24	0.91
Access to internet has helped you in crops/animals' management	12.2	62.0	6.3	16.7	2.7	2.36	0.99
Mobile phones have helped you get information on the market prices of products to help you know when to sell or buy.	11.8	12.2	5.9	63.4	6.8	3.41	1.16
Technology has helped you to optimize resource utilization such /as water and energy to ensure sustainable food production.	5.9	35.8	11.8	43.9	2.7	3.02	1.12
I have not encountered difficulties in accessing and adopting technology in enhancing crop/animal production.	2.3	9.1	8.1	66.5	14.0	3.81	0.87
There are minimal financial implications associated with implementing and maintaining technology.	4.1	9.1	10.4	59.3	17.2	3.76	0.98
I have acquired training to effectively use technology to enhance food security strategies.	4.1	8.6	6.3	64.7	16.1	3.81	0.9

Source: Research Data (2024)

Based on the results in table 4.8, majority of the respondents agreed that technology has positively impacted their food production, 67.4% agreed, 14.5% strongly agreed, 4.5% disagreed and 1.8% strongly disagreed while 11.8% were undecided. These results imply that majority of the respondents had realized the importance of technology in their

farming and as a result had noted the increase of their production. This was also revealed by mean 2.12 which showed that majority of the respondents had indicated realizing positive impact of technology, however it had a slightly wide deviation (standard deviation = 0.77).

The assertions of Sinyolo (2020) were in consistent with the findings, the study established that technology enhanced food security in South Africa and that the farmers need to be strengthened and empowered on technology application in order to enhance food security.

Majority of respondents at 67.9% agreed that Mobile phones have helped them to get information on county provision of inputs/ subsidies like fertilizers while 12.7% strongly agreed with the statement the statement.11.3% disagreed while 2.7% strongly disagreed and 5.4% were neutral on the same. With a mean of 2.24, the respondents on average, agreed that mobile phones have helped them to get information on county provision of inputs and or subsidies though the standard deviation of 0.91 was not so narrow. These results imply that majority of the respondents got information from the county very easily via their mobile phones. Any time that the county wanted to distribute any farm inputs or any services like vaccinations to the farmers it would be done instantly using mobile phones. These results were affirmed by the opinion of respondent R7 who stated that:

Communication has never been so easy like today, whenever as the county we have any information, we want to disseminate to the farmers it is just done by tapping a mobile phone, the information is spread within no time. Sometimes for example if there is a disease outbreak and we need to control it, together with announcements through the chiefs, churches and schools an instant message is first sent to the farmers. This has made communication easier than before since if one gets the information, they tells the others around them.

The results were consistent with assertions of Sullivann (2017) that technology provided information to smallholder farmers on innovative agricultural practices to increase production and thus enhanced food security.

On whether access to internet has helped in the management of crops/animals, 62% agreed while 12.2% strongly agreed. 1.6% disagreed with the statement and 2.7 strongly disagreed. 6.3% of the respondents were undecided. These results implied that majority of the farmers in the county owned smart phones and could access internet. The findings further imply that some of the questions which would only be answered by rarely seen experts in the county could instantly be answered through internet and the farmers took this to their advantage in crops and animals management. The results were affirmed by the opinions of respondent R1 who stated that:

“Majority of residents in Kajiado County are Maasais in tribe, many stereotype this community to be uneducated and marginalized, this is not true since majority of them own smartphones and access internet anytime. You will confirm the truth of the matter with how fast they answer the questions.”

More than sixty three percent (63.7%) of the respondents disagreed that mobile phones have helped the farmers to get market information for their products. 6.8% strongly disagreed with the statement, 11.8% strongly agreed, 12.2% agreed that mobile phones have helped them to get information on market, however 5.9% were un decided. These results imply that majority of the respondents did not have market information for their products; they did not have market prices too so as to decide in which market to sell or buy from. It further implies that the few that that agreed with the statement may have an app whereby they could get market information from various markets. These results were affirmed by respondent R9 who stated that:

As Kajiado County we have revenue officers especially in livestock markets in the county, these officers collect revenue from the traders every day, unfortunately there is no way to account for it, it is difficult for the county to know how many animals were sold at what price and how much was collected. There is no platform for farmers to be availed with such information, and mostly the brokers buy animals from the farmers very cheaply with unfavorable prices because they don't know how much to sell and where to sell.

The results were consistent with assertions of Celestin (2020) who reviewed the markets in developing regions and relationship between value chain actors and small-scale producers.

The study recommended that market information is paramount for profound decision making.

Majority of the respondents at 43.9% disagreed that technology has helped them to optimize resources utilization like water and land while 35.8% agreed with the statement, 5.9% strongly agreed, 2.7% strongly disagreed while 11.8 were neutral. The aggregate scores indicated that on average the respondents had a neutral response; the mean was 3.02 with a slightly wide deviation (standard deviation =1.12).

From qualitative analysis while responding to use of technology for optimization of resource utilization, R9 said:

“As a county we are very far on using technology for resources optimization, in developed countries, they are using AI for powered crop monitoring, use GPS technology and automation. However just very few farmers use drones here. We have a long way to go on the matter”

On the difficulties encountered in accessing technology to enhance food security, 66.5% of respondents disagreed with the statement that they did not encounter difficulties and 14.01% strongly disagreed, 9.1% disagreed and 2.3% strongly agreed, however 8.1% of the respondents were undecided. With the mean of 3.81 and standard deviation of 0.87, majority of the respondents were neutral on the difficulties they experienced in accessing technology.

Majority of the respondents disagreed on that they experienced minimal financial implications when adopting technology at 59.3% and 17.2% strongly disagreed. 9.1 % agreed with the statement and 4.1% strongly agreed that the financial implications were minimal. With the mean of 3.76 findings indicate that majority of the respondents are neutral on the same though with a slightly wide deviation (standard deviation= 0.98)

4.5.2 Food Security

Food security is the dependent variable in the study. The study sought to determine the level of food security elements in Kajiado County. The food security composite measure was arrived at by adding the dimensions of food security (Food availability+ food accessibility+ Food stability +food utilization).The results are as indicated in table 4.9.

Table 4.9 Descriptive statistics for food security

1 = Strongly Agree (SA); 2 = Agree (A); 3= Neutral (N); 4=Disagree (D); 5= Strongly Disagree (SD).

Statements	1	2	3	4	5	Mean	Std Dev
	%	%	%	%	%		
Food availability is high in Kajiado County	0.5	42.5	13.6	40.3	3.2	3.03	0.99
Food accessibility is high in Kajiado County	0	17.7	11.8	67	3.6	3.57	0.82
Food Stability is high in Kajiado County	1.4	7.7	11.3	54.8	24.9	3.94	0.89
Food utilization is high in Kajiado County	7.7	11.8	10.9	63.8	5.9	3.48	1.03
Is Kajiado Food Secure	Yes				15.38		
	No				84.62		

Source: Research Data (2024)

The results indicated that 42.5% of the respondents agreed that food availability is high in Kajiado County and 40.3% disagreed .13% were neutral, 3.2% strongly disagreed and 0.5% of the respondents strongly agreed with the statement. With the mean of 3.03 the respondents were neutral in this regard though the variation was fairly wide (standard deviation = 0.99). The results implied that the agreements and disagreements were approximately equal on availability of food. These findings agreed with the perspectives of Bowbrick (2022) on the study on entitlement and food availability decline. The study established that food availability is the physical presence of food within an area and depends on factors such as agricultural productivity, food imports, and food reserves.

On food accessibility 67% of the respondents disagreed with that food accessibility is high, while 17.7% agreed that it is.3.6% strongly disagreed while 11.3 were neutral on it. With the mean of 3.57 the respondents were neutral on this regard though the variation was not so wide (standard deviation = 0.82). These results imply that access to food was a challenge to the majority of the respondents may be because they did not have the

financial ability to buy it or did not have a physical access to the market where it was sold. Jafari and Jafari (2020) on the study climate change and food security reiterates that the ability to obtain sufficient food is determined by factors such as income levels, food prices, distribution channels, and transportation infrastructure. Availability of food does not give assurance of food security especially if there is no purchasing power to obtain it for everyone.

On food stability majority of respondents at 54.8% disagreed with the statement that food stability is high while 24.9% strongly disagreed on it. 7.7% agreed and 1.4% strongly agreed while 11.3% did not take any side. The mean of 3.94 showed neutrality of the respondents with not very wide deviation of 0.89. The results implied that majority of the respondents were not confident that they would have food in future even if they had food at the time of the survey. It means that they lack food time to time. Savary *et al* (2020) study on food systems, resilience mechanisms and mapping disruptions establishes that reliability and predictability of access to food over time considers factors such as market volatility or fluctuations in food prices, environmental disasters and political stability which influence the food distribution and access.

More than half of the respondents (63.8%) disagreed that food utilization is high in Kajiado County, 5.9% strongly agreed with the statement, 11.8% agreed and 7.7% strongly agreed 10.9% were neutral. With the mean of 3.48 it showed neutrality of the respondents in this regard with a fairly wide deviation (standard deviation = 1.03) These results implied that the respondents were not keen on taking balanced diet and could just feed on what is available not taking into consideration of the nutritional value. The findings agree with the works of Clapp (2022) on the study of the framework of six-dimensional food security that focuses on the quality and nutritional value of food consumed. The study considered factors such as consumption of a variety of foods, Protection against foodborne illnesses, adequacy of dietary intake, clean water access and hygiene practices. The respondents were asked whether Kajiado County is food secure or not. Majority of the respondents (84.6%) opined that Kajiado County was not food secure and only 15.4% of the respondents were of the opinion that Kajiado County was food secure. The findings imply that majority of the respondents felt that more efforts were

needed to enhance food security in Kajiado County. With the mean of 3.48 it showed neutrality of the respondents in this regard, however it had a fairly wide deviation (standard deviation =1.03). The perspectives of Ingutia and Sumelius, (2022) on their study on food security determinants by women farmers in rural Kenya agree with the study findings. The study establishes that Kenya has made strides towards food security but challenges remain equitable access to nutritious food for all its citizens. The study noted that improving agricultural productivity, strengthening food distribution systems, and addressing nutritional needs are ongoing priorities for the government and various stakeholders.

4.5.3 Agricultural Extension interventions

The study sought to evaluate the effectiveness of agricultural extensions in enhancing food security in Kajiado County. The respondents were expected to indicate their level of agreement or otherwise with the statements in the table 4.10.

Table 4.10 Descriptive statistics for Agricultural extension Interventions

1 = Strongly Agree (SA); 2 = Agree (A); 3= Neutral (N); 4=Disagree (D); 5= Strongly Disagree (SD).

Statements	1	2	3	4	5	Mean	Std Dev
	%	%	%	%	%		
Training farmers is a key factor in fighting food insecurity in the county	39.8	52.9	1.8	3.2	2.3	1.75	0.83
Agricultural extension officers have provided you with subsidized animal feeds for livestock.	9.1	14.9	8.1	31.2	36.7	3.71	1.34
Agricultural extensions officers provide farmers with training on vaccination	10.9	50.7	6.3	28.5	3.6	2.63	1.11
Agricultural extensions officers provide training on disease control and treatment	10.9	53.9	3.2	29	3.2	2.6	1.11

The training includes simple techniques such as fertilizer application to ensure the appropriate amount is used	10	24.9	8.6	53.9	2.7	3.14	1.13	
Agricultural extensions officers has provided artificial insemination services to farmers at lower costs	8.6	11.8	6.3	44.8	28.5	3.73	1.24	
Agricultural extension officers training has opened avenues to better farming methods	10	40.7	5.9	40.3	3.2	2.86	1.15	
I have been able to do Value addition for your farm products after agricultural extension services were offered	9.1	10.9	5.4	71	3.6	3.49	1.04	
Cattle dips provided for your animals has helped your animals to remain healthy	10	12.2	5	67	3.2	3.44	1.08	
Has Agricultural extension officers provided training to farmers in the fields	Yes						57%	
	No						43%	
Has your production increased after agricultural extension services were offered?	Yes						55.20%	
	No						44.80%	

Source: Research Data (2024)

According to table 4.10, slightly more than half of the respondents at 52.9% agreed that training is a key factor in fighting food insecurity while 39.8% strongly agreed with the same. 3.2% disagreed while 2.3% strongly disagreed. 1.8% remained undecided on it. With the mean of 1.75 the findings suggest that majority of respondents generally agreed that training is a key factor in production though with a slightly wide deviation (standard deviation = 0.83). These results agree with the assertions of Norton and Alwang (2020) who

studied the changes that occurred in agricultural extension when the funding was reduced and the farm visits could not happen which had a negative impact on farmers since their production reduced and this increased food insecurity. On provision of subsidized forage for farmers 36.7% strongly disagreed, 31.2% disagreed, 14.9% agreed and 9.1% strongly agreed. 8.1% remained undecided. The mean of 3.71 indicates that majority of the respondents were neutral on this matter though the deviation was fairly wide (standard deviation = 1.34).

Almost three quarters of the respondents at 64.7% of the respondents disagreed that they have acquired training to effectively use technology while 16.1% strongly disagreed, 8.6% agreed and 4.1% strongly agreed that they have acquired training to effectively use technology. However, 6.3% were undecided on the same. With the mean of 3.81 the findings indicates that majority were undecided on the same though with a slightly wide deviation (standard deviation = 0.9).

From qualitative analysis when responding to the question on forage provision to farmers' respondent R7 said:

“We have not currently provided the forage directly to the farmers, what we have done we have provided them with fast growing millet and sorghum grown for forage, we have introduced sugar graze millet which flourishes with little water, it is so good for silage. Those farmers who have benefitted will tell you how fast it grows and how nutritious it is to the animals.”

Half of the respondents (50.7%) agreed that extension officers had provided training on vaccination and its importance while 10.9% strongly agreed, however 28.5% disagreed, 3.6% strongly disagreed while 6.3% of the respondents were neutral on the statement. With the mean of 2.63 the findings reveal that on average majority were in agreement that they were trained on vaccination use and importance with a slightly wide deviation (standard deviation of 1.11). On diseases control, majority at 53.9% agreed that they were trained on different ways of pests and diseases control while 10.9% strongly agreed with the same. However, 29% of respondents disagreed that they have been trained, 3.2% strongly disagreed while 3.2% were undecided on the matter. With the mean of 2.60 on average the findings show that the majority of the respondents were in agreement that

extension officers have trained them on pests and diseases control with a slightly wide deviation (standard deviation = 1.11).

From the qualitative analysis respondents R1 reported that:

We have been to a great extent been involved in livestock keeping, mostly the extension officers visit the farmers and they are trained on how to control pests and diseases for example by ensuring cleanliness and spraying their animals to kill pests. It is true that many times the extension officers are not facilitated by the county to visit farmers, though we are lucky that there are many projects in Kajiado County which by a large extent support the extension officers especially by fueling the vehicles or motor cycles. The county doesn't have an adequate budget for the extension officers and therefore sometimes they are not facilitated. The county sometimes buys the vaccines to be given to the cattle mostly for free or for a very little charge of Ksh 20 per cow.

Majority of the respondents at 53.9% disagreed that extension officers train them even on simple techniques like fertilizer application to ensure they know which fertilizers to use, when and to what amount. 2.7% strongly disagreed, however 24.9% of respondents agreed, 10.0% strongly agreed but 8.6% were neutral. With the mean of 3.14 and standard deviation of 1.13 the results indicated that on average the respondents were neutral on the matter.

On whether extension officers had provided artificial insemination (AI) services to the farmers, majority at 44.8% disagreed with it and 28.5% strongly disagreed with the statement. However, 11.8% agreed that artificial insemination services had been provided, 8.6% strongly agreed while 6.3% did not take any side. With the mean of 3.73 and standard deviation of 1.24 the results indicate that averagely they were neutral on provision of AI service. Respondent R8 on the provision of AI services stated that:

Most farmers in Kajiado County are pastoralist although we are trying the much we can to have modulated pastoralism which is commercial instead of traditional pastoralism which is there currently. Most pastoralists use bulls for mating and only dairy farmers use artificial insemination. It is a private affair; dairy farmers

sponsor themselves for the service. The County had a Demo farm where there were high quality breeds of bulls, farmers could take their cows to be served, they could either breed their cows or buy the bulls this improved breeds in a great way, unfortunately the demo farm collapsed because of lack of support and poor management. We are hopeful that one day we shall have a fully functional, well managed demo farm.

On the statement that extension officers had opened avenue for better farming methods 40.7% agreed with the statement while 40.3% disagreed, 10.0% strongly agreed while 3.2% strongly disagreed. However, 5.9% of the respondents did not take sides. With the mean of 2.86 and standard deviation of 1.15 the outcome shows that majority agreed that extension officers has helped them better their farming methods. This has also been confirmed by the question that agricultural extension officers had provided training to farmers in the fields whereby 57.0% said yes while 43.0% disagreed. More than half the respondents (55.2%) affirmed that the production had increased after extension officers visited their farms while the remaining 44.8% did not think so. These results are in tandem with the findings of Migika (2013) who found that in circumstances where the extension officers visited farms frequently, better farming methods were reported and higher production was well noted. Additionally, the results agrees with the recommendations by Davis *et al.* (2019) recommended the strengthening of agricultural extension system in Ethiopia since where they frequently visited and trained the farmers food production had increased.

Nearly three quarters of the respondents (71%) disagreed that the extension officers had helped farmers to engage in value addition for their farm products after offering their services. Another 3.6% of the respondents, strongly disagreed with this statement while 10.9% agreed, 9.1% strongly agreed that they were able to do value addition of their farm products and the remaining 5.4% of the respondents remained neutral. With a mean of (3.49), the respondents were neutral in this regard though the variation was fairly wide (standard deviation = 1.04).

Respondents were also expected to affirm or disaffirm on the statement that the cattle dip provided for cattle farmers had helped them in maintaining animal health hence

increasing the animal value and products, 67.0 of the respondents disagreed, 28.5% strongly disagreed, however only 12.2% agreed with the statement and 10.0% strongly agreed. However, 6.3% were undecided on the matter. The outcome had a mean of 3.44 and standard deviation of 1.08, which clearly indicated that on average majority of the respondents were undecided about the matter. On qualitative analysis, the respondent R5 stated that:

The county only builds the cattle dips for the farmers which it has provided quite a number but the management is left with the farmers, this is where the problem is, we have cattle dips but they are not functional since the farmers have not had the ability to manage it. The county budget also has not put that into consideration. This means that currently farmers spray their cattle at their homes which many pastoralists don't do. You will find a farmer with many numbers of livestock but the value is so little, some are invested by pests, making them unhealthy, production is low, calves die very often. I wish the county would consider and have a budget for facilitating cattle dips for the farmers.

4.5.4 Credit Availability Interventions

The study sought to examine the effectiveness of credit availability in enhancing food security in Kajiado County. The respondents were expected to indicate their level of agreement or otherwise with the statements in the table 4.11.

Table 4.11 Descriptive statistics for Credit Availability Interventions

1 = Strongly Agree (SA); 2 = Agree (A); 3= Neutral (N); 4=Disagree (D); 5= Strongly Disagree (SD).

Statements	1	2	3	4	5	Mean	Std Dev
	%	%	%	%	%		
You frequently require financial assistance in form of credit to increase your crop production/livestock production.	26.7	59.3	4.1	9.1	0.9	1.98	0.87
It is very easy to access credit	4.1	7.2	7.2	47.1	34.4	4	1.04

Credit availability has played a role in increasing food production	10.4	42.5	5.9	23.5	17.7	2.95	1.34
I have accessed the amount of credit you wanted to enhance your production	6.3	11.8	7.2	54.8	19.9	3.7	1.11
I have not faced any challenges in accessing credit to enhance your farm production.	4.1	5.9	8.1	50.2	31.7	3.99	1
The process involved in applying and receiving credit is simple.	5.4	8.1	7.2	45.3	33.9	3.94	1.11
The interest of the credit accessed was subsidized by the county	5	9.5	10	38.9	36.7	3.93	1.14
No collateral was required in accessing the credit.	6.3	6.3	9.5	38.5	39.4	3.98	1.15
I have used credit to invest in technologies that enhance resilience and adaptability to climate change.	8.1	22.6	6.3	41.2	21.7	3.46	1.23

Source: Research Data (2024)

The Farmers in Kajiado County based on their experienced were expected to indicate whether they frequently financial assistance in form of Credit to increase their crops and or animals' production. The majority at 59.3% and 26.7% agreed and strongly agreed that they frequently require credit. This means that most of the farmers required a form of financing in their individual attempt of achieving food security. Only 9.1% and 0.9% disagreed and strongly disagreed respectively. However, 4.1% were undecided. With the mean of 1.98 the results mean that on average the farmers strongly agreed that they often require credit with a slightly wide deviation (standard deviation= 0.87). The study also wanted to determine the ease of acquiring credit.47.1% of the respondents disagreed and

34.4% strongly disagreed that accessing credit is easy, 7.2% agreed with the statement and 4.1% strongly agreed while 7.2% were undecided. With the mean of 4.0 the findings on average means that majority of the respondents disagreed that accessing credit is easy though it had a wide deviation (standard deviation =1.04)

On the statement that credit has played a role in increasing food production 42.5% of the respondents agreed, 10.4% of the respondents strongly, 23.5% disagreed while 17.7% strongly disagreed and 5.9% was neutral on the statement. With the mean of 2.95 the outcome demonstrates that respondents largely share the view that the credit plays a big role in enhancing food security but it had a wide deviation (standard deviation = 1.34)

The findings are consistent with the assertions of Ankrah *et al* (2020) who studied the role of credit access mobilization in Ghana who revealed that farmers who secured loans were able to farm in large scale and hence resulting to increased production. Their recommendation is that accessing credit is key towards achieving food security in each country.

The respondents were split on the statement that they accessed the amount of credit they wanted 54.8% of respondents disagreed that they got the amount they wanted, 19.9% strongly disagreed. 11.8% agreed, 6.3% strongly agreed while 7.2% of the respondents were undecided. The mean of 3.7 demonstrates that on average the respondents view was neutral though with a slightly wide deviation (standard deviation = 1.11) Concerning whether respondents faced challenges in accessing credit 50.2% disagreed with the statement while 31.7% strongly disagreed. 4.1% and 5.9% agreed and strongly agreed respectively. 8.1% were undecided on the matter. The mean of 3.99 shows that the general view taken by the respondents was one of neutrality though it had a slightly wide deviation (standard deviation=1.00). The findings agreed with the assertions of Obagbemi *et al* (2022) who studied the effects of credit among smallholder farmers in Kwali Area, Abuja who produced rice. The study concluded that the rice production doubled when they received credit, they were able to do irrigation in large scale and enjoyed economies of scale. They recommended that the country should ease the process of accessing credit for better production.

On whether the process involved in accessing credit is simple the majority of the respondents at 45.3% disagreed and 33.9% strongly disagreed. 8.1% disagreed, 5.4% strongly disagreed while 7.2% were neutral. With the mean of 3.94 it showed neutrality of the respondents in this regard with a fairly wide deviation (standard deviation of 1.11)

Majority of the respondents disagreed that interest of the credit accessed was subsidized by the county 38.9% disagreed and 36.7% strongly disagreed, 9.5% agreed with the statement 5.0% strongly agreed while 10% were undecided. The results mean that the farmers who received credit paid a hundred percent interest as calculated without any subsidy. The mean of 3.93 and standard deviation of 1.14 reveal that most respondents were neutral. Concerning the statement that collateral was not a requirement for receiving credit was disagreed on at 38.5% and those who strongly agreed with this statement was 39.4%. 6.3% agreed further 6.3% strongly disagreed while 9.5% were undecided. The mean of 3.98 reveal that on average the response was neutral with a slightly wide deviation (standard deviation=1.15). Finally, on whether the farmers used the credit to invest in technology was disagreed on by the majority at 41.2%, 21.7% too strongly disagreed. 22.6%, 8.1% strongly agreed while 6.3% were neutral. The mean of 3.46 reveal that the majority's view was neutral with a wide deviation (standard deviation =1.23). On the same issue of accessing credit respondent R1 reported that:

The national government doesn't give credit or subsidize it so you should not expect that the counties could have a role that the national government don't have. But all is not lost, as Kajiado County we have a cooperative where we encourage farmers to join, save and get subsidized credit from it. There are other farmers' cooperatives, we have taken it as our responsibility to train farmers on the importance of joining cooperatives; to save and have credit they may require to increase their production.

4.5.5 Research Interventions

The study sought to determine the effectiveness of research interventions in enhancing food security in Kajiado County. The respondents were expected to indicate their level of agreement or otherwise with the statements in the table 4.12.

Table 4.12 Descriptive statistics for Research Interventions

1 = Strongly Agree (SA); 2 = Agree (A); 3= Neutral (N); 4=Disagree (D); 5= Strongly Disagree (SD).

Statements	1	2	3	4	5	Mean	Std. Dev
	%	%	%	%	%		
I have personally benefitted from any research intervention related to food security.	7.7	31.2	31.7	25.3	4.1	2.87	1.01
I have benefitted from new Vaccines as a result of research	8.1	63.8	6.3	19	2.7	2.45	0.98
I have benefitted from drought resistant seeds to enhance food security	9.1	46.2	6.8	35.8	2.3	2.77	1.1
I have witnessed better water provision services as a result of research	8.1	37	8.1	43	4.1	2.99	1.14
Research grants are always available to facilitate programmes of food security.	6.8	6.8	6.3	47.5	32.6	3.93	1.13
The research has helped in better marketing techniques	7.7	8.6	7.2	57	19.5	3.72	1.11
I have noted a positive change in food availability as a result of research interventions	10	35.8	8.6	38	7.7	2.98	1.2
Research interventions has led to high yielding animals	8.1	43.4	9.1	34.4	5	2.85	1.13
Better methods of tagging/branding animals to prevent theft are available as a result of research being done	8.1	38.9	8.6	39.8	4.5	2.94	1.14

Source: Research Data (2024)

According to table 4.12 the majority of respondents at 31.7% were neutral on the statement that they have personally benefitted from any research intervention related to food security.31.2% agreed with the statement while 7.7% strongly agreed.25.3%

and 4.1% disagreed and strongly disagreed respectively. The mean of 2.87 suggest that generally respondents agreed that they have personally benefitted from Research though with a slightly wide deviation (standard deviation = 1.01). These results imply that most respondents had seen a positive outcome from researches that have been done.

A majority of the respondents (63.8%) agreed that they have personally benefited from the vaccines as a result of the research while 8.1% strongly agreed, 19% disagreed, 2.7% strongly disagreed and 6.3% remained neutral. The mean of 2.45 suggests that majority of the respondents agreed they have benefitted from vaccines though with a fairly wide deviation (standard deviation of 0.98). These results imply that most farmers have enjoyed the benefits of research. The findings agree with the work of Sukhna *et al.*, (2022) on the perception of extension professionals and delivery of agricultural extension service. The study established that research led to secure environments which reduce stress in animals, which is critical for their overall health and productivity. Stressed animals are more susceptible to diseases and have lower growth rates. Research in farm security often included aspects like proper housing, ventilation, and disease prevention measures, all of which contribute to healthier animals.

On the issue of benefit from drought resistant seed as a result of research, majority of the respondents at 46.2% and 9.1% agreed and strongly agreed respectively, 35.8% disagreed, 2.3% strongly disagreed while 6.8% remained undecided. The mean of 2.77 suggest that the majority view of the respondents was in agreement that they have benefitted from drought resistant seeds as a result of research; it had a slightly wide deviation (standard deviation of 1.10). About 43.0% and 4.1% of the respondents disagreed and strongly disagreed respectively that research has enabled them to have better water provision, 37.0% agreed, 8.1% strongly agreed while 8.1% remained neutral. The mean of 2.99 and standard deviation of 1.14% suggest that majority of the respondents have noticed better water provision as a result of research that has been done. The findings agreed with respondent R7 who stated that:

Research is a very important but very expensive affair that the county government is not able to carry, it is a role of the national government. Fortunately, as a County we partner with research institutions some of which are international and

hence fund the research. Research has to a great extent benefitted Kajiado county. Research has resulted to better vaccines, animals used to die a lot, especially the young ones. When farmers accepted vaccination, we can say we have controlled the diseases through vaccines. Research has also brought by the Sugar graze sorghum and millet for livestock forage, which is fast growing, nutritious and it is drought resistant. Farmers who have benefitted from it are very happy about it.

Majority of the respondents at 47.5% and 32.6% disagreed and strongly disagreed respectively that funds are always available for research. 6.8% agreed, 6.8% also strongly disagreed while 6.3% were neutral. The mean of 3.93 suggest that majority of the respondents were neutral on the matter though with a slightly wide deviation (standard deviation = 1.19). These results imply that lack of funds is a great challenge towards doing research to enhance food security. The findings are in agreement with the perspectives of Gnezdova *et.,al* (2020) on the Russian study titled modernization of main funds for agricultural purpose in increasing food security. The study established that inadequate funds allocation for research created the greatest barrier towards implementation of research requirements needed to enhance food security in Russia.

On the statement that research has helped in better marketing techniques, 57.0% disagreed and 19.5% strongly disagreed. 8.6% agreed, 7.7% strongly disagreed while 7.2% were undecided. The mean of 3.72 and a deviation which was fairly wide at standard deviation of 1.11 suggests that the general view of the respondents was neutral. On whether the farmers have noted a positive change in food availability as a result of research interventions, majority at 38.0% disagreed and 7.7% strongly disagreed. 35.8% agreed with the statement while 10.0% strongly agreed. 8.6% of the respondents did not take sides. With the mean of 2.98, the general view of the respondents was in agreement that farmers have noted a positive change in their production as a result of research, though this had a fairly wide deviation (standard deviation of 1.20)

Majority of the respondents at 43.4% agreed that research interventions led to high yielding animals, 8.1% strongly agreed, 34.4% and 5% disagreed and strongly disagreed respectively while 9.1% remained neutral. The mean of 2.85 implied that most of the

respondents agreed that research has resulted to higher yielding animals though this had a slightly wide deviation (standard deviation of 1.13). The findings are consistent with those of Willis and Nilakanta (2017) on the study foundations of qualitative research who established that research impacted on overall farm management, disease prevention, nutrition, regulatory compliance and indirectly contributed to creating environments where animals achieve their genetic potential for high yields.

From the study on whether research had resulted to better methods of tagging/ branding animals to prevent theft, 38.9% and 8.1% agreed and strongly agreed respectively. 39.8% and 4.5% disagreed and strongly disagreed respectively while 8.6% remained neutral. With the mean of 2.94 the findings imply that averagely the view of the respondents is in agreement that research has resulted to better tagging and branding methods and thus has reduced theft. This mean had a fairly wide deviation (standard deviation of 1.14).

4.5.6 Moderating Effect of Policy Interventions

The study sought to establish the moderating effect of the national government policies on the County government interventions in enhancing food security in Kajiado County. The respondents were expected to indicate their level of agreement or otherwise with the statements in the table 4.13

Table 4.13 Descriptive statistics for moderating effect of government policy

1 = Strongly Agree (SA); 2 = Agree (A); 3= Neutral (N); 4=Disagree (D); 5= Strongly Disagree (SD).

Statement	1	2	3	4	5	Mean	Std Dev
	%	%	%	%	%		
I have benefitted from subsidy policies of inputs like fertilizers/Seeds/ vaccination services from the government	26.2	62.9	3.2	5.4	2.3	1.95	0.85
There are policies on animals' off take in times of drought and restock when the climate is	5.9	12.7	9.5	12.7	59.3	4.07	1.31

good.							
There are policies in place for provision of clean water to enhance production	9.1	45.1	9.1	31	5.9	2.79	1.15
The governments in place always have a political will to run programmes to enhance food security.	6.3	11.3	6.8	35.3	40.3	3.92	1.22
Funds are always available to ensure implementation of policies that enhance food security.	7.2	5.9	7.7	44.8	34.4	3.93	1.14
Policies are there to ensure value addition of your products to increase longevity	5.9	14.5	5.4	65.6	8.6	3.57	1.03
The government policies have improved availability of nutritious food in Kajiado county	6.8	15.4	5.9	66.1	5.9	3.49	1.04
There are policies to ensure better road networks for ease of distribution of your products	8.6	53.4	6.3	28.5	3.2	2.64	1.08

Source: Research Data (2024)

From the results in table 4.13, 62.9% and 26.2% of the respondents agreed and strongly agreed respectively that they have benefitted from policies on subsidy of inputs like fertilizers/Seeds/ vaccination services from the government. 5.4% disagreed, 2.3% strongly disagreed while 6.8% of the respondents remained undecided. The mean of 1.95 means that averagely, majority of the respondents were in agreement that they have benefitted from subsidy with a slightly wide deviation (standard deviation = 0.85). These results imply that the government has provided some inputs for the farmers. The results agree with the assertions of Mulupi, (2022) on the fertilizer subsidy program and maize

productivity in Kakamega County among small-scale farmers. The study established that the Kenyan government had implemented programs to support small-scale farmers, enhance agricultural infrastructure, promote irrigation schemes, and provide subsidies for agricultural inputs. These efforts were designed to boost food production and ensure food availability

To confirm whether the county did the offtake of the animals during unfavorable climatic conditions, the respondents gave their agreement level on availability of policies on animals' off take in times of drought and restock when the climate was good. The results indicated that majority of the respondents disagreed with the statement at 59.3%, 4.07% strongly disagreed. 12.7% agreed, 5.9% strongly agreed while 12.7% remained neutral on the statement. The mean of 4.07 implied that on average the respondents disagreed that there was offtake of animals during drought and restocking done when the climatic conditions were favorable. The deviation was slightly wide at standard deviation of 1.31. Respondent R8 agreed with these findings and stated that:

The government does not currently offtake the animals during the drought seasons from the county rather, the money is given to Kenya Meat Commissioners to buy animals from the willing sellers but unfortunately the community around the County traditionally believe that many animals is source of wealth and the animals end up dying since they are attached to them and they find it difficult to sell them. However, the government has helped the farmers with livestock insurance whereby, the government has a policy of paying the 70% of the insurance cost while the farmer is left to pay 30% of the cost to the maximum of 5 cows in Kajiado County.

On the policies on provision of clean water to enhance production, 45.1% agreed and 9.1% strongly agreed that there are policies in place to help in provision of water to enhance production. 31.0% disagreed, 5.9% strongly disagreed with the statement while 9.1% remained undecided. The mean of 2.79 implied that on average majority agreed that there are policies in place to provide water to enhance production though the deviation was fairly wide at 1.15. The results concurred with the findings of Gebru *et al.*, (2021) on the study on Ethiopian's technologies intervention contributions on water harvesting in arid and semi-arid areas in ensuring households' who reiterates that the

government develop contingency plans and emergency response strategies to address water supply disruptions caused by natural disasters, droughts, or infrastructure failures which is a key aspect in addressing food security.

Majority of the respondents disagreed that there was political will of the government to run programmes that enhance food security at 40.3% strongly disagreeing, 35.3% disagreed, 11.3% agreed, 6.3% strongly agreed while 6.8% of the respondents were undecided. The mean of 3.92 implied that on average the results showed neutrality though it had a fairly wide deviation of 1.22 as standard deviation. The assertions on designing for policy effectiveness by Peters *et al.* (2018) revealed the importance of political will for success in driving policies and recommended that the political will is key so that the agenda is prioritized.

On whether the funds are always available to ensure implementation of policies that enhance food security, 44.8% disagreed while 34.4% strongly disagreed that funds are always available. 5.9% disagreed, 7.2% strongly agreed while 7.7% were neutral. The mean of 3.93 imply that majority of the respondents were neutral on the availability of funds though it had a fairly wide deviation (standard deviation of 1.14).

Respondent 9 had this to say:

Agriculture is underfunded, there are well stated policies on different areas to enhance food security but the budget cannot allow. Extension services are not adequately facilitated, little funds to help adopt technology or do research. We are still so far on policies implementation compared to developed countries; many policies are just on paper.

More than half of the respondents (65.6%) disagreed that the availability of policies to ensure value addition of farm products increases longevity, 8.6% strongly disagreed, 14.5% agreed that value addition policies are there, 5.9% strongly agreed while 5.4% were neutral. The results mean was 3.57 implying that on average the respondents' views were neutral though it had a fairly wide deviation at standard deviation of 1.03. These results imply that Kajiado County farmers had a challenge of adding value to their products. Rokšana (2014) on the study on strategic approaches to Food Security in

Bangladesh reiterates that policies that promote research and development in agriculture lead to innovations in processing techniques, preservation methods, and product diversification which as a result in new value-added products that cater to consumer preferences and increase profitability for farmers.

More than half of the respondents (66.1%) disagreed that government policies have improved availability of nutritious food in Kajiado County. 5.9% strongly disagreed, 15.4% agreed, 6.8 strongly agreed and 5.9% were neutral. The mean of 3.49 implied that on average the results were neutral although the deviation was fairly wide (standard deviation of 1.04). Slightly more than half of the respondents (53.8%) agreed that policies are in place to ensure better road networks for ease of distribution of farm products while 8.6% strongly agreed. 28.5% disagreed, 3.2% strongly disagreed while 6.3 were neutral. The mean of 2.64 implies that on average the respondents agreed that policies on improving road networks are in place, though this had a fairly wide deviation at standard deviation of 1.08

4.6 Diagnostic Tests

In this section the normality, Multicollinearity and heteroscedasticity tests are presented.

4.6.1 Test for Normality

This study evaluated normality by the use of Shapiro-Wilk test.

Table 4.14 Normality test by use of Shapiro Wilk statistics.

Variable(Observation)	Observation (N)=Df	Shapiro Wilk Test		Observed Conclusions
		Statistics (t)	Sig Level (P-value)	
Technology intervention	265	0.99782	0.99788	Normally distributed
Agricultural extension	265	0.99543	0.96412	Normally Distributed
Credit availability	265	0.99656	0.99435	Normally distributed
Research Interventions	265	0.98312	0.14377	Normally distributed
Government policies	265	0.99376	0.99216	Normally distributed
Food Security	265	0.99549	0.95865	Normally distributed

Research (Data 2024)

The Shapiro wilk test test result were computed as illustrated in the table 4.14. It shows that the respective *P_ values* for the study variables. The technology interventions, agricultural extension interventions, credit availability interventions, research interventions, government policy interventions and food security were normally distributed at a range of -0.1 to +0.1 (Das and Imon,2016) as reflected by more than 0.05 significance level. Table 4.14 shows normality. Where *P_ values* 0.99788 > 0.05, *P_ values* 0.96412 > 0.05, *P_ values* 0.99435 > 0.05, *P_ values* 0.14377 >0.05, *P_ values* 0.99216 >0.05 and *P_ values* 0.95865>0.05. Technology interventions, agricultural extension interventions, credit availability interventions, research interventions, government policy interventions and food security were normally distributed at 95% level of confidence. This implies that all the variables were normally distributed and therefore ensured the validity of the chosen statistical methods and the reliability of research findings.

4.6.2 Test for Multicollinearity

Variance Inflation Factor and Tolerance level (1/VIF) were used in testing Multicollinearity. The VIF above 10 and tolerance of below 0.1 shows Multicollinearity. The table 4.15 shows that the VIF values were lower than 10 and tolerance values more than 0.1 indicating absence of Multicollinearity.

Table 4.15 Multicollinearity results (using VIF and Tolerance)

Variable	Multicollinearity statistics		Conclusion Observation
	VIF	Tolerance(1/VIF)	
Technology Interventions	1.89	0.63564	Multicollinearity absent
Agricultural extension interventions	1.02	0.98211	Multicollinearity absent
Credit availability interventions	1.05	0.97772	Multicollinearity absent
Research interventions	1.79	0.83421	Multicollinearity absent
Government Policy interventions	1.93	0.52566	Multicollinearity absent
Mean (VIF and Tolerance)	VIF=1.28	Tolerance=0.65922	
Dependent Variable: Food security			

Source: Research (Data2024)

Table 4.15 Shows technology interventions VIF is 1.89, agricultural extension interventions VIF of 1.02, credit availability interventions VIF of 1.05, research interventions VIF of 1.79 and government policy interventions VIF of 1.93, The mean shows that the variables have VIF of 1.28 which is less than 10 and tolerance value of more than 0.1. This meant that there was no likelihood of Multicollinearity being present among the variables

4.6.3 Test of Heteroscedasticity

To test heteroscedasticity Breusch –Pagan test was utilized to test for constant variance as presented in table 4.16.

Table 4.16 Breusch –Pagan test

Breusch-Pagan test heteroscedasticity	
Ho:	Constant Variance
Variables	County intervention
Chi2(1)	37.68
Prob>Chi2	0.0000

Source: Research Data (2024)

The results in table 4.16 indicate a P-value of 0.000 which is small enough to reject the null hypothesis of homoscedasticity meaning that there was no evidence to support heteroscedasticity in the variables that were modeled.

4.7 Inferential Statistics

The study had four independent variables which led to the use of multiple regressions to show the joint relationship between the independent variables (technological interventions, agricultural extension interventions, credit availability interventions and research interventions) and the food security in Kajiado County. To check for model fitness the R squared was used. The coefficient of determination, R^2 gave the proportion of the variance.

4.7.1 County government interventions and Food security

The study computed composite indices for county government interventions (derived from composite indices of technological interventions, agricultural extension

interventions, credit availability interventions and research interventions) and food security in Kajiado County. Then, the coefficient of determinants (R^2) was generated to describe the proportion of variation in food security that was accounted for by the interventions (technological interventions, agricultural extension interventions, credit availability interventions and research interventions) which were the regressors. Table 4.17 present the Regression model summary, Analysis of variance (ANOVA) and model coefficients outputs which were generated.

Table 4.17 Model summary for County interventions on food security

Model Summary^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.638 ^a	.407	.396	.58658

a. Predictors: (Constant), Research interventions, Technological Interventions, Agricultural Extensions Interventions , Credit availability interventions

b. Dependent Variable: Food Security

Source: Research Data (2024)

From the model summary in table 4.18, the coefficient of determination ($R^2=.407$) indicates that 63.8% of the variation in Food security in Kajiado County was jointly explained by the changes in the four county interventions (technological interventions, agricultural extension interventions, credit availability interventions and research interventions). This mean that the four interventions accounted for a significant variation in food security in Kajiado county. In term of overall significance of the regression equation, table 4.19 present the F-statistic and P-*value* used to test the null hypothesis that there is no significant statistical effect of county government interventions on food security in Kajiado County.

Table 4.18 Analysis of Variance (ANOVA)

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	50.992	4	12.748	37.050	.000 ^b
	Residual	74.320	252	.344		
	Total	125.312	256			

a. Dependent Variable: Food Security

b. Predictors: (Constant), Research interventions, Technological Interventions, Agricultural Extensions Interventions , Credit availability interventions

Source: Research Data (2024)

Table 4.18 shows the *F-statistic* was 37.050 and associated *P-value*= 0.000. Since the calculated *P-value* was less than $\alpha=0.05$, there is evidence against the null hypothesis, that there is no significant statistical effect of county interventions on food security in Kajiado County. Therefore, the null hypothesis was rejected since the result implied that County interventions had a significant effect on food security in Kajiado County. The eventual regression model was then generated from model coefficient output in table 4.20

Table 4.19 Regression results for county interventions (Model of coefficients)

	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	1.19	0.19		6.275	.000
Technological Interventions	0.223	0.074	0.205	3.008	0.003
Agricultural Extensions Interventions	0.019	0.056	0.024	0.337	0.036
Credit availability interventions	0.238	0.059	0.307	4.056	.000
Research interventions	0.188	0.068	0.214	2.785	0.006

a. Dependent Variable: Food Security

Source: Research Data (2024)

From the table 4.19 the regression equation is presented in equation 4.1 below:

$$Y = 1.190 + 0.205 \text{ TI} + 0.024 \text{ AE} + 0.307 \text{ CA} + 0.214 \text{ RI}$$

Where:

Y = Food Security

TI = Technology interventions

AE = Agricultural extensions interventions

CA = Credit availability interventions

RI = Research interventions

4.7.2 Technology interventions and food security

Using hypothesis testing, the study sought to test the how significant the relationship between technology interventions and food security was. The hypothesis was: H_0 : Technology application interventions by county government are not significantly effective in enhancing food security in Kajiado County. The results in table 4.20, technological intervention were significantly influencing food security in Kajiado county at $P\text{-value} = 0.003 < 0.05$. Further, a $\beta = .205$ means that 1% improvement in technological intervention lead to a 20.5% increase in food security in Kajiado county in the presence of agricultural extension interventions, credit availability interventions and research interventions. The null hypothesis H_{01} that technology application interventions by county government are not significantly effective in enhancing food security in Kajiado County was therefore rejected. These results are in agreement with the assertions of Mok and Tan (2020) on innovations for food security in Singapore which established that technological innovations is urgently needed for maximization of food security despite the land and other natural resources diminishing around the world to produce adequate food. Singapore lacks both natural resources and space, yet it is an example of how to balance between resources and food supply. More technological innovations are therefore needed to ensure the natural resources are utilized maximally to produce sufficient, safe and nutritious food for the population.

The results also agree with the work of Sinyolo (2020) whose study established that having large pieces of land which are highly potential does not guarantee high production, the production may still be low if modern agricultural technologies such as precision farming, genetic improvements, or digital tools are not adopted or not effectively utilized.

4.7.3 Agricultural extension interventions and food security

Using hypothesis testing, the study sought to test the how significant the relationship between agricultural extension services interventions and food security was. The hypothesis was: H₀₂: Agricultural extension services intervention by County government does not significantly enhance food security in Kajiado County. Table 4.20 shows that agricultural extension intervention were significantly influencing food security in Kajiado County ($\beta=.019$, $t= .337$, $P\text{-value}= 0.036 > 0.05$) this means that 1% increment in agricultural extension interventions led to 36% increase in food security in Kajiado county in the presence of technology interventions, credit availability intervention and research interventions. The null hypothesis H₀₂ that agricultural extension intervention by county government does not significantly enhance food security in Kajiado County was rejected. These results imply that agricultural extension interventions significantly influenced food security. This agreed with the work of Tamsah (2022), on the study on quality of agricultural extension on productivity of farmers which established that the more the knowledge that the extension farmers had the more effective they trained the farmers and hence they noted higher production of farm products.

The findings also agreed with the assertions of Ajefu *et al* (2021) on the study on coping with negative shocks and the role of the farm input subsidy programme in rural Malawi. The study established that agricultural extension officers provided training and subsidized livestock feeds which mitigated the impact of climate variability. Forage production was significantly impacted by climate variations such as droughts or floods in Malawi and therefore extension officers came in hand in helping farmers recover from such natural disasters by providing financial relief or incentives to continue with forage production despite adverse conditions. This continuity ensured that there was enough feeds available for livestock even during challenging times, thereby maintaining stable food production.

4.7.4 Credit availability interventions and food security

Using hypothesis testing, the study sought to test the how significant the relationship between credit availability interventions and food security was. The hypothesis was: H_{03} : Credit availability interventions are not effective in enhancing food security in Kajiado County. Table 4.20 shows that credit availability interventions were significantly affecting the food security in Kajiado County ($\beta=.307$, $t= 4.046$, $P\text{- value}= 0.000 <0.05$). This means that a 1% increment in credit availability intervention lead to 30.7% increase in food security in Kajiado county in the presence of technology interventions, agricultural extension intervention and research interventions. The null hypothesis H_{03} that Credit availability interventions are not effective in enhancing food security in Kajiado County was therefore rejected. Frequently farmers require credit to buy high quality farm inputs like seeds and fertilizers, high quality breeds of cattle, some require credit in installing technology among other uses. As cited by Uaiene *et al.*, (2019) in their study in Mozambique that credit encourages production enabling the farmers to reap the benefit of high production thus higher profit margins that could not be obtained without credit. Credit does not only increase production but also enhance food security.

Obtaining credit has its own challenges including collateral conditions, which discourage the farmers to never again get credit, very high interest could also be a challenge hence repaying back the credit every month and enhance production became almost impossible. The results agree with the assertions of Kehinde (2020) that the benefits of credit can be encouraged when the collateral conditions are removed since it discourages farmers from getting credit from financial institutions. The study also reiterates that providing credit to farmers is an important strategy in increasing agricultural productivity and efficiency.

Another detriment that farmers face in obtaining credit is receiving the amount below which they requested. This means that the credit amount was a concern to farmers such that they do not get the actual amount they wanted. If a farmer had a project could be to transform from traditional pastoralism to zero grazing and required credit for the project, giving credit half the amount required for the project could be counterproductive since it could not complete the project thus making the farmer more food insecure than before.

Also if the farmer wanted credit to buy farm inputs and the amount gotten just bought the seeds and not enough to buy fertilizers as required, then the credit could not lead to more production. This means that to ensure effectiveness of credit intervention then the amount given as credit is of concern. The results agree with assertion of Obagbemi *et al.*, (2022) who studied the effects of Micro-Credit Scheme on Rice Production among Smallholder Farmers in Kwali Area Council, Abuja, that amount of credit given to the farmer should be satisfactory. The rice farmers who got the specific amount they requested for, got higher production than those who could not get enough due to their collateral/savings level.

4.7.5 Research interventions and food security

Using hypothesis testing, the study sought to test the how significant the relationship between research interventions and food security was. The hypothesis was H_{04} : Research interventions are not effective in enhancing food security in Kajiado County. The table 4.20 shows that research interventions were significantly affecting the food security in Kajiado County ($\beta=.214$, $t= 2.785$, $P\text{-value}= 0.006 <0.05$). This means that 1% increment in research intervention lead to 21.4% increase in food security in Kajiado County in the presence of technology interventions, agricultural extension intervention and credit availability interventions. The null hypothesis H_{04} that research interventions are not effective in enhancing food security in Kajiado County was therefore rejected. The results imply that Kajiado County had enjoyed the benefits of research. It had resulted to higher yielding animals and hence more production enhancing food security. This is reiterated by Eche-Enriquez and Vivas (2022) study on farming, education and migration. The study established that research led to better control access to high-quality feed and water and ensuring animals receive optimal nutrition. Research on the livestock led to studies on feed formulation, feeding schedules, and access control to feed, which directly impacts animal growth rates and yield.

The results also agree with the work of Fahad *et al.*, (2020) on farmers' awareness level and their perceptions of climate change, which established that farmers with long-standing experience often have better agricultural knowledge and skills but research is paramount which contributed to higher productivity and better food security. The study noted that as the farming population ages by practicing farming for a longer period and

they learn more from experience but there is a growing need for research so as to move with the evolutions in the world and also to enable succession planning to ensure the continuity of agricultural operations, and encourage young people to enter the farming profession and provided opportunities for them to gain experience and skills from older farmers which is essential for the long-term sustainability of the agricultural sector.

4.7.6 Moderating effects of government policies on food security interventions

The fifth objective was to establish the moderating effect of the national government policies on the County government interventions in enhancing food security in Kajiado County. The study sought to establish the moderating effect of the government policies on the County government interventions in enhancing food security in Kajiado County. Multiple regression analysis was conducted between composite variables and food security which is the dependent variable.

Step one:

Table 4.20: Model Summary for government interventions on food security

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.650 ^a	.422	.417	.57617

a. Predictors: (Constant), County Government Interventions

Source: Research Data (2024)

In determining when to reject the null hypothesis in favour of alternative hypothesis, the study conducted the ANOVA where F-statistic (79.740) and associated P-value (0.000) were used for determination. This led the study to reject the null hypothesis that there is no significant effect from county government interventions on food security in Kajiado County in favour of the alternative hypothesis. As such the study concluded that there was a significant effect of county government interventions on food security in Kajiado County.

Table 4.21: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	52.943	2	26.471	79.740	.000 ^b
	Residual	72.370	218	.332		
	Total	125.312	220			

a. Dependent Variable: Food Security

b. Predictors: (Constant), County Government Interventions

Source: Research Data (2024)

County government interventions on food security were quantified as represented in table 4.21 by the regression coefficients developed. County government interventions had a significant direct effect on food security in Kajiado County. ($\beta = .541$, P value=0.000) The eventual regression is as presented in equation 4.1

Table 4.22: Regression Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	1.379	.165		8.338	.000
County Government Interventions	.541	.069	.583	7.813	.000

a. Dependent Variable: Food Security

Source: Research Data (2024)

Y=1.379+.541 CI.....equation 4.1

Equation 4.1 indicates that for a unit increase in county government interventions there will be an associated direct increase in food security by 54.1% holding other factors constant. It was therefore concluded there was a significant effect of county government interventions on food security. In step two the government policies (the moderator) are introduced. The individual significance of county government interventions and government policies on food security was then evaluated. The hypothesized relationship was:

H₀₅ there was no cumulative relationship of county government interventions and government policies on food security in Kajiado County.

Step two

Table 4.23: Model Fitness for the Moderating Effect of government policies

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.659 ^a	0.434	0.426	0.57186

a. Predictors: (Constant), Government Policies and County Government Interventions, County Government Interventions, Governance Policies

Source: Research Data (2024)

Table 4.24 ANOVAa

	Sum of Squares	df	Mean Square	F	Sig.
Regression	54.349	3	18.116	55.398	.000 ^b
Residual	70.964	252	0.327		
Total	125.312	255			

a. Dependent Variable: Food Security

b. Predictors: (Constant), Government Policies *County Government Interventions, County Government Interventions, Governance Policies

The R squared was used to check how well the model fitted the data after moderation. The results in Table 4.20 show that the R squared after moderation by government policies was 0.659, which was higher than the non-moderated effect which had its R square being 0.407. This means that government policies moderate the relationship between the county government interventions and food security in Kajiado County, which explain the 65.9% variations in food security.

The ANOVA results confirm that the regression model of moderating effect of government policies on the county government interventions on food security is significant supported by F=55.398, which is greater than tabulated F-statistic and $p < 0.000$ since p-value was 0.000, which is less than 0.05. The results affirm the importance of government policies towards enhancing food security in Kajiado County.

Table 4.25: Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.721	0.233		7.394	0
Governance Policies	-0.118	0.11	-0.143	-1.071	0.046
County Government Interventions	0.397	0.098	0.428	4.068	0
Government Policies *County Government Interventions	0.069	0.033	0.375	2.073	0.039

Source: Research Data (2024)

FS= 1.721+0.397 CI- 0.118 GP +0.069 CI*GP.....equation 4.2

Where FS= Food Security

CI= County government interventions

GP= Government Policies

Based on the coefficient results, the county government interventions was significant against food security, with $P\text{-value}=0.039<0.05$. The results also show that the government policies were significant against the dependent variable (food security) with $p\text{-value } 0.046<0.05$. Finally, the results show that interaction term (county government interventions and government policies) was significant with $P\text{-value}=0.039<0.05$. This implies that government policies have a moderating effect on the relationship between the county government interventions and food security in Kajiado County, Kenya. The null hypothesis H_{05} that government policies do not have a moderating effect on food security interventions in Kajiado County was therefore rejected. The study adopted the alternative hypothesis that government policies have moderating effect on the relationship between county government interventions and food security in Kajiado County.

CHAPTER FIVE: SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This study aimed to establish the effectiveness of County governments' interventions towards enhancing food security in Kajiado County. It was specifically guided by five objectives: To determine the effectiveness of technology application in enhancing food security in Kajiado County, to evaluate the effectiveness of agricultural extensions in enhancing food security in Kajiado County, to examine the effectiveness of credit availability in enhancing food security in Kajiado County, to determine the effectiveness of research interventions in enhancing food security in Kajiado County and to establish the moderating effect of the national government policies on the County government interventions in enhancing food security in Kajiado County. This chapter gives the summary of the findings; conclusion and recommendation based on the outcome and recommended areas for further research.

5.2 Summary of Findings

Food security have for a long time been subject to academic and non-academic research. The national and county governments have implemented various interventions to enhance food security. Various efforts that have been done have not been effective for the country to cope with food insecurity. Food insecurity persist and the counties continue to grapple necessitating introduction of interventions aimed at mitigating the effects. The study utilized pragmatic philosophy. Descriptive and Explanatory research design were employed to draw 414 respondents from the large population. Descriptive research design provided demographic information, description percentages and event tables. Explanatory research design helped to get relationship between variables. Three theories informed the study: theory of access, diffusion of innovation and agency theory. Multiple regressions was employed in determining relationship between independent variables (technological interventions, agricultural extension interventions, credit availability interventions and research interventions) and dependent variable (Food security).

The findings indicate that majority of the registered farmers were male, aged 31-50 years, attained university level of education and owned more than five acres of land. The

majorities of the extension officers were female, aged 31-40 years and had attained tertiary level of education. The influence of technology, extension officers, credit availability and research on food security was found to be significant at 0.05 significance level.

The first objective was to determine the effectiveness of technology in enhancing food security. The null hypothesis that technology application interventions by county government are not significantly effective in enhancing food security in Kajiado County was rejected. The findings implied that technology application intervention influenced food security.

The second objective was to evaluate the effectiveness of agricultural extensions in enhancing food security in Kajiado County. There was evidence against the null hypothesis that agricultural extension intervention by county government does not significantly enhance food security in Kajiado County. It then ensures a stable food supply and reduces dependence on food imports.

The third objective was to examine the effectiveness of credit availability in enhancing food security in Kajiado County. The null hypothesis that credit availability interventions are not effective in enhancing food security in Kajiado County was rejected. There was evidence in the findings that credit availability intervention influenced food security significantly.

The fourth objective was to determine the effectiveness of research interventions in enhancing food security in Kajiado County. The null hypothesis was that research interventions are not effective in enhancing food security in Kajiado County which was rejected. There was evidence in the findings that research significantly influenced food security in Kajiado county

The fifth objective was to establish the moderating effect of the national government policies on the County government interventions in enhancing food security in Kajiado. The null hypothesis was that government policies do not have a moderating effect on food security interventions in Kajiado County which was rejected since there was

evidence that government policies moderated the relationship between the county government interventions and food security.

5.3 Conclusion

From the study findings it was concluded that all the independent variables (Technological interventions, agricultural extension interventions, credit availability interventions and research interventions) were statistically significant in enhancing food security in Kajiado County. It was also concluded that government policies had a moderating effect in enhancing food security in Kajiado County. The qualitative analysis highlighted how the county government interventions influenced food security. This has helped the Kajiado County farmers in their efforts of food production and distribution for the society.

The first objective of the study was to determine effectiveness of technology application in enhancing food security in Kajiado County. Based on the study findings a number of conclusions were made. First, technology had positively impacted crops and animals production in Kajiado County. The correlation analysis results indicated a positive and significant association between technology and food security. This study therefore concluded that technology adoption is an important intervention towards enhancing food security in Kajiado County. It further concluded that empowerment in terms of finances and knowledge to effectively adopt technology is very important.

The second objective was to evaluate the effectiveness of agricultural extensions in enhancing food security in Kajiado County. The study concluded that when it comes to empowering farmers through training, extension officers providing subsidized farm inputs including seeds, fertilizers, vaccination and other disease control methods, training on value addition and better farming methods were very important aspects that were found to influence food security in Kajiado county to a great extent. The study further concluded that there exists a positive and significant relationship between agricultural extension officers and food security in Kajiado County. This means that investing more in agricultural extension officers will give a boost towards enhancing food security in the county.

The third objective was to examine the effectiveness of credit availability in enhancing food security in Kajiado County. Based on the findings, the study concluded that empowering farmers by providing credit to them is very important towards enhancing food security. The results that credit availability played a great role in increasing crops and animals' production was of essence. Based on the findings, the study concluded that credit availability positively and significantly influenced food security in Kajiado County. This meant that provision of credit significantly enhanced food security. The study also concluded that lack of collateral and enough savings made credit access for the farmers very difficult. Further, the study concluded that the county should subsidize the credit for the farmers and act as collateral for the farmers' credits to be paid once the products are sold.

The fourth objective was to determine the effectiveness of research interventions in enhancing food security in Kajiado County. Based on the findings the study concluded that research interventions are very important aspect towards enhancing food security. From the findings research interventions positively and significantly influenced food security in Kajiado County. Research enhance provision of new vaccines, drought resistant seeds, better water provision, better marketing and better farming methods. The study further concluded that the greatest challenge that research interventions were facing is inadequate funds to do further research.

The fifth objective was to establish the moderating effect of the national government policies on the County government interventions in enhancing food security in Kajiado. Based on the results of both the descriptive statistics and inferential statistics the government policies played a great role on the interventions done by the county towards enhancing food security. The findings therefore suffice to conclude that proper and successful implementation of the policies would in a great extent enhance food security.

5.4 Contribution of the study to the body of knowledge

The study sought to establish effectiveness of county interventions in enhancing food security in Kajiado County. The findings of this study will be beneficial to the farmers and policymakers in enhancing food security. The study adds to the existing body of knowledge on food security issues. Previous studies have tested the causes and impacts of

food security. This study, however has established the interventions aimed at enhancing the food security together with the moderating effect of the government policies effect on the same adding to the existing body of knowledge in this field. It improves to the researchers' conversation on enhancing food security and extends conceptualization by integrating various interventions beyond the prior mitigation aspects to establishing a conceptual framework towards enhancing food security.

Theoretically, this study provided evidence of how theory of access, diffusion of innovation and agency theory interlinks with food security. It establishes importance of theories and how they sharpen understanding in any field. Major gaps on research variables, methodology and modelling were conceptualized in this study. The study enhanced the empirical literature by highlighting how various interventions enhance food security. It also paved the way for further research on enhancing food security.

5.5 Recommendations for Policy application

Based on the findings, the county governments, farmers and other stakeholders can draw policy implications. In this study, the county government's interventions influenced food security in Kajiado County. The researcher recommended the promotion of policies that incentivize adoption of drought-resistant crops, water harvesting, and sustainable grazing practices to build resilience against climate variability. The agricultural extension officers should be facilitated to create awareness on smart agriculture and livestock keeping. Policies should be developed to support development of early warning systems and disaster risk management frameworks tailored to local conditions. The study also recommends there should be policy frameworks for flexible loan products aligned with agricultural cycles and non-traditional collateral. The last recommendation was to support development of solar-powered irrigation and water storage technologies.

5.6 Suggestions for Further Research

This study recommends that future studies be done on longitudinal research design to validate the findings and conclusion of the current study. There's need for further research to be carried out on other interventions that enhance food security. Further research can be done on: - Conducting in-depth case studies and comparative analyses across different regions and contexts to identify context-specific factors influencing the

success or failure of food security interventions, analyzing the impact of policies and governance structures on food security at local, national, and international levels and investigate how climate change affects food security and resilience of communities

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APPENDICES

Appendix I: Introductory Letter

Dear Respondent,

RE: REQUEST FOR PARTICIPATION IN A RESEARCH STUDY

I am s PhD student at Kenyatta University pursuing a doctor in Philosophy degree in Public Policy and Management. I am carrying out an academic research titled: **“Effectiveness of County Governments’ Interventions in Enhancing Food Security in Kenya: A Case of Kajiado County”**

I would kindly request you to participate and answer questions stated. The discussions will only take a maximum of one hour..I guarantee that you will remain anonymous and you are not required to share your identity. I wish to kindly request that you may consent to participate to enable me complete this research study successfully. However participation is Voluntary and I will answer all the questions that you may have.

The findings of this study will be important for the County Government to enhance food security in the region. Kindly don’t indicate your name to remain anonymous.

I greatly appreciate your willingness to participate.

Thank you.

Yours sincerely,

Eunice Macharia

C82/CTY/20205/2021

Appendix II: Questionnaire for Farmers
INFORMED CONSENT

I have read and understood the intent of this study and I agree to participate voluntarily

Yes [] No []

Section A: RESEARCH QUESTIONS FOR FARMERS

Section A: Biodata

Please tick (✓) where appropriate

1. What is your sex? Male [] Female []

2. What age bracket describe you best?
20 years or less [] 21-30 [] 31-40 [] 41-50 [] 51 years and above []

3. What is your highest level of education?

Primary []

Secondary []

Tertiary []

University []

4. What is the overall size of your farm in acres?

Less than 1 year []

2 – 5 years []

Above 5 []

5. What is main activity done on your farm?

Crop farming []

Livestock keeping []

- Mixture of Crops and Livestock farming []
- Others []

6. For how long have been doing the above activity/activities on your farm?

- Less than 5 years []
- 5 – 10 years []
- 10-15 years []
- Above 15 years []

PART II: Food Security

7, Is Kajiado County food secure?

- Yes ()
- No ()

8. Are you aware of any interventions put in place by the county government to enhance food security?

- Yes ()
- No()

If yes mention some of them.....

9. What adaptability interventions should the county implement to enhance food security in the county?

.....

10. In this section Please rate the level of agreement/disagreement with the statements by putting a tick in the most appropriate choice that best represents your view/opinion by choosing the most appropriate choices from 1= **Strongly Agree(SA)**; 2. =**Agree (A)**; 3. =**Neutral (N)**.4. =**Disagree (D)**; and 5. =**Strongly Disagree (SD)**

Statements : The following indicators measure the food security	1	2	3	4	5
Food availability is high in kajiado county					
Food accessibility is high in kajiado county					
Food Stability is high in kajiado county					
Food utilization is high in kajiado county					

11. Using the scale provided, rate the overall effect of County interventions: technology, agricultural extension services, credit availability, research and policy frameworks in enhancing food security in the County.

25% () 26-50% () 51-75% () 76-100% ()

PART III: County Government interventions in enhancing Food Security

11. In this section Please rate the level of agreement/disagreement with the statements by putting a tick in the most appropriate choice that best represents your view/opinion by choosing the most appropriate choices from 1= **Strongly Agree(SA)**; 2. =**Agree (A)**; 3. =**Neutral (N)**.4. =**Disagree (D)**; and 5. =**Strongly Disagree (SD)**

Section A: Technological Interventions to enhance food security

12. State the specific type of technology you use to enhance food security.

Mobile Apps []

Automated feeding []

High-tech Irrigation []

None []

13. How frequent do you use technology in your farming?

Rarely []

Twice a week []

Daily []

Once a month []

Never []

Statements	1	2	3	4	5
The implementation of technology has positively impacted your food production					
Your crop yields / Livestock production has increased as a result of using technology					
Mobile phones have helped you get information on county provision of inputs/ subsidies like fertilizers.					
Access to internet has helped you in crops/Animals management					
Mobile phones have helped you get information on the market prices of products to help you know when to sell or buy.					
Mobile Apps have helped you get Market information of your products					
Technology has helped you to optimize resource utilization such as water and energy to ensure sustainable food production.					
I have not encountered difficulties in accessing and adopting technology in enhancing crop/animal production.					
There are minimal financial implications associated with implementing and maintaining technology.					
I have acquired training to effectively use technology to enhance food security strategies.					

14. Which aspects of technology do you think need to be improved to enhance food security?

- i. Provision of internet []
- ii. More Mobile Apps []
- iii. Provision of AI services []

Section B: Agricultural Extension Interventions to enhance food security

15. In what ways have the agricultural extension services provided by the government enhanced your production?

- i. By training []
- ii. By Marketing your products []
- iii. By providing farm inputs like fertilizers, AI services[]

16. Has Agricultural extension officers provided training to farmers in the fields

Yes [] No []

If yes explain briefly the type of training provided.

17. Has your production increased after agricultural extension services were offered?

Yes [] No []

If Yes state the amount of crops you produced after receiving subsidized inputs from one acre of land

.....

Or the amount of animal product you produced after agricultural extension services were offered.

.....

18. What is your level of agreement with the following statements on Agricultural Extension Intervention services in enhancing food security in Kajiado County?

Statements	1	2	3	4	5
Training farmers is a key factor in fighting food insecurity in the county					
Agricultural extension officers have provided you with subsidized animal feeds for livestock.					
Agricultural extensions officers provides farmers with training					

on vaccination					
Agricultural extensions officers provide training on disease control and treatment					
The training includes simple techniques such as fertilizer application to ensure the appropriate amount is used					
Agricultural extensions officers has provided artificial insemination services to farmers at lower costs					
Agricultural extension officers training has opened avenues to better farming methods I have been able to do Value addition for your farm products after agricultural extension services were offered					
Cattle dips provided for your animals has helped your animals to remain healthy					

Section C: Credit availability to enhance food security.

19. Have you accessed credit facilities to support your crop production/ livestock

Farming? Yes []

No []

If yes, did the County of Kajiado subsidize the interest earned?

Yes []

No []

20. Please indicate your level of agreement/disagreement with the following aspects of Credit availability in enhancing food security.

Statements	1	2	3	4	5
You frequently require financial assistance in form of credit to increase your crop production/livestock production.					
It is very easy to access credit from the Kajiado County government					
Credit availability has played a role in increasing food production					

I have accessed the amount of credit you wanted to enhance your production					
I have not faced any challenges in accessing credit to enhance your farm production.					
The process involved in applying and receiving credit is simple.					
The interest of the credit accessed was subsidized by the county					
No collateral was required in accessing the credit.					
I have used credit to invest in technologies that enhance resilience and adaptability to climate change.					

21. Do you think there should be specific policies or initiatives that the county government should have to provide credit to enhance food security?

Yes ()

No ()

If yes. Explain specific policies

.....

Section D: Research interventions to enhance food security

22. Are you aware of any research interventions aimed at enhancing food security in Kajiado County? Yes() No ()

If yes indicate which ones.....

23. Please indicate your level of agreement/disagreement with the following aspects of Research interventions in enhancing food security.

Statements	1	2	3	4	5
I have personally benefitted from any research intervention related to food					

security.					
I have benefitted from new Vaccines as a result of research					
I have benefitted from drought resistant seeds to enhance food security					
I have witnessed better water provision services as a result of research					
Research grants are always available to facilitate programmes of food security.					
The research has helped in better marketing techniques					
I have noted a positive change in food availability as a result of research interventions					
Research interventions has led to high yielding animals					
Better methods of tagging/ branding animals to prevent theft are available as a result of research being done					

24. Are there aspects of food security that has been improved by research interventions? Yes [] No []

If yes which ones?

.....

Section E: Government policy intervention in moderating food security.

25. Has government policies supported development and implementation of programmes and initiatives aimed at enhancing food security in Kajiado County?

Yes [] No []

If yes which ones?

.....

26. Please indicate your level of agreement/disagreement with the following aspects of Government policies interventions in enhancing food security.

Statements	1	2	3	4	5
I have benefitted from subsidy policies of inputs like fertilizers/Seeds/ Artificial insemination services from the government					
There are policies on animals' uptake in times of drought and restock when the climate is good.					
There are policies in place for provision of clean water to enhance production					
The governments in place always have a political will to run programmes to enhance food security.					
Funds are always available to ensure implementation of policies that enhance food security.					
Policies are there to ensure value addition of your products to increase longevity					
The government policies has improved availability of nutritious food in Kajiado county					
There are policies to ensure better road networks for ease of distribution of your products					

27. What additional policies could further improve food security in Kajiado County

.....

Appendix III: Questionnaire for Agricultural Extension Officers
INFORMED CONSENT FORM

I have read and understood the intent of this study and I agree to participate

Yes [] No []

Section A: Biodata

Please tick (✓) **where appropriate**

1. What is your sex? Male [] Female []
2. Which age bracket describes you best?
20 years or less [] 21-30 [] 31-40 [] 41-50 [] 51 years and above []
- 3 What is your highest level of education?
Primary [] Secondary [] Tertiary [] University [] Others []

PART II: County Government interventions in enhancing Food Security

Section A: Technological Interventions to enhance food security

In this section Please rate the level of agreement/disagreement with the statements by putting a tick in the most appropriate choice that best represents your view/opinion by choosing the most appropriate choices from 1= **Strongly Agree(SA)**; 2. =**Agree (A)**; 3. =**Neutral (N)**.4. =**Disagree (D)**; and 5. =**Strongly Disagree (SD)**

4. State the specific type of technology you use to enhance food security.

Mobile Apps []
Automated feeding []
High-tech Irrigation []
None []
Others []

5. How frequent do you use technology in providing services?

Rarely []
Twice a week []
Daily []
Once a month []

Never []

Statements	1	2	3	4	5
Implementation of technology has positively impacted technology					
I have observed an increase in crop yields / Livestock production as a result of using technology					
Mobile phones have helped you give information on county provision of inputs/ subsidies like fertilizers/seeds/AI services					
I have used technology for crop/animals management for farmers					
Mobile phones has helped you give information on the market prices of products to help farmers know when to sell or buy					
Technology has helped you to optimize resource utilization such as water and energy to ensured sustainable food production					
I have not encountered difficulties in accessing technology in enhancing crop/animal production					
There are minimal financial implications associated with implementing and maintaining technology					
I have acquired training to effectively guide farmers on technology use to enhance food security strategies.					

Section B: Agricultural Extension Interventions to enhance food security

6. Have you provided training to farmers in the fields where they live and or work?

available					
Accessing credit is an easy process					
Credit availability has played a role in increasing food production					
The credit you accessed was enough for the activity you wanted to do					
There are no challenges in accessing credit					
The process involved in applying and receiving credit is simple.					
The interest of the credit accessed was subsidized by the county					
No collateral was required in accessing the credit.					
I have used credit to invest in technologies that enhance resilience and adaptability to climate change.					

Section D: Research interventions to enhance food security

10. Are you aware of any research interventions aimed at enhancing food security in Kajiado County? Yes () No ()

11. Please indicate your level of agreement/disagreement with the following aspects of Research interventions in enhancing food security.

Statements	1	2	3	4	5
I have personally benefitted from any research intervention related to food security.					
Research has enabled invention of new vaccines					
Research has enabled invention of drought resistant seeds					
Research interventions has enabled better water provision.					

Research interventions has led to high yielding animals					
Research grants are always available					

12. Are there aspects of food security that has been improved by research interventions?

Yes () No ()

If yes which ones?

Section E: Government policy intervention in enhancing food security.

13. Has government policies supported development and implementation of programmes and initiatives aimed at enhancing food security in Kajiado County?

Yes () No ()

If yes which ones?.....

14. Please indicate your level of agreement/disagreement with the following aspects of Government policies interventions in enhancing food security.

Statements	1	2	3	4	5
The policies are available to give subsidies to the farmers in provision of inputs like fertilizers, seeds and AI services					
There are policies in place for livestock off take in times of drought and restock in times of better climatic conditions					
Policies are in place on provision of water to enhance food production					
The governments in place always has a political will to run programmes to enhance food security					
Funds are always available to ensure implementation of policies that enhance food security					
There are policies to ensure value addition of farm products					
The government policies has improved availability of					

nutritious food in Kajiado county					
There are policies to improve road networks in Kajiado county					

15. What additional policies could further improve food security in Kajiado County?

.....

END

THANK YOU FOR YOUR TIME

Appendix IV: Interview Schedule for Kajiado County government officials

1. Which are the problems facings agricultural extension in the County?
2. What do you think is the solution to food insecurity in the County?
3. In what ways has the ministry of agricultural and Livestock helped the county in mitigating the issue of food insecurity?
4. In which ways have the farmers been trained to use technology to enhance food security?
5. From a general perspective, which aspects of technology do you think need to be improved and how can it be pursued to enhance food security?
6. Do you think there should be specific policies or initiatives that the county government should have to provide credit to enhance food security? If yes explain
7. What programmes has the County Put in Place to enhance crop and animal products value addition
8. Are there research programmes which have been done to increase food security? If yes Which ones
9. Has technology been used in animal farming and crop production to enhance food security? If yes how?
10. Which programmes have been put in place to enhance credit availability to small scale farmers which can enhance food security?
11. Have agricultural extension officers been effective in their service delivery to enhance food security?
12. Do you think there are policies that have helped to enhance food security in the county? If so which ones and how?

Appendix V: Map of Kajiado



Appendix VI: Authorization Letter



KENYATTA UNIVERSITY
GRADUATE SCHOOL

E-mail: kubps@yahoo.com
dean-graduate@ku.ac.ke
Website: www.ku.ac.ke

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 810901 Ext. 57530

Internal Memo

FROM: Dean, Graduate School
TO: Eunice Wamuyu Macharia
C/o Department of Public Policy & Administration
KENYATTA UNIVERSITY

DATE: 16th February, 2024
REF: C82/CTY/PT/20205/2021

SUBJECT: APPROVAL OF RESEARCH PROPOSAL

This is to inform you that the Graduate School Board at its meeting 14th February, 2024 approved your Ph.D. Research Proposal entitled "Effectiveness of County Governments' Interventions in Enhancing Food Security in Kajiado County, Kenya".

You may now proceed with your Data collection, subject to clearance with the Director General, National Commission for Science, Technology & Innovation.

As you embark on your data collection, please note that you will be required to submit to Graduate School completed supervision Tracking and Progress Report Forms. The Forms are available at the University's Website under Graduate School webpage downloads.

Also, please ensure that you publish article(s) from your thesis before submitting it to Graduate School for examination as per the Commission for University Education and Kenyatta University guidelines. By copy of this letter, the Registrar (Academic) is hereby requested to grant you substantive registration for your Ph.D. studies.

Thank you,

ANNBELL MWANIKI
FOR: EXECUTIVE DEAN, GRADUATE SCHOOL

c.c. Chairman, Department of Public Policy and Administration
Registrar (Academic) Att; Mr. Richard Chweya

Supervisors:

1. Dr. Weldon Ng'eno
C/o Dept. of Public Policy & Administration
Kenyatta University
2. Dr. Jane Njoroge
C/o Dept. of Public Policy & Administration
Kenyatta University

JL/mn

Appendix VII: NACOSTI Permit

 REPUBLIC OF KENYA	 NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION
Ref No: 828704	Date of Issue: 26/February/2024
RESEARCH LICENSE	
	
<p>This is to Certify that Ms. Eunice Wamuyu Macharia of Kenyatta University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Kajjido on the topic: Effectiveness of County Governments' Interventions in enhancing food security in Kajjido County, Kenya, for the period ending : 26/February/2025.</p>	
License No: NACOSTI/P/24/33458	
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