SOCIO-ECONOMIC DETERMINANTS OF FOOD INSECURITY AND INTERVENTIONS FOR ENHANCING FOOD SECURITY AT HOUSEHOLD LEVEL IN MAKUENI COUNTY, KENYA

JAMES NDWIGA KATHURI

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DECLARATION

STUDENT:

This Thesis is my original work and has not been presented for any degree or for award in any other university

Signature: ..... Date: .....

James Ndwiga Kathuri, B.A, PGDE, M.A

C82/10893/2008

Department of Geography

SUPERVISORS:

We confirm that the work reported in this thesis was carried out by the candidate under our supervision.

Signature: ..... Date: .....

Prof. Leonard Kisovi

Department of Geography

Kenyatta University

Signature: ..... Date: .....

Prof. Joy Obando

Department of Geography

Kenyatta University

DEDICATION

This thesis is dedicated to my late parents, Joshua Nyaga and Esther Kiini. May the Almighty God Rest their Souls in Eternal Peace.

AMEN.

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I am utterly grateful to the All-loving God by whose strength and grace I have been able to complete this Thesis.

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ABSTRACT

This study sought to examine effectiveness of interventions to curb household food insecurity within Makueni County, Kenya. This study was prompted by the fact that the region is one of the Arid and Semi-Arid Lands with persistent food insecurity in the Country. The study aimed at exploring best practices of addressing food insufficiency in the region. The study objectives were to: ascertain the socioeconomic determinants of household food insecurity within Makueni County; examine effectiveness of coping and adaptive strategies undertaken by households to enhance food security; assess the effectiveness of institutional frameworks used in addressing household food insecurity; and identify alternative strategies that can be used efficiently to enhance household food security within Makueni County. Makueni County was selected because it is among the regions that is food insecure. The study was guided by descriptive research design as it captures reality as it is. A semi-structured questionnaire was used to gather data from households. This was complimented with observation method. A total of 400 household heads were randomly sampled from a total of 144,320 households in Makueni County based on the population census of 1999. The independent variables whose relationship was considered with food security as a dependent variable include socio-economic factors of food insecurity; coping and adaptive mechanisms to food insecurity and institutional interventions through which food insecurity is being addressed. The concept of food security was considered with regard to the population's ability to produce sufficient food or being able to afford the required quantity and quality of food stuff. The Statistical Package for Social Sciences was used to analyse the data. The statistics used were mainly descriptive statistics such as mean, mode, median, percentages and correlations. Chi-Square was on the other hand was used to test the hypotheses while the regressions/logit model was applied in determining the relationships between the dependent and a set of predictor variables. Key findings of the study were that food security among the sampled population was greatly influenced by socio-economic elements such as the number of regular dependants, inadequate financial capital, lack of training, lack of adequate extension services, lack of adequate diversity of economic activities, age of dependents and land size. Therefore, the same elements play a key role in reinforcing or inhibiting the efficacy of food insecurity interventions for every household. Over 80 per cent of the farmers were found to be resilient and use a number of coping and adaptive strategies to deal with food insecurity. These strategies include food rationing, seeking for casual labour jobs, small scale business, running down assets and trade-off (buying of food instead of other household needs) among others. In spite of this, over 80 per cent of the households remain food insecure. Eighty one percent (81%) of the households did not practice the best strategies of agricultural production. The institutional frameworks have also not solved the problem of food insecurity in Makueni County. Part of the recommendations made by this study is need to explore ways of building on the household coping and adaptive strategies, enhancing and implementing National and County Government and private sector (multisector) interventions that aim at mitigating food insecurity. The study further recommends the need to establish suitable approaches to diversify economic activities for the farmers. Some of the approaches may include building agricultural industries to boost the communities' food insecurity. The findings of this study will be useful to the National and County Governments and the private sector in developing more pragmatic and effective policies and programmes that can help in making Makueni County food secure.

ABBREVIATIONS AND ACRONYMS

ASALs	Arid and Semi-Arid Lands
AU	African Union
CBOs	Community Based Organisations
CBS	Central Bureau of Statistics
ECA	Economic Commission for Africa
EWS	Early Warning Systems
FAO	Food and Agricultural Organisation
GDP	Gross Domestic Product
GOK	Government of Kenya
IBRD	The International Bank for Reconstruction and Development
IMF	International Monetary Fund
MDGs	Millennium Development Goals
MOA	Ministry of Agriculture
NGOs	Non- Governmental Organizations
NMK	Njaa Marufuku Kenya
OECD	Organization for Economic Co-operation and Development
SSA	Sub Saharan Africa
SDGs	Sustainable Development Goals
TCP	Total Cost of Production per unit output
TICAD	Tokyo International Conference on African Development
UN	United Nations
USA	United States of America
WFP	World Food Programme
WFS	World Food Summit
WHO	World Health Organization

OPERATIONAL DEFINITIONS OF KEY TERMS AND CONCEPTS

Food security: This is used to refer to the ability of households to acquire adequate food that is nutritious, and safe. This term encompasses household food production through cultivation, food storage and preservation as well as food access through people' purchasing power or social linkages. The contrary to this is **Food insecurity.**

Bio-physical determinants of food insecurity: This is used to refer to natural oriented factors such as climate, soil and topography that influence food insecurity

Socio-economic determinants of food insecurity: This is measured through factors such as imbalanced expenditure on non-food items, inadequate land, large family size, inadequate capital, lack of training, inadequate communication on weather and climate dynamics among others that contribute to food insecurity

Manufacturing/Industry: This is used to refer to the value addition to materials by changing their form or combining them into more useful and valuable commodities. This includes simple handicraft production of pottery, wood ware and agricultural goods among others.

Coping strategies: This is used to refer to all the short-term/ immediate strategies or acts that individuals and households in a food insecurity situation use to be able to provide food resource for the survival of the family members. These includes selling of firewood, selling charcoal, selling livestock, engaging in causal labour jobs, food aid, food rationing, and borrowing from relatives and friends to be able to acquire food among others.

Adaptive strategies: This refers to the long-term strategies used by the individuals and households to address food insecurity. These include keeping of livestock, use of new crop varieties, agroforestry, seeking formal employment and undertaking small scale irrigation among others.

Institutional Interventions: This refers to the strategies used by government and /or private sector to address food insecurity in the region such as provision of relief food, provision of relief seeds, farmer training, finance credit etc.

Interventions for enhancing food security: This refers to integrated strategies used by various players to promote household food security in the region.

Best strategies of food security: This is used to refer to factors such as adoption of technology, use of large-scale irrigation, provision and use of communication on weather and climate variability, and embracing industrialization among others to enhance household food security.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Over 135 million people in the world have continued to face food insecurity despite the high economic development which has been witnessed globally. FAO (2019) and FSIN (2020) observed that several people who are facing the problem of hunger across the globe has enlarged gradually for numerous and subsequent years, highlighting the gigantic task of eliminating food insecurity by 2030. It is reported that close to one billion people are living under absolute poverty (a daily income below USD 1.25) per individual and 135 million people being in acute food insecurity with close to 820 million others suffering from hunger. Therefore, extra effort should be exerted if the hunger and poverty are to be eradicated by 2030 as projected in the Sustainable Development Goals (SDGs) (FSIN, 2020; FAO, 2015; and FAO, 2019). Food insecurity remains a critical concern as health factors such as HIV/Aids and currently the coronavirus (COVID 19) pandemic continue to affect households. HIV/Aids for example has a significant reduction in household food production, leads to a decline in the supply of labor for food production and leads to loss of knowledge about farming methods due to death of adults and a reduction in skilled labor among other effects. FSIN (2020) and UN (2020) notes with concern that COVID 19 disease is having unprecedented impact on food security globally such as shocks in food production and disruption of domestic food supply chains. Locally, food security has become among the top agenda of the Kenyan Government as included in the government's Big Four Agenda and Country's Vision 2030 (GOK, 2007).

According to Kasturi (2009) projections indicate that global population is 7.5 billion in 2020 and will be 9.8 billion by 2050. The greatest challenge of twenty-first century is to ensure growth in agricultural production for the purpose of meeting food demand across the world and enhance global food security. The greatest population rise (90 percent) is taking place amongst the developing nations of the world and hence these nations will bear the greatest effect of food insecurity. Shrinking rain fed agricultural land space existing per individual globally is among the repercussions of the ballooning world population and this will impact food security. Deforestation and deprivation of farms by cultivating marginal lands and damaging top soil, increase in urbanization and antagonism for water are being contributed by population pressure and hence will have far reaching effect on food security. Consequently, numerous developing nations in Africa and Asia are already cultivating only 0.02-0.05 ha of grain land per occupant (Kimenyi, 2002; FAO, 2019; FAO, 2011a and FAO, 2015).

Some countries such as Japan, South Korea, Taiwan and Egypt are becoming more dependent on food imports and others dependent on food aid from developed countries as in the case of numerous nations in Sub Sahara Africa (Kasturi, 2009; FAO, 2011b).

The agricultural sector in Africa is yet to realize its full potential despite the significant role it plays in the region's economy. The misfortunes of the region's agricultural sector is evidenced by extreme underfunding and poor performance of the region's agricultural products in the global markets (Moore, and Stanford, 2010; GOK, 2007; Fulginiti, 2004; IBRD, 2000). Majority of the African countries continue to record deficit in their agricultural production even other regions with developed

economies are experiencing food overproduction. It is certain that there has been net importation of agricultural products into Africa 1980. Scholars like Moore, and Stanford, (2010), Maxwell (2003), and Baulch (2001) attribute the volatility of the continent's agricultural sector to the unreliable trend of rainfall in the continent.

Whereas half of the population in Kenya are economically poor, about 33% of them are facing food insecurity (Barasa, 2010 and GOK, 2002). Moreover, close to 75% of the country's poor population are living in rural settings where majority are practising subsistence agriculture. Most counties with frequent cases of food insecurity and poverty are in the Eastern, North-eastern, and Coastal regions of Kenya. Development of agriculture in the country is heavily dependent on rainfall. However, Nyangito *et al.* (2004) reported that greater importation of food in the country and overdependence on food aid has been necessitated by the unreliable distribution of rainfall in the country.

As such, food insecurity continues to be a major problem especially among the residents of Low-income economies. This calls for further inquiry into the underlying causes of the food insecurity and poverty in addition to establishing their effects among the households. Bio-physical factors like topography, slope, diseases, soil infertility, and climate are the generally perceived causes of food insecurity. There are some socio-economic elements such as market factors, weak infrastructure, and population growth which also contributes to food insecurity in a country (Obayelu, 2011; Singh, 2009; Kasturi, 2009; Pillarisetti *et al.*, 2007; Dyer, 2006; and Waugh, 2002). Waugh (2002) states that the area has the world's lowest irrigation with limited capital and technology. Therefore, its agriculture is almost wholly reliant upon naturally favourable environment due to use of fertilizers, new seeds, pesticides, and

machinery. The soils in many areas have fertility constraints, low capacity to hold water and is vulnerable to erosion. Greater rates of evapotranspiration is as harmful to crops as the unpredictable rainfall which may cause flooding one year and then fail several years. With increases in population, fallow periods have been reduced and land has been overgrazed or over cropped (Waugh, 2002; Montgomery, 2003; and Sodano and Hingley, 2013).

In spite of the fact that food insecurity still remains a big challenge in several countries, particularly in Africa in general and Kenya in particular, there is a glaring lack of studies on how socio-economic dynamics like household income, agricultural market, and technology interact to influence food security at the household levels. Of further importance is to examine the impact of employment status, education, and excessive household spending on non-food substances like social welfare, alcohol, and tobacco on household food insecurity.

Food insecurity influences households to engage in coping strategies such as the disposal of productive assets and migration. Governments and private sector also make interventions such as resorting to food imports and seeking food aid particularly during years of low rainfall when it is assumed that climate change is the major culprit of low food yields. In particular, Sub-Saharan Africa (SSA) is the second most important world destination of food aid after Asia (Stevens and Keenan, 2003). Africa received about 2.8 million tonnes of food aid in 2000. Additionally, Africa has dominated the number of people receiving food relief for decades now. For instance, there were 21.5 million people from Africa among the 32 million disaster victims who received food relief from the World Food Programme (WFP) (AU and NEPAD,

2003). In 1970, SSA food aid was three quarters of a million tonnes of cereals. By 1998 this had grown to 2.2 million tonnes (a yearly average rate of upsurge of 3.8 %), signifying about one-seventh of the areas total cereal imports. Imports of cereals by SSA were estimated at 17 million tonnes in 2000, including 2.8 million tonnes of food aid. The most rapid growth occurred in the period up to 1984, when cereal food aid imports peaked at 6.1 million tonnes (Devereux, 2003; Stevens and Keenan, 2003; and Winston and Sunielle, 2010). This scenario has continued to persist to date. Indeed, according to Singh (2009) millions of the world's greatest vulnerable people are faced with hunger as food deficiencies loom and crop prices continue to increase. Escalating food prices have made 100 million persons worldwide below the poverty line. Singh (2009) notes further that FAO hosted a World Food Security Conference in June 2008, where about 75 million people from 60 countries which were experiencing the greatest pinch of high food prices were given food aid worth $1.2 billion.

Is spite of the various household oriented and government and private sectors interventions on food insecurity, the problem still persists. Thus, hunger and poverty in Africa must be seen as the most urgent problem that needs to be addressed. Studies, suffice to mention Derbile (2009) and Molua (2009) have focused on the household coping mechanisms as well as government and private sector interventions without examining the impact of the same in ensuring sustainable food security.

Poverty and famine have been significantly reduced in the High-income Economies. However, in Africa, famine occurs at least every four years since the mid 1970 (Shikwati and Amuhaya, 2005). In particular, famine in dry lands is as frequent as two-year cycle. Indeed, according to Ongwae and Karanja (2005), the majority of the

major short falls in food supply in Kenya were recorded in 1928, 1933-34, 1937, 1939, 1942-44, 1947, 1951, 1952-55, 1957/58, 1984/85 and 1999-2000 mainly due rainfall deficits. According to Gupta (2004), food insecurity can lead to several vices like political insecurity across the globe, unsustainable agricultural practices, and increased migration to urban centers from the rural areas. Therefore, the great problem of food insecurity covers several countries globally and Kenya in particular. If substantial investment in agriculture can be done, it can be of significant contribution to the country's economic development. It can generate the much-needed foreign exchange, create employment for the increasing surplus labour and trigger industrialization among other advantages (Gupta, 2004).

From the foregoing, it is clear that an assessment of food insecurity is of a high priority in order to get a workable solution to the problem. Food insecurity is largely as a result of bio-physical factors. It is also largely seen as a result of factors of production. However, it is important to establish the linkage of a myriad of factors that influence food security especially with regard to accessibility of food. The preceding discussion informed the framing of the current study to assess the socioeconomic determinants of food insecurity; effects of coping and adaptive mechanisms to food insecurity; institutional frameworks to food insecurity; and explored alternative strategies that can be efficiently used to enhance sustainable food security. Focusing on Makueni County, this study was mainly driven by the need to ascertain realistic strategies for actual eradication of food insecurity. Makueni County was chosen because it is one of the Arid and Semi-Arid Counties in Kenya which faces perpetual food insecurity mainly due to inadequate precipitation. The study was conducted with a view of providing a more evidence-based understanding of

household food insecurity within Makueni County and this can add value to the rest of the food insecure regions.

1.2 Statement of the Problem

Literature, suffice to mention (FAO, 2019; FAO, 2010; Nyariki and Wiggins, 1997; Devereux, 2003; AU and NEPAD, 2003; Stevens and Keenan, 2003; Swift and Hamilton, 2001; and Warr, 2014) indicate that food insecurity has persistently generated debate within Sub-Saharan Africa. They observed that Africa produces the lowest quantity of food globally. This paints a very disappointing image about the continent. Studies also indicate that in Kenya more than 70% of the ASALs face food shortage most of the time, yet more than 80% of the people are farmers. There has been an increase in the frequency of drought over the past three decades growth in the number of drought victims (Ongwae and Karanja, 2005; Huho and Mugalavai (2010) and GOK (2019).

Further, GOK (2013) and FSIN (2020) indicate that Makueni County is largely an ASAL region and among the most affected by frequent droughts and food insecurity. Whereas most of the studies blame food insecurity to bio-physical factors, it is crucial to establish the link between food insecurity and other determinants such as imbalanced expenditures on non-food items at the household level, employment status and educational level among others.

Interventions to food insecurity have been done at the household level and also by the governments and the private sector. However, questions still arise as to why food insecurity still remains a challenge and why these interventions by households and institutions have not managed to effectively enhance food security in Makueni

County. From the foregoing, it is clear that the persistent food insecurity in Makueni County calls as a matter of priority for more evidence-based comprehensive studies that can help analyse a myriad of socio-economic determinants of food insecurity; and impact of interventions used by households, government and private sector level, in a more integrated manner with the aim of ensuring more effective methods of addressing food shortage in the region. Consequently, this study was motivated by the need to provide a better understanding of the multiple factors driving food insecurity and hindrances to effective interventions to the problem at the household level.

1.3 Objectives of the Study

1.3.1 General objective

The main aim of the study was to investigate socioeconomic determinants of food insecurity and interventions for enhancing household food security within Makueni County.

1.3.2 Specific objectives

Four specific objectives listed below were used to guide the study:

1. To establish the socioeconomic determinants of household food insecurity within Makueni County.
2. To examine coping and adaptive strategies of enhancing household food security within Makueni County.
3. To assess whether the institutional frameworks used in addressing household food insecurity within Makueni County are effective.
4. To evaluate alternative strategies that can be used in enhancing household food security within Makueni County.

1.4 Research Questions

The under listed are the main questions which the study sought to answer:

1. What are the socioeconomic determinants of household food insecurity within Makueni County?
2. What and how effective are the coping and adaptive strategies of enhancing household food security within Makueni County?
3. What and how are the institutional frameworks used in addressing household food insecurity within Makueni County?
4. What are the alternative strategies that can be efficiently used in enhancing household food security within Makueni County?

1.5 Hypotheses

The hypotheses in this study were:

H_o1: Socioeconomic factors have no significant influence on household food insecurity within Makueni County

H_1 1: Socioeconomic factors have a significant influence on household food insecurity within Makueni County

H_o2: There is no significant effect of coping and adaptive strategies of enhancing household food security within Makueni County

H_1 2: There is a significant effect of coping and adaptive strategies of enhancing household food security within Makueni County

H_o3: The Institutional frameworks applied have not significantly enhanced household food security within Makueni County

H_1 3: The Institutional frameworks applied have significantly enhanced household food security within Makueni County

1.6 Justification of the Study

Despite the fact that food insecurity within Makueni County is not a recent phenomenon and is a cyclic problem little has been done to comprehensively analyze the socioeconomic determinants of food insecurity, the coping and adaptive strategies used by households and evaluation of interventions applied in addressing food insecurity in Makueni County. Further, there is need to establish alternative strategies that can successfully address food shortage in the region in a sustainable manner.

This study is justified owing to the importance of ensuring food security in Makueni County. It is on record that the government and Non- Governmental Organizations (NGOs) have always provided some intervention on food insecurity in the region. Indeed, the Government policy set out in Kenya Vision 2030 and the Big Four Agenda puts emphasis on the need to promote food security in the country. As evidence that food insecurity remains a problematic issue in Kenya, two ASALs conferences have been held by Counties within ASAL region in conjunction with the Ministry of Devolution representing Kenyan National government. The inaugural conference was held in Malindi, Kilifi County Kenya between 5th and 7th September, 2018. The theme of the conference was "unlocking the potential of ASALs for accelerated national development". The conference was attended by 29 counties including Makueni County where food insecurity problem remains unresolved. The areas of discussion in the conference which have a bearing on food security included: challenges and opportunities to facilitate better development of ASALs; consolidating the engagement and coordination of ASALs development partners; creation of tracking mechanisms for implementing the conference's outcomes; aligning the priorities and development plans of ASALs with the Big Four Development Agenda

and Kenya's Vision 2030; and developing and adopting a roadmap of addressing emergent ASALs development plans. The Big Four Development Agenda are tied to the country's Vision 2030, aligned to the 17 SDGs and also aligned with the Africa's 2063 agenda whose theme is "The Africa We Want". The Big Four Agenda targets acceleration of economic growth while prioritizing affordable housing, provision of universal health cover, nutrition and food security, and manufacturing. The second ASALs conference was held in Amboseli National Park in Kajiado County between 10th and 12th September, 2019 and was a follow up on issues discussed in the 1st ASALs conference. Among the key issues discussed were: mechanization of irrigation for food security, livestock farming, agriculture and value addition among others.

At the household level, Individual farmers have come up with their coping and adaptive strategies whenever they are faced with food insufficiency. It has also been common for people seeking elective posts at national and county levels to acquire political mileage by promising communities that they would fight food insecurity in the area, yet the problem of food still persists. Then the questions remain: *Why has it not been possible to provide a sustainable solution to the problem of food insecurity in this region? Is it only farming which can provide farmers with food?* Other than the bio-physical determinants of food insecurity that have been largely focused on in literature, there is need to document information in a more integrated manner on the non-biophysical determinants of food insecurity at the household level; the effects of food insecurity to the households; the coping and adaptive strategies applied and effectiveness of institutional frameworks with a view of exploring more appropriate strategies for mitigating food insecurity in Makueni County.

Consequently, this study sought to systematically provide empirical data on the situation of food insecurity in the region with a view of making recommendations of improving food security status in the region. The findings are not only of benefit to the households but also the policy makers for purposes of considering alternative strategies of ensuring food sufficiency.

1.7 Significance of the Study

In general, the study is significant as it sought to provide disaggregated data regarding determinants of household food insecurity, coping and adaptive strategies adopted, and evaluation of institutional frameworks in enhancing food security in Makueni County.

The study has explored suggestions that are crucial for communities to re-think their systems of livelihood so as to engage on what can really provide them with sufficient food other than relying mainly on farming. This study sought to establish long-term, self-sustaining programs that can foster food security and economic development.

Finally, this study is significant because it has provided a more integrated empirical information on non-biophysical determinants of food insecurity and appropriateness of food insecurity intervention frameworks. The data will play a major role in improving food security because it will inform the governments or any other players' policy interventions. Indeed, the processes of making policies and planning can experiencing substantial snag when such information is lacking.

1.8 Scope and Limitations of the Study

In terms of scope, the study focused on an ASAL region since food insecurity in Kenya is mostly encountered in the ASALs. Makueni County represents the ASALs with food insecurity and thus became the main area of focus.

The County stands out as a good representation of areas with low to medium potential where several households undertake subsistent farming yet face food insecurity frequently. The county receives very little and erratic precipitation (an average of 329.3mm and 372.4 mm in long rain (April - June) and short rain seasons (October-December) respectively (GOK, 2002). This hinders farmers' ability to do proper planning of their agricultural activities. Language barrier was a limitation to the Researcher, but effort was made to recruit competent locals as research assistants.

The research also anticipated limitation with regard to validity and reliability of the questionnaires. However, effort was made to ensure the instrument was tested for validity through expert opinion on the coverage of the variables. A pilot study in an ASAL County (Machakos County) was conducted so as to test reliability of the questionnaire through the split-half technique. Many researches have paid much attention to the bio-physical determinants of food insecurity but little has been done on the non-biophysical factors such as the education and status of employment, demanding household spending on non-food products such as tobacco, alcohol and participation in socio-welfare activities among others. Hence this study was mainly limited to these and other variables that inherently influence household food insecurity in Makueni County.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

The chapter presents insight into what has already been done in the field of food insecurity with a view of identifying academic gaps for bridging. The chapter aims at sharpening and deepening the theoretical and empirical foundation of the research in question. Literature reviewed on food insecurity provides an analytical framework for analysing and interpreting data.

2.2 Overview of World Food security issues

According to FAO (2016) on 25th September 2015, United Nations (UN) members agreed on the 17 SDGs. The goals were aimed at eliminating hunger and poverty through restoration and sustainable management of natural resources. Goal number two is the most relevant to the current study as it tries to attain food security by eliminating hunger and enhancing nutrition as well as ensuring that agriculture is sustainable. Moreover, when considered with goal number one on ending all forms of poverty, then it is clear that households can have sustainable livelihoods with the achievement of these two crucial goals. The 17 goals as set out by the UN is a clear indication that food insecurity still remains a major challenge in the World particularly as evidenced by the second SDG which points on the need to end food insecurity. Moreover, all the other 16 SDGs are interlinked to the second goal. This implies that action or inaction of the other 16 SDGs will affect food security in the World. Appendix 7.1 is list of the seventeen SDGs while appendix 7.2 shows that disasters and famine in the region have a long history and therefore the need to seek for a solution to food insecurity.

Thus, while the world's population is continuing to grow there is a wide concern on means of preventing millions of people from starvation by effective production and distribution of food, especially in countries with little development agriculturally (Waugh, 2002; Montgomery, 2003 and Bryant, 2008). There is the big question on the number of people who can live on earth sustainably. FAO (2019) indicates that there has been an increase of people facing food insecurity in the World over the years and this complicates the efforts to end hunger before 2030. According to the UN (2020) COVID 19 is now an additional threat to food security for millions of people in the world who were already suffering from food crisis. Unless action is taken, there might be a global food emergency.

It is observed that every person in the world's population current can get 1.3 acres of land that is suitable for cultivation if the world's 7.9 billion acres of arable land is equally shared out to each living individual. Additional good news is that important contributions are being made enhance food production through genetic engineering. There is selective development of food varieties to facilitate production of desirable qualities, disease resistance species, and high yields. Therefore, previous fears of global food shortages have been eliminated by these advances, despite the continuous population growth -Waugh, 2002; Montgomery, 2003 and Bryant, 2008). Despites this, FAO (2019) observes that economic slowdowns and declines in the world pose challenges to food security and nutrition and hence the need to address these issues as well as the increasing inequalities.

Generally, the World food system is rapidly changing. Indeed, a number of scholars (Tansey, 1995; Burton, 2001; Waugh, 2002; ECA, 2003; WFS, 2007; Bryant, 2008; FAO, 2018; Hendriks, 2015; and FAO, 2019) indicate that there are several concerns

worldwide which had great influence on the food system. These are summarized in table 2.1.

Table 2.1: Worldwide Concerns likely to have great influence on the food system

Author	**Key Challenge / concern on food system**
Waugh (2002); WFS (2007); and FAO (2011 a)	Globalisation of food production is increasing with large supermarkets and transnational companies in High Income Economies procuring more of their food from countries with low income. Plantations, large scale commercial estates and, increasingly, small scale farmers are making contracts to supply wine, vegetables, and fruits to consumers in countries with high income. The result is reduced production of staple foods in the Low Income nations.
Waugh (2002); and FAO (2011 b)	Of the over 800 million people suffering from under nutrition, 200 million are children. One-third of children in Low Income Countries suffer from malnutrition.
Waugh (2002)	The traditional trend has been to clear more land for crops whenever the need for more food arose. However, currently most suitable land for agriculture has been used already, or turned into a residential area. Nevertheless, turning the remaining wetland habitats, grassland, or forest into farmland has overbearing environmental repercussions, and the remaining soil is largely unproductive and very fragile, that is, less sustainable.
WFS (2007) and Bryant (2008)	People are living longer and the global population is still rising in spite of the fact that the carrying capacity of the earth is less than 15 billion people, a number that may be reached within the next century if present trends continue. Current trends indicate that every day, about a quarter million people added to the earth. Present trends decrease the species' diversity while further straining the Earth′s eco-systems – destroying the ozone layer, pollution, and increased desertification.
ECA (2003); WFS (2007) and Bryant (2008)	Food production in Africa continues to decline. For example, annual growth rate in agricultural output was four per cent and 3 per cent for food production in 1999-2001. Per capita food production did not increase at all. Indeed, Africa receives an average of 3.2 million tons of food annually.
Burton (2001); WFS (2007); FAO (2011a and FAO, 2019)	Those in the tropical developing countries particularly in Africa was more vulnerable to impacts of climate change such as prolonged drought as they have lower level of adaptive capacity in terms of education, technology and

	organization.
ECA (2003); WFS (2007); FAO (2011 c) and FAO (2018)	There has been a fall in global cereal prices, causing farmers who might in the future have justified the expense of additional inputs (fertilizer, water etc) to keep yields high, to move away from cereals to more profitable crops.
Tansey (1995) and Bryant (2008)	Big corporations have increased their capacity to control bigger trade shares in retailing, manufacturing, and agriculture. Small businesses, on the other hand are shrinking further.
Burton (2001); Bryant (2008) and FAO (2018)	Use of biotechnology in the production of food (Genetically Modified Foods) has caused feelings that such food could be a solution to food shortage but is risky to the environment and people's health
Tansey (1995); Burton (2001); Bryant (2008); FAO (2011 a) and FAO (2018)	Liquid biofuels are the fastest growing segment of the bioenergy sector. Liquid biofuels particularly ethanol are currently produced primarily from agricultural crops such as sugarcane and maize, that are also used for food. Thus, biofuels continue to have direct implications for food security particularly through their impact on commodity prices.
Topouzis (2003); Villarreal, 2006; FAO (2019); FSIN (2020) and UN (2020)	Impacts of HIV/Aids on agriculture such as loss of labour supply, reduced productivity, yields and agricultural output among others. Currently, the COVID 19 pandemic is also having unprecedented impact on food security such as the shocks in food output and disruption of supply chains

There have been many debates with regard to food insecurity especially Africa (Derbile, 2009; Jafry, 2012; Molua, 2009; Sadano and Hingley, 2013; Hendriks, (2015); FAO, (2019) among others). In spite of the debates on food aid dependence and the need to reduce food imports, the problem of food insecurity in Africa still remains. Indeed, scholars such as Elberier, and Abdul. (1998); Molua (2009); Moore and Stanford (2010) state that drought and famine in Africa is a disaster issue. Millions of Africans are affected by natural disasters such as drought which accounts for a significant proportion. Drought is a persistent disaster particularly in the ASALs.

Its persistence adds many social and economic problems like shortage of food, famine, disease, epidemics and mass migration. FAO (2018) indicates that about 7.1 million people in the Sahel are in dire need of food aid due to drought and conflict. The range of food shortages and socio-economic crises in Sahel region reflects its vulnerability to yearly drought and long-term climate change.

Whereas high-income countries are experiencing food over-production, Africa experiences production shortfalls, especially in terms of the continent's per capita. The potential of food production of subsistence farmers in Africa still remains at the subsistence level hence they continue to bear prolonged food shortages. In Makueni County in particular, majority of the population are farmers, yet they are on perpetual food shortage. Indeed, famines in this region have a long history dating as far back as 1840 (Appendix 7.3). In 1840 for example, the famine was referred to the famine of hides and skins; while in 1895, the famine was named Uganda Railway famine as it occurred during the period of construction of the Kenya Uganda Railway. Other famines that occurred in the region as indicated in appendix 7.3 include the famine of the soil in 1949 and in 1983/1984, the famine was referred to as "I am dying with cash in my hands" which means that the famine was so severe that despite having some money in their pockets, there was no adequate food for purchase.

From the foregoing literature, it is clear that food insecurity is a major challenge globally and therefore more research in this aspect is crucial so as to contribute to more information that can help to boost food security globally and in Makueni County in particular.

2.3 Determinants of household food insecurity

Several theories have been employed to explain the determinants of agricultural production. One of such models is the McCarty and Lindberg optima and Limits model (Waugh, 2002). According to optima and limits theory, there exists an ideal or optimum location for each specific type of farming depending on the altitude, slopes, soils, and climate. This is where the Total Cost of Production per unit output (TCP) is reduced for a livestock or crop. An increase in distance from this point makes the optimum condition less ideal, that is, too wet or dry; too steep or high; too hot or cold or a less suitable soil. Consequently, the profitability of producing the crop or rearing animals is reduced, and the law of diminishing returns operates when either the output decreases or the cost of maintaining high yields becomes prohibitive. Eventually a point is reached when physical conditions are too extreme to permit production on an economically viable scale, and later at even a subsistence level (Figure 2.1)

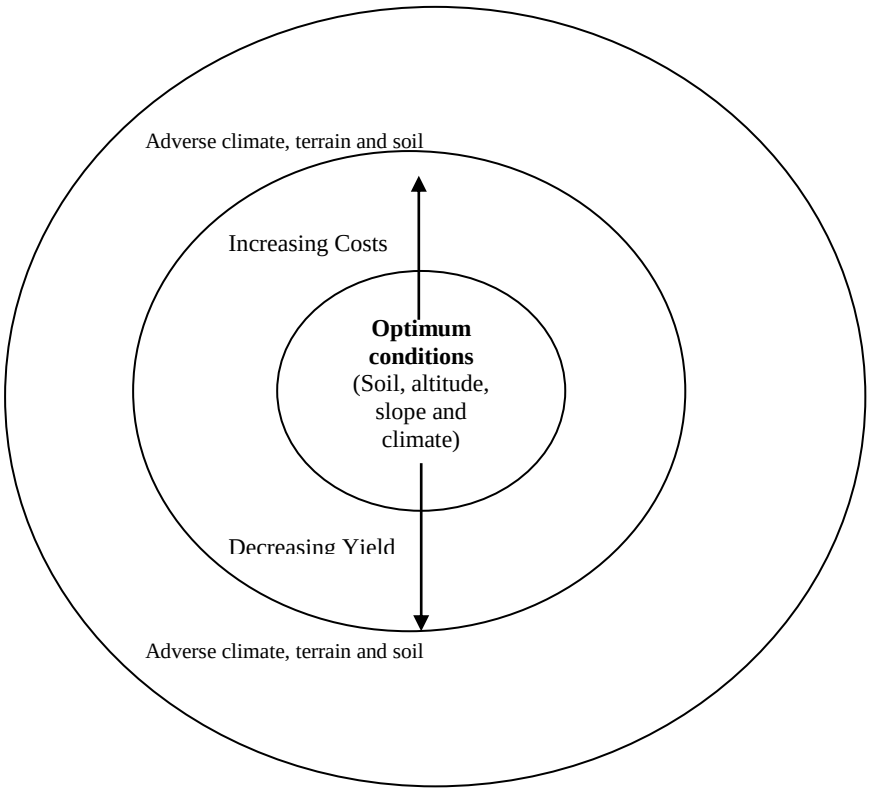

Figure 2.1: The Optima and Limits Model ***(Modified from Waugh, 2002)***

According to this model, the inner circle is the agglomerated pattern of farming activities, the second circle from the interior represents the diminishing and dispersed pattern (law of diminishing returns) while the outer circle is mainly unused (no pattern). The boundary between the second circle and the outer circle represents the limit of production.

This model is important because it highlights the bio-physical determinants of food insecurity. These factors are particularly important when applied to explain the factors of food production in the ASALs. Indeed, in the area of study, the main bio-physical factors that influence food production are but not limited to climate, topography and soil.

Despite the fact that bio-physical factors determine food production (Waugh, 2002), it is also crucial to point out that food insecurity is not only based on production but also on the ability of the household to have financial capacity to purchase food items. Thus, a myriad of non-biophysical factors that account for food insecurity in the region are explored in this study. FAO (2016) point out that addressing food insecurity problem is not only about boosting production but also increasing incomes and strengthening markets.

According to Waugh (2002) and Singh and Dhillon (2004), there has been a movement away from the view that agriculture is controlled solely by physical conditions. The location of different types of agriculture at all scales depends upon the interaction of physical, cultural and economic factors. Decisions made regarding farming are also influenced by the people's behaviour based on age, knowledge, perception and experience.

According to Waugh (2002), the cultural factors influencing agricultural production include land tenure, inheritance laws and the fragmentation of holdings and farm size. In many countries, for example, patrilineal inheritance laws have meant that on the death to a farmer the land is shared equally between all the sons (rarely between daughters). Such traditions have led to the subdivision of farms into several scattered and small fields. Fragmentation results in much time being wasted in moving from one distant field to another and makes the land uneconomical and farmers can only operate at subsistence level. Economic variables affecting agricultural activities include transport, markets, capital, technology and the government among others. Technological developments such as new seeds, cross breeding of animals, improved machinery and irrigation may extend the area of optimal conditions and the limits of production (Waugh, 2002; Gitau, 2004; and Singh and Dhillon, 2004).

Different researchers have endeavoured to empirically determine causes of food insecurity across different localities. One of such studies was done by Ramsey et al. (2016) who reported poverty, employment, residents' education level, ethnicity, and parental age as some of the latent causes of food insecurity. The study was conducted through email surveys among households with children in the age bracket of 3 years to 17 years. Logistic regression was used to analyse the collected data. The study paved way for the current study in its findings that households that are socio-economically disadvantaged are more likely to experience food insecurity compared to high-income households. The researchers also demonstrated that food insecurity continues to be a challenge both to the low-income and high-income economies. However, the current study surveyed the socioeconomic determinants of food insecurity among countries with low income.

Foley *et al.* (2009) conducted a study in South Australia and based the findings on the data that was collected by South Australian Monitoring and Surveillance System (SAMSS). Different findings were established through logistic regression analysis. Key among the findings was that households characterised by inability to make regular savings, low education levels, at least three children, and aboriginal descent experienced the highest level of food insecurity.

A study by Lê *et al.* (2015) was done in Australia's North Eastern Tasmania rural Municipality to examine the Dorset population's financial and physical ability access food. The major concern of the study was to determine how food security was influenced by the population's socio-economic dynamics and the strategies being employed to cope with food insecurity. A combination of qualitative and quantitative research approaches was employed through the application of focus group discussions and questionnaire in the data collection. The fundamental cause of food insecurity among the sampled population was found to be challenges associated with knowledge issues, affordability, availability, and access to food.

The above studies provided important insights for the current study with regard to potential agents of food insecurity among households. Some of such agents include size of the household, the population's level of education, and the households' economic strength to buy food stuff (Foley *et al*, 2009). On research methodology, a study by Lê *et al.* (2015) was very instrumental in highlighting important approaches like focus group discussions and questionnaires as effective means of collecting data for the current study. Nevertheless, the geographical variation in the previous studies limits generalization of their findings in the local Kenyan context or even the specific

condition of Makueni County. For instance, Australia maybe relatively food secure than Kenya because her economy is a High-income one.

In addition to evaluating determinants of food insecurity, Loopstra (2018) went further to examine intervention strategies for solving food insecurity issues among countries with high-income economies. Loopstra (2018) singled out household income to be the major determinant of food insecurity. He also pointed out that people with profound poverty are more prone to food insecurity. Households included are families with many children, single parents, uneducated adults and other vulnerable people. Food insecurity is also linked to other factors such as food desert, food inflation, poor management of personal or household finances, and poor health. However, the study failed to provide generalizable insight to the local context since it was based on United Kingdom, Canada, and USA which are high-income economies.

A study by Iheoma (2020) was done in South Eastern Nigeria among agrarian communities to examine determinants of the communities' household food security. The study established that status of the communities' food security was dependent on the distance between the households and the market place, dependency ratio, monthly income, level of education, and marital status. It emphasized that food security of a household is likely to be greater if the household is provided for by an unmarried individual whose education is higher, has a monthly income, and has less than five dependents. Additionally, food insecurity increased with increase in distance between the households and the market place. Urgent handling of the mentioned factors was one of the recommendations of the study as a way of boosting food security. The relevance of the study to the current study lies in its elaborate exploration of the critical variables. That is, determinants of food insecurity. The present study addresses

the determinants of food insecurity, coping and adaptive strategies as well as interventions to food insecurity with specific focus to a region based in ASAL in Kenya.

2.4 Coping and Adaptive Strategies to Curb household Food Insecurity

Derbile (2009) found out that in North-eastern Ghana, farmers plant many indigenous drought resistant crop types and practice diverse rounds of planting and or staggering planting among multiple farms. They also use home-grown types of organic fertilizer, control soil erosion through grass strips and stone terracing and embracing paddy farming for enhancing soil and water conservation towards improving plant adaptive to drought. He asserts that through meticulous work, farmers are decreasing susceptibility to rain-fed agriculture to drought through indigenous knowledge systems of drought risk management.

Molua (2009) in a study in Northern Cameroon' observed that households are exposed to burdens associated to production and availability of food, little earnings and accessibility of food and use of food supplies, intensified by the actual and perceived impacts of the changeability of present climate. Temporary coping strategies include variation of livelihood which in turn affects accessibility and consumption choices of food. He further observed that manipulation of income and market strategies for food supply steadiness include a number of non-farm income generation approaches to cope with anticipated scarcities brought by variability in climatic conditions. Some of the outstanding determinants of household food security include delivery of extension services, land tenure, access to credit facilities, farming conditions, household demography and climate variation.

Pottier (2015) conducted a study in Kampala, Uganda on the theme "coping with urban food insecurity: Findings from Kampala, Uganda". The study used survey method and based on primary data, the results show that as part of coping strategies, food insecure households dropped or decreased consumption of *matoke*, the plantain stable, soon after its availability declined or its market price rose. According to Pottier (2015), the population in turn shifted to a diet for which the base was a stiff maize porridge (*posho*), eating just one meal a day.

Berlie (2015) also conducted a study on coping mechanisms and food security at household level in drought-prone areas in Ethiopia focusing on Lay Gayint district. Using a questionnaire, in-depth interview and discussions within focus groups, it established that growing trees for the sale, diversification of livestock and natural resource protection were vital adaptive approaches used by the better-off families. Short-term term strategies employed by households included sale of charcoal and fuel firewood, borrowing loans/credits and seeking cash or in kind from friends. In order to improve livelihoods, the study advocates adoption of quick maturing and drought-resistant varieties, effective usage of available water and the planting of upland apple trees and growing of eucalyptus trees in reachable. The studies Pottier (2015) and Berlie (2015) relates to the present study on the variable of coping strategies and that they are based on low income countries. However, while Pottier (2015) only focused on one coping strategy i.e. dietary changes Berlie (2015), on the other hand addresses more coping and adaptive strategies to food insecurity. The present study examines not only the coping and adaptive mechanisms applied by households but also determinants and interventions to food insecurity at the household level.

Law *et al.* (2018) contributes to this study through their qualitative study on identification of common coping strategies practiced by indigenous peoples (Orang Asli) in Peninsular Malysia during periods of food insecurity. Using qualitative case study design and in-depth interviews, the study found out that there were various coping strategies used which were thematically grouped into two. Firstly, food consumption (these were: rationing, decreased dependents, food diversification, and dietary changes). Secondly, financial management (these were: reduced daily expenses, reduced expenditure on school-going children, and increasing household income). This study sheds some light on the current study not only on the methodology applied but also on the key variable of coping strategies applied during food insecurity. The current study uses both qualitative and quantitative techniques and also focuses on both coping and adaptive strategies to food insecurity among other variables.

2.5 Global Food Insecurity Interventions

Food insecurity remains a major challenge in the global agenda despite the longstanding efforts to eliminate hunger by FAO and worldwide programmes as early as 1960 when Freedom from Hunger Campaign was inaugurated by FAO. Another remarkable effort to half the food insecure population by year 2015 was conceived in the Rome Declaration of World Food Security in 1996 by the World Food Summit (WFS) (Gani and Prasad, 2007).

Several leading institutions and organizations like the IMF, World Bank, and the UN among others have developed universal framework for realization of development targets and goals by international players by (2010 and 2015) by SSA and the world

as a whole. These goals which were eight in number were referred to as the UN Millennium Development Goals (MDG) (Ahmed and Cleeve, 2004).

The first MDG aimed at halving the proportion of people who are poor and suffer from hunger. A few countries such as Botswana, Cape Verde, Cote d'Ivoire, Mauritius, Senegal, Seychelles, and South Africa were able to make good progress to achieve the MDGs. These goals were replaced by SDGs in 2015 and goal number two still emphasizes food security. In spite of this, most of African's population suffers significantly from food shortages. In 2002, at the WFS, the Governments reaffirmed the "right of everyone to have access to safe and nutritious food" but emphasised that food security is the responsibility of national governments and society (Gani and Prasad, 2007; Ziervogel and Ericksen, 2010; UNDP, 2015 and FAO, 2018).

The desire to dramatically reduce hunger has fuelled many humanitarian assistance programs over the last decade. With some 40,000 non-governmental organizations (NGOs) operating to provide relief and generate economic viability, a state of crisis continues. As such, it is necessary to gain a better understanding of what factors predict success in establishing long-term, self-sustaining programs that foster economic growth in Low Income Countries (Duke and Long, 2007).

In order for Africa to accomplish and sustain an average GDP growth rate of above 7 per cent per year, a rate that is said to be appropriate to support decrease of people in poverty by half by 2015, it would require enormous investment to be put in many areas such as agriculture, industry, education, and health. It would necessitate, for instance, investment increase at rates of 29 per cent and 25 per cent per year to be added to the present levels of investment in agriculture and industry, respectively, for

sub-Saharan African nations to be at par with Malaysia, Indonesia, and Thailand (ECA, 2001).

FAO noted the need to double food production among developing countries in order to boost overall production by 70% to meet the needs of the projected world population of 9.8 billion people by 2050. It has been projected that the world will need up to 3 billion tonnes of cereals to feed both the animals and human by 2050. This is an enormous increase in demand in comparison to the current demand of 1.8 billion tonnes. However, it is likely to go higher considering the introduction of liquid biofuels. Therefore, the agricultural sector will have to adopt more sustainable and efficient means of production like depending on the rural workforce given that increasing the production must be done while moderating and adapting to climate change (Rao, 1997; Ringler, 2010; FAO, 2011a; FAO, 2018 and FAO 2019).

Singh (2009) notes that food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food for a healthy and active life. For food security to be maintained, it is important to take into account variables like climate, socio-economic systems, and politics. The constraints of addressing food security include coping with the overgrowing population, reduction of poverty, proliferation of food security while preserving the natural resources, mounting inflation and income deficiencies, shifting food habits, making biofuels out of food crops, increasing market products and urbanization. Thus, a multi-stranded approach is required to address food insecurity (Singh, 2009).

Thirlwall (2006), observes that one of the distinguishing characteristics of Low Income Countries is the fact that their economies are dominated by agriculture and

petty service activities. There is very little by way of manufacturing industry. Getis and Fellman (2004), notes that at least two-thirds of the labour force in many Low Income Countries is directly involved in farming and herding. In some countries such as Burundi, the figure is more than 90%. In the developed economies, a small fraction of labour force (8% in most of Western Europe, below 5% in Canada and less than 3% in the United States of America (USA) is directly employed in agriculture.

The practice of food production in the United States is highly energy demanding. As farming is greatly mechanized, the harvested food is comprehensively processed and stored a variety of ways demanding significant amount of energy. The products are elaborately packaged and often transported long distances to the consumer (Montogomery, 2003).

According to Getis and Fellman (2004), developed economies have a declining number and proportion of farm workers, along with farm consolidation and increasing output. New technologies have enabled farmers to grow surplus crops. They even export to international markets.

Further, as pointed by Lawrence (2005), there is need to embrace manufacturing instead of primary production since the demand for manufactured products have high-income elasticity. However, the production structure is yet to experience any significant change within countries in Africa even though they all expected to embark on programmes of industrial development and grow their manufacturing sectors immediately after gaining independence. The plan was to base manufacturing in Africa on food processing and processing of other primary products before progressing to manufacturing of capital goods among other advanced consumables.

Nevertheless, economic growth in Africa can still be driven by manufacturing into the world market.

According to Singh (2009) there are some specific actions required to address the food insecurity. These are:

1. Need for UN's FAO to institute a global fund, donated by all countries that can benefit net food importing countries during food insecurity.
2. Need to increase food production. Despite pressure on land, small farmers can produce adequate food if they are provided with better-quality seeds, fertilizers and other modern inputs.
3. Global food crisis will also be solved through natural resources management. This will entail improving the quality of soil and ensuring proper management of water resources by effective ways of harvesting. About 5 billion acres of productive agricultural land worldwide is currently degraded. This land should be saved and also put effort to preserve land that is still fertile.
4. Capacity building for farmers should be done using improved seeds and they should not be reliant on international seed manufacturers. They should also be trained on the use of fertilizers that are environmentally friendly, enhanced amenities for transport and storage, good standards as per the international requirements, and international corporations.
5. In agricultural production, oil is very crucial and therefore managing its price is also important in addressing food insecurity. Therefore, government are advised to inspire motor vehicle manufacturers to manufacture hybrid cars, promote and embrace gas powered vehicles and stimulate gas production.

There should also be promotion of alternative source of energy and reduce use of oil.

6. The problem of food insecurity will also require the role of scientific community. The scientists are preoccupied with ways of having a new "green revolution," to address a rising food insufficiency in many countries.

Singh (2009) observed further that in the 4th and 7th decades of 1900s, major development around food technology – notably, pesticides and chemical fertilizers, better-quality seed varieties, enhanced technology in farming and irrigation– contributed to enormous increases in food production worldwide. The "green revolution" protected many people from starvation because there was increase in harvest within Asia, and Mexico among other regions across the globe. Although Getis and Fellman (2004), Lawrence (2005), Thirlwall (2006), and Singh (2009), provides some relevant actions required to address food insecurity, these suggestions are general in nature and fails to capture the role of households and institutional frameworks in addressing food insecurity problem. Further, their suggestions do not offer ways in which food insecurity in ASAL regions can be addressed.

Loopstra (2018) indicates that various programmes and policies have been used to curb food insecurity among countries with high income. Social protection strategies designed at making households financially capable of meeting their basic requirements and social security interventions which are food-specific, like the USA's food stamps, currently referred to as Supplemental Nutrition Assistance Programme (SNAP) have been used as interventions to food insecurity. Food banks (also known as food pantries in the USA) support people who need assistance with free groceries and also aim at ensuring families do not encounter lack of food. The aim of

community food programmes is to decrease food insecurity within households through training of leaders of the households on proper budgeting to ensure the limited food budget is stretched to last as many days as possible. The programmes also seek to ensure accessibility to food stuff by providing food box initiatives or shopping vouchers as well as establishing community shopping centers. Social safety nets such as pensions to the aged are also used as interventions to food insecurity in the USA and other high-income countries. Despite these programmes, Loopstra (2018) indicates that there is absence of evidence to demonstrate that these interventions successfully decrease food insecurity. This study is relevant to the current research because of keen interest on the interventions on food insecurity. However, while the current study focuses on interventions in Makueni County which is in a low-income country, Kenya, Loopstra (2018) paid attention on interventions of food insecurity among countries with high income like USA, Canada and others in Europe while the current study focuses on interventions of food insecurity specifically in an ASAL region in low income country, Kenya.

2.6 Food Insecurity Institutional Interventions in Kenya

The institutional and policy framework that governs the agricultural industry is very important in developing the country's entire economy (FAO, 2013 and FAO, 2018). The Government of Kenya has had much effort to increase agricultural productivity through various policies. For instance, the focus of trade reforms in agriculture in the early 1980s helped to bring about macroeconomic change in general although they were less successful in stimulating growth in the sector. Apart from the trade policy, the government of Kenya also had input policy reforms. The reforms liberalized input markets and the country developed a network for agricultural inputs such as

chemicals, fertilizers, seeds, livestock foods and agro-chemicals among others (GOK, 2003).

The government also came up with an agricultural policy focusing on food security to ensure food self-sufficiency to help keep the nation fed without relying on food imports. Moreover, the Economic Recovery Strategy for Wealth and Employment creation of 2003 proposes to implement interventions contained in the Kenya Rural Development Strategy which also include improvement of farmers' access to credit, irrigation development and enhanced research and extension (GOK, 2002b and GOK, 2003)

A policy document which is very specific to addressing agricultural issues is the Strategy for Revitalizing Agriculture 2004-2014. This policy document proposes action on a number of aspects aimed at increasing agricultural productivity by lowering unit costs of production among others (GOK, 2004).

In 2007, Kenya also launched vision 2030, a blueprint that aims at transforming Kenya into a newly industrializing, "middle-income country providing a high quality life to all its citizens by the year 2030". In agriculture, the policy document emphasizes the need to increase productivity. It states that the specific strategies to be focused on included among others: increasing livestock and crops productivity, and promoting agricultural growth in the private sector and among households through transformation of major livestock and agricultural institutions. It notes further that, the government introduced new policies on land usage by: encouraging farmers to adopt efficient use of their lands with medium and high potential; advocating for effective marketing techniques to enhance market accessibility by small holders; and

preparing new lands to be cultivated through strategic development of more irrigable lands within semi-arid and arid areas for livestock and crops (GOK, 2007).

In an effort to promote Agriculture, the Government of Kenya through the Constitution of Kenya (2010) sets out the principles of land policy as:

Kenya's land is supposed to be held, utilized and managed in a sustainable, productive, efficient, and equitable manner based on principles as:

a) Land should be accessed equitably;
b) Land rights should be guaranteed;
c) Resources be sustainably and productively managed;
d) Land management should be cost effective and clear;
e) Areas that are ecologically sensitive should be protected and conserved;
f) Property and land practices, customs, and laws that are discriminatory in terms of gender should be done away with;
g) Communities be encouraged to solve land disagreements via initiatives that are planned by local community according to the spirit of the new constitution

The above principles are to be executed via national land policy established and revised frequently through legislation by the national government.

According to IMF (2010) and GOK (2007), Kenya is yet to achieve her objective of eliminating hunger and safeguarding food security. Poverty is still restricting access to adequate food for over 40% of the country's population. However, the government is trying to ease the situation by reforming relevant policies for holistic solution of

hunger and poverty problems. For example, the Food Security and Nutrition Policy (FNSP) has been finalized (IMF, 2010).

Among the policy proposals involve establishment of a Strategic Food Reserve to expand the existing Strategic Grain Reserve for inclusion of other food products like meat, pulses, rice, powder milk, and financial (cash) reserves. Areas of improvement have been made in the area of adding value together with small scale honey and fruits production; making detergent and domestic production of body oil and lotion. Additionally, traditional food crops farming has been reinforced to address food security. The flagship projects in the agricultural sector for enabling the country achieve vision 2030 include:

1. **Passing of the Consolidated Agricultural Reform Bill:** Need to review, update and **s**ynchronize legal framework to justify agricultural parastatals' marketing, lobbying, processing, licensing, regulatory, and development functions. Industry development and dispute determination instruments were set up by this bill. The requirements of the producers, processors and consumers were to be set up by a regulatory agency. The transformations improved efficiency of operations, cut costs of marketing and grow the producers' functions. The legal modifications put a structure for the execution of institutional reforms which are critical in the achievement of Kenya *Vision 2030* aims for the agricultural sector.

2. **Fertilizer Cost-reduction Programme:** The scheme was executed through cost reduction programme for fertilizer. This involved buying and supply chain enlargement of the input's market as well as blending and manufacture

of fertilizer locally. While engaging the private sector and establishing the capability farmers institutions' of importing and distributing fertilizer in large quantities, was the primary stage of the programme. The project of reducing the fertilizer's cost needed training of farmers and their organizations; efficiently acquiring and distributing fertilizer, and providing warehousing to deal with the ineffective and expensive fertilizer importation as well as the existing circulation system. This was followed by the need to decrease costs of other inputs.

3. **Creation of Disease-Free Zones:** This comprised of enhancement of disease control and vaccination by controlling movement and strengthening veterinary department and. It also involved investment in livestock rearing, range improvement, and stimulating infrastructure to increase the value, quantity, and quality meat for export. Milk exports in Kenya also benefited from intensified activities of controlling disease in highland areas.

4. **Land Use Master Plan:** A National Land Use Master Plan be developed with Agriculture Land Use Master Plan as part of it. The Master plan will target to use all types of land efficiently.

5. **ASAL Development Project:** A venture that was firstly effected in Athi River and Tana basins for irrigating 600,000 - 1,000,000 hectares of land. As part of Government's plan to boost development in the ASALs, the first and second conferences were held in Kilifi and Kajiado counties respectively. The first conference was held in Malindi, Kilifi County from 5th to 7th September, 2018 on, "unlocking the potential of ASALs for accelerated national development". The main areas discussed in the conference included:

consolidating the engagement and coordination of ASALs development partners; creation of tracking mechanisms for implementing the conference's outcomes; aligning the priorities and development plans of ASALs with the Big Four Development Agenda and Kenya's Vision 2030; as well as developing and adopting framework for addressing emergent needs of ASALs development (GOK, 2018). The second ASAL conference was held on 10th to 12th September, 2019 in Amboseli National Part, Kajiado County. The conference made several resolutions which included: promotion of greenhouse technology including irrigation and market gardening as a means of boosting food security; need for enhanced investment on mega water desalination of water aquifers such as Turkana and Lotikipi basins; need to review land use practices to avert irregular land subdivision in order to have adequate land for livestock production; use of climate maps in agriculture as a way of promoting commercial agriculture in the ASALs; and zoning of industrial lands to promote investment and use of modern methods of farming to provide adequate food for the growing population (GOK, 2019).

It is also important to observe that since 2006 the Government of Kenya started to implement "Njaa Marufuku Kenya" (NMK) programme - meaning eradication of hunger in Kenya. The NMK programme comprises of three constituents. The first one is deals with support of community-led projects for improvement of food security, and concentrates on community empowerment through training of members of the group and their facilitators. The second element aims at improving health and nutrition standing of susceptible persons and school going children through the support of community nutrition awareness and school meal programmes. The third

one deals with improvement of private sector food security innovations. This encompasses participation of community-based organizations (CBOs), NGOs, private sector organizations and other autonomous food security innovations (MOA, 2006).

The approaches employed by NMK in all the three elements comprise of training and empowerment, community focused agricultural development initiatives (through community participation in project planning and implementation) and production in agriculture through buying and application technology/farm inputs.

In spite of these policy interventions, the country still faces food insecurity. Indeed, despite the execution of the NMK Programme from 2006, food insecurity remains problematic in many parts of the country. In Makueni county in particular, famine has been experienced almost every year with some famines dating as early back as 1840. This is in spite of various interventions to ensure food security particularly by the Government.

Similarly, a study conducted by Wabwoba and Wakhungu (2013) on 'factors affecting sustainability of community food security projects in Kiambu County, Kenya' revealed that many food security projects have been funded by both the Kenyan government and other development partners in an effort to mitigate against food insecurity. Unfortunately, such projects leave little impact after the end of funding. The findings revealed that the sustainability of community food security projects is affected by group members' participation, rainfall patterns, leadership, management and funding levels.

As part of addressing food insecurity and securing overall economic growth, the government of Kenya came up with the Big Four Agenda in 2017. The Big Four

Agenda is anchored to the Vision 2030 of Kenya and linked to the Vision 2030's Third Medium Term Plan (2018-2022). The agenda entails: expansion of manufacturing sector; affordable housing; food security; and affordable health care for all. With regard to food security agenda, the Government aims at encouraging large scale and commercial farming to increase and diversify the staples in the country through irrigation and other technologies. Small scale farmers will increase food productivity by enhancing better extension services, access markets and provision of subsidies (GOK, 2017).

From the foregoing literature, it is clear that the suggested policy interventions on food insecurity are general and have not improved food security situation in Kenya especially in the ASALs. Scholars such as Wabwoba and Wakhungu (2013) have thrown some light on factors affecting sustainability of community food security projects. However, their study is specific to Kiambu County which is not among the ASAL regions in Kenya which face perpetual food insecurity. Further, various literature such as GOK, (2017) and GOK, (2019) among others gives policy frameworks aimed at mitigating food insecurity problem. In spite of this, little has been suggested on the role of households with regard to their coping and adaptive strategies as well as effectiveness of institutional frameworks in addressing food insecurity in Makueni County.

2.7 Summary of Knowledge Gaps identified in the literature reviewed

Literature indicates that the frequency of food insecurity particularly in the low-income countries continues to encourage discussions and research. The continued existence of food insecurity mainly in parts of the African region in general and

Kenya in particular, makes this study relevant as it is important to seek for sustainable solutions to the problem.

The bottom line in the literature reviewed is on general food security world over. This means that much of literature reviewed provides a generalised view of the problem of food insecurity. Accordingly, this study aims to address the issue of food insecurity in the low-income countries such as Kenya with particular attention on the ASALs. The main aim is to make available an empirical attention on bio-physical and socioeconomic factors influencing food insecurity as well as coping and adaptive strategies at household level; the impacts of institutional frameworks on food insecurity and the on-farm and non-farm strategies that can be applied in the region. This is an area that the literature reviewed fails to capture and is therefore a value addition to academic scholarship and informing policy.

The literature reviewed underscores the fact that food insecurity is of major concern world over particularly in Africa. The fact that the world population continues to grow particularly in Africa is a pointer that the continent must be prepared to feed the extra mouths by all means.

Whereas the high-income Economies such as the USA enjoy surplus food produced by a few people, the worrying scenario in Africa is that majority of the people are farmers yet they are food insecure. Literature from the high-income Economies indicates that majority of the people engage in manufacturing and service activities and that agriculture is highly mechanized. This literature throws some light on how best Africa in general and Makueni County in particular can be food secure by engaging in alternative strategies rather than on agriculture alone.

A number of food security institutional interventions have been used in many African countries and even in the study area in Kenya. Some of these interventions include food aid, provision of free seeds to farmers, irrigation programmes and credit facilities among others. In spite of these interventions the study area still remains food insecure. It is on this basis that this study seeks to explore ways of how best to change the regions status quo.

2.8 Conceptual Framework

Based on the literature reviewed, this study conceptualizes that the region under study is food insecure largely due to socio-economic factors. Although bio-physical factors influence food security in the region mainly on food production, the socio-economic factors significantly influence food security not only on the basis of food production but also on food access. The socio-economic factors influencing food security include farmers' land size, family size, education, access to information on climatic and weather conditions, availability of markets, capital and technology among others.

The study further conceptualizes that as a result of food insecurity, households have tended to adopt a number of diverse coping and adaptive mechanisms in order to survive. Some of the coping and adaptive mechanisms include; formal employment, keeping of livestock, engaging in casual labour, irrigation replacing rain-fed agriculture, food aid from the Government and the private sector and remittances from relatives among others.

Apart from the coping mechanisms, the study also examined institutional frameworks applied in addressing food insecurity in the region. These frameworks include aspects such as provision of general relief food, relief seeds, irrigation, provision of inputs

and financial support among others as provided by Government and NGOs. This study considers that the coping and adaptive mechanisms and the institutional frameworks should have a significant impact on the region's food security. Further, the study seeks to explore the alternative strategies that can be efficiently applied by households to be food secure. The alternative strategies to be explored include intensive irrigation, use of high yielding varieties of seeds engaging in formal employment, manufacturing and engagement in business among others. In general, four broad independent variables namely, bio-physical and socio-economic factors, coping and adaptive mechanisms, institutional frameworks and alternative strategies may have an impact on food security (dependent variable). Food security was operationalized as the food production as well as access of food through sufficient incomes. The assessment of the relationship between these variables forms the core of this study.

The current study therefore aimed at establishing the linkage between these variables and food security with a view of establishing a paradigmatic shift (an integrated model) given that the region under study has been in perpetual food shortage. This study sought to explore a possibility of an alternative strategy of providing food security in the region instead of the sole reliance on agriculture which has not provided sufficient food to the farmers. In this regard, other alternative strategies such manufacturing industry and other non-farm activities if established in the area can trigger growth in the rural regions such as the area under study. Indeed, it beats logic for about 80% of the population in the region to engage in agriculture, yet they have to keep on relying on food aid. The bio-physical variables such as soil, altitude, slope and climate as indicated in the optima and limits model shown in figure 2.1 as well as

the socio-economic determinants which forms the core of this study significantly influences food security in the region under study. Figure 2.2 shows the conceptualized integrated model of the variables that affect food security. For food security to be guaranteed, two conditions are met: food needs to be available and families must have the capability to obtain it.

In this study and as indicated in figure 2.2, food insecurity is considered as a dependent variable and is influenced by various independent variables such as, socio-economic factors (land size, amount of income, family size, level of education among others); coping and adaptive mechanisms to food insecurity and institutional interventions used to address the food problem. The households, ability to produce adequate food or to buy enough food for themselves was used to determine the extent of food security among them. In this study, the bio-physical factors such as soil, altitude and climate were not considered and therefore were considered as intervening variables to food insecurity. Thus, apart from the bio-physical variables, the various independent variables highlighted were examined to see if they have had an impact on food security; and how best the problem of food insecurity in the area can be mitigated.

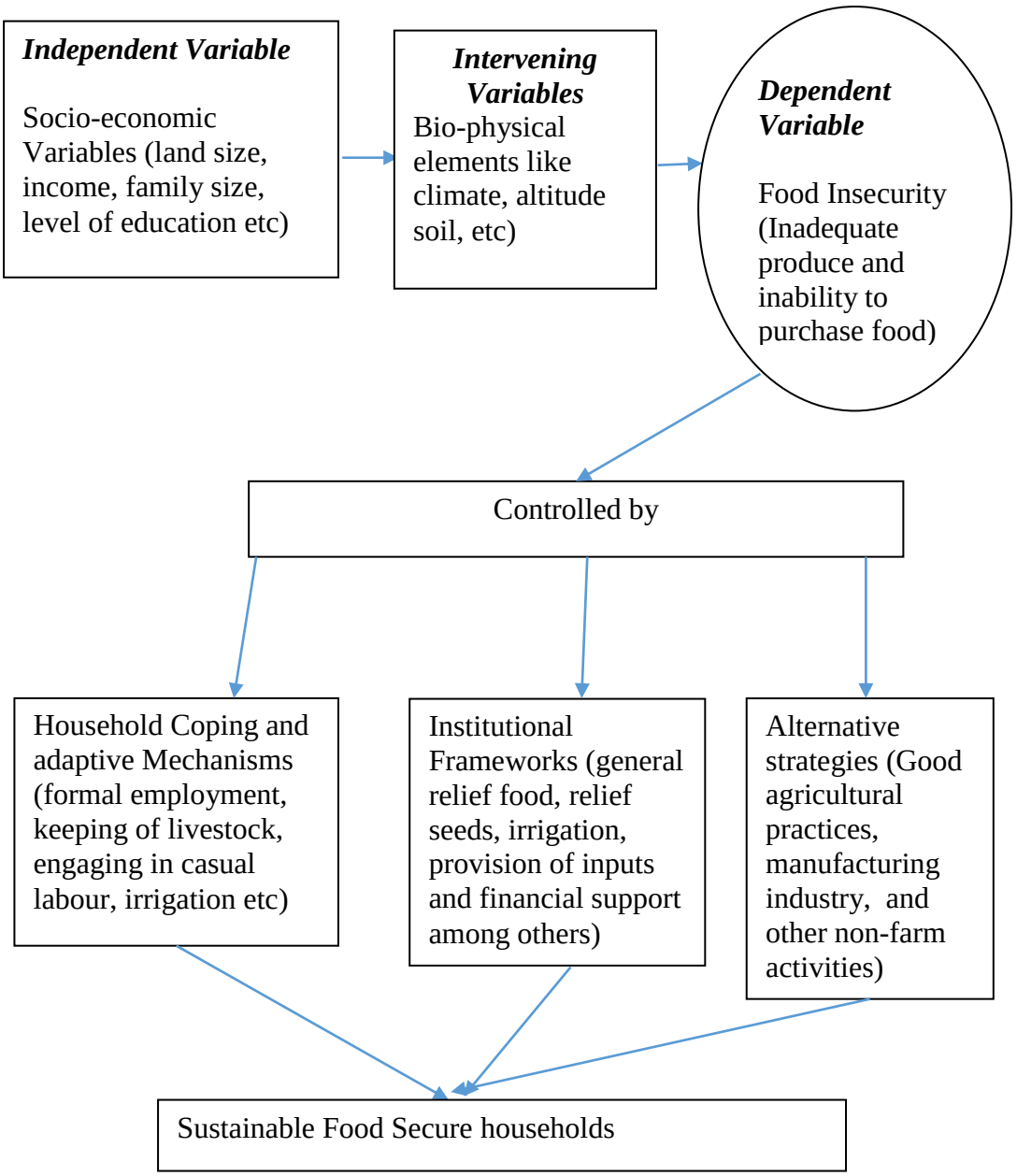

Figure 2.2: Variables influencing household food insecurity

(Author's Own Conceptualization, 2021)

CHAPTER THREE

3.0 METHODOLOGY

3.1 Introduction

This chapter presents an account of the methods that were used to carry out the research and data analysis. The main areas addressed in the chapter include the research design, data collection instruments and data analysis procedure.

3.2 Site of the Study

This study was undertaken in Makueni County (Figure 3.1). The county has six Sub-Counties including Kaiti, Mbooni, Kilome, Makueni, Kibwezi West, and Kibwezi East. Makueni County is situated in the South Eastern part of the country. Makueni County borders Machakos to the North, Kitui to the East, Taita Taveta to the South and Kajiado to the West. The county lies between Latitude 1º 35´ and 3° 00´ South and Longitude 37º10´ and 38º 30´ east and covers an area of 8,008.7 Km2. In terms of relief, the main physical features in the county include the volcanic Chyullu hills which lie along the South West border of the county in Kibwezi East and West sub counties; Mbooni hills in Mbooni Sub County and Kilungu and Iuani hills in Kaiti Sub County. Other features include Makongo forest and scenic view, Makuli Forest and Nzaui hill (GOK, 2013).

According to GOK, (2013), soils in Makueni County range from the deep well drained Luvisols, Planosols and Acrisols, to poorly drained Vertisols. These soils are underlain by rocks of the Precambrian basement systems (granites) and tertiary volcanic rocks.

With regard to climate, there are two rainy seasons in Makueni County; a short rainy season and a long rainy season. Whereas the former takes place between October and December, the latter is experienced between April and June. The average rainfall during the longer rainy season often averages at 329.3mm while an average rainfall of 372.4mm is often received in the shorter season. In terms of temperature the County is coolest (20.2°C) in July and hottest (24.6°C) in February. However, temperatures as high as 35.8°C are sometimes witnessed within the lower altitude regions. The extreme temperatures often result to greater evaporation thus worsening the dry environment. Notably, human activities like charcoal burning and farming on the top hills have exacerbated natural forces to alter the climatic conditions of the region. The ultimate result has been food insecurity due to increased crop failure in the region

Climate disparities and extreme variances in temperatures in Makueni County are attributable to the altitudinal variation. To the north, it is frequently cool whereas, in the low-lying parts of the south, it is generally hot. In most of the cases, the county experiences low temperatures at nights and high temperatures during the daytime. In the dry periods that are usually in May to October the lower regions of the County encounter high temperatures. The northern areas of the county have low temperatures particularly the hilltops. This is due to the forests and windy situations that are in these zones. The low-lying areas of the south are extremely dry because they lie on lower altitudes and experiences annual rainfall in the range of 300 mm to 400 mm (GOK, 2013).

In terms of economic activities in Makueni County, agriculture is the key driver contributing about 47.2% of the Gross County Product. The average small-scale farm size is 2.5 Ha (GOK, 2013; 2019 and Makueni County Government, 2019). Table 3.1 shows a summary of the main land attributes in the County.

Table 3.1: Main Land Attributes in Makueni County

S/no.	Land Attribute	Land Size
1	Area	7,965.8 Km^2
2	Arable area	6,245.2 Km^2 (78.4%)
3	Non-arable area	1,720.6 Km^2 (21.6%)
4	Gazetted forest	178.9 Km^2 (2.25%)
5	Acreage under food crops	195,000 Ha
6	Acreage under cash crops	11,700 Ha

Source: GOK (2013)

County hilly areas with medium rainfall have potential for food crop production. Coffee, horticulture and dairy farming activities are also common activities of livelihood. Over three quarters of the farmers in the county are embracing and growing maize as a staple crop instead of millet and sorghum. The arid nature of the county has undesirably affected agricultural activities which are the major sources of livelihood in Makueni County. The unreliable precipitation pattern complicates planning of agricultural activities among farmers in the County.

Makueni County often faces crop fail due to the low rainfall thus contributing to food insecurity. Other factors contributing to food insecurity include: small farms due to sub division, crop diseases, poor storage facilities and sale of harvested crops to highly exploiting middle traders to meet other domestic needs (GOK, 2013).

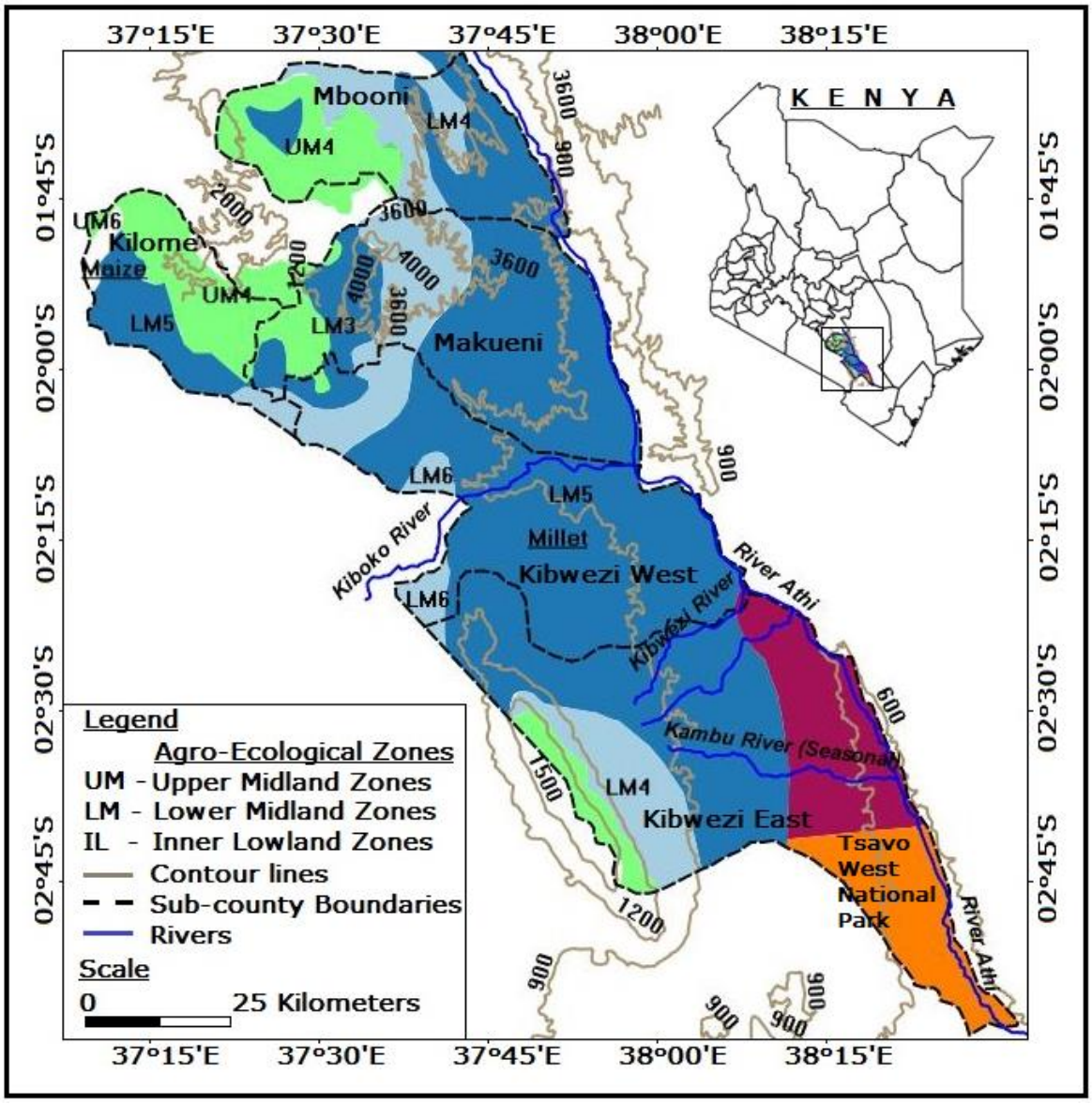

Figure 3.1: Map of the Study Area

Source: Farm Management Handbook of Kenya Vol. 2/East Kenya, Topographic sheets for Nairobi (SA-37-5), Kitui (SA-37-6) and Kibwezi (SA-37-10), Survey of Kenya

Demographically, Makueni County's population size as per the 2019 census was 987,653 while as per the 1999 census it was 771,545. This was a 28% growth of the population size from 1999 to 2019. The average population density is 121 persons per Km^2. In terms of population structure, a large population is young as

approximately 75% are under 35 years. Specifically, the youth (18- 35 years) account for almost 24 percent of the total population hence the need to plan for the current youthful population and the foreseen population growth which will push demand for social services and food higher. Those under 15 years puts pressure on the income of working class making their resources inadequate. The youthful population is however a resource if they are adequately imparted with skills through education and training (GOK, 1997; 1999; 2002; 2013; 2019).

The choice of Makueni County as the site of study was made because it is among the ASAL regions of Kenya. FSIN (2020) indicate that most of those in food crisis in Kenya in 2019 were pastoralists households such Turkana, Mandera, Baringo, among others as well as marginal agricultural and agro-pastoral households which include Kitui, Makueni, Kilifi, and Meru North. Makueni County faces frequent food insecurity despite being in low to medium potential areas as well as notable involvement of households in subsistent farming. The fourth and fifth Agro-ecological zones in which Makueni County is situated experience crop failure thrice in every five seasons (Government of Makueni County, 2019 and GOK, 2013). Communities occupying such zones tend to be agro pastoralists.

3.3 Research Design

This study was based on descriptive research design. The design guided the study in the use of questionnaires in data collection from farming household heads who were sampled within Makueni County. The approach facilitated capturing of all the study variables as was intended in its conceptualization. Descriptive research design is appropriate in unfolding the status of affairs as it exists (Robison, 1998; Mugenda and

Mugenda, 2003 and Kombo and Tromp, 2006). In this design a researcher is able to describe aspects such as characteristics, values, attitude, and behavior among subjects.

3.4 Variables Selection

This study focuses on a number of variables. Given that the study's dependent variable was food security, determining factors such as institutional interventions of food insecurity, coping and adaptive mechanisms, and socio-economic factors were the independent variables in terms of how they interact to influence food security in the sampled population. Food security was viewed with regard to the population's ability to produce food and economic capacity to afford the required food stuff. The various independent variables highlighted was considered to check if they have had an impact on food security; and how best could the problem of food insecurity in the area be a thing of the past.

3.5 Target Population and Sample

The study target population was 144,320 households in Makueni County. This population was based on the National population census of 1999 since the data was collected long before the 2019 census which indicates the total households as 244,669. Thus, a total of 144,320 households were used as the target population from which a number of household heads were sampled to provide information on the socio-economic factors influencing food security, their coping mechanisms, and their opinion regarding institutional interventions on food insecurity as well as their views on best practices currently being applied to address household food insecurity.

3.6 Sample size and Sample selection

In this study Yamane's formula was used in computing the required number of household heads sample size as;

$$n = \frac{N}{1 + Ne^2}$$

Where n = Sample size

N = Number of households in Makueni County (144,320)

e = Margin of error **(**0.05)

Therefore:

$$n = \frac{144{,}320}{1 + 144{,}320x0.05^2}$$

$n = 398.9 \approx 399$ households/household heads

From the computation, the study's sample size was estimated at 399 farming household heads. Based on stratified random sampling, the sample size was divided by six sub counties in Makueni County to get about an equal number of 66 farming household heads in each sub-county.

3.7 Data Collection Techniques

This study relied on the semi-structured questionnaires (Appendix 7.3) to gather data from the farming household heads. The researcher recruited Research Assistants through whom the questionnaires were distributed and data collected from the household heads. The questionnaire collected data on socio-economic determinants of food insecurity, coping and adaptive mechanisms used to deal with food insecurity, institutional interventions and best strategies applied in addressing food insecurity. Both closed-ended and open-ended questions were used. As indicated by Mugenda and Mugenda (2003) and Robson, (2002), the closed-ended questions are

advantageous because they are easy to analyse, easy to administer and economical in terms of time and money. On the other hand, open-ended questions are advantageous since they are easier to develop and allow the respondents to give detailed data. Moreover, they provide insights on the respondent's feelings, hidden motivation, interests and decisions. The researcher also made use of Observation schedule (Appendix 7.4) to gather data on crops grown, nature of the environment, socio-economic activities carried out and nature of crops in the farm among others. Photography was used to record information observed. The exercise of collecting data was undertaken during the short rain season (October to December, 2017).

3.8 Pre-testing of Data Collection Instruments and Ethical Considerations

Before conducting the actual study, a pre-test of data collection instruments was conducted to forty household heads. These household heads were randomly selected and the research tools were administered to them by the Research Assistants. After pre-testing, items in the tools were adjusted accordingly. Pre-testing helped in testing the research instruments' reliability.

With regard to ethical issues, the Researcher acquired the Research permit from the National Council of Science and Technology (Appendix 7.5 and 7.6) before embarking on the study. Further the two Research Assistants were trained not only on how to administer the research tools but also were briefed on the crucial need to assure anonymity of respondents and confidentiality of information provided. The respondents were clearly informed that the research study was purely voluntary and anonymity would be maintained.

3.9 Data Analysis

Version 25 of the Statistical Package for Social Scientists (SPSS) was employed to facilitate in the analysis of the data that was collected and coded for easier entry into the statistical tool. The analysis included evaluation of descriptive statistics like frequencies, percentages, modes, and mean. Correlational analysis was also performed to evaluate the existence and nature of relationship between the study's variables. Descriptive statistics was used to facilitate meaningful description of the respondents' scores and their distributions across the study items with minimal indices. Chi Square (χ^2) was applied to test the study hypotheses by examining the statistical significance of any relationships among the concerned variables.

The regression/logit model was employed to ascertain the relationships among the variables. This model is most applied for examining and describing the relationships between variables with binary responses and predictor variables. It aims at modelling the dependent variable's mean in relation to the predictor variables. According to Sekaran (2006), the use of the model to analyse data is recommended as the study has several independent variables which are important in determining the effect (dependent variable). Kothari (2004) argue that, the model's application assumes that the variables under study are normally distributed, there exists a linear association between the variables and the variables are measured without error and are considered reliable. Thus, the model was instrumental in determining how the predictor variables including food insecurity determinants, coping and adaptive strategies and institutional interventions relates with food insecurity.

CHAPTER FOUR

4.0 RESEARCH FINDINGS AND DISCUSSION

4.1 Introduction

The chapter provides results from the analyzed data as well as their interpretations in the context of the study. The information has been provided in the form of narration with the help of tables and numerical figures for clarification. Chi-square and multiple regression were used to determine the statistical significance between the study variables.

4.2 Response Rate

The response rate for the questionnaires was 100% which implies that all the 400 respondents targeted accepted to participate in the research exercise. This response rate is attributable to the researcher and his research assistants administering the questionnaires and interviewing the respondents in the study area.

4.3 The Status of Food Insecurity in Makueni County

The study examined the status of food insecurity in Makueni County by investigating a number of aspects. Over 80 per cent of the households were found to be faced with the problem of food insecurity. The specific findings are discussed in the sections that follow.

4.3.1 Food Sufficiency for the Family

The respondents were asked whether their families had sufficient food most of the times. Figure 4.1 shows the analyzed responses;

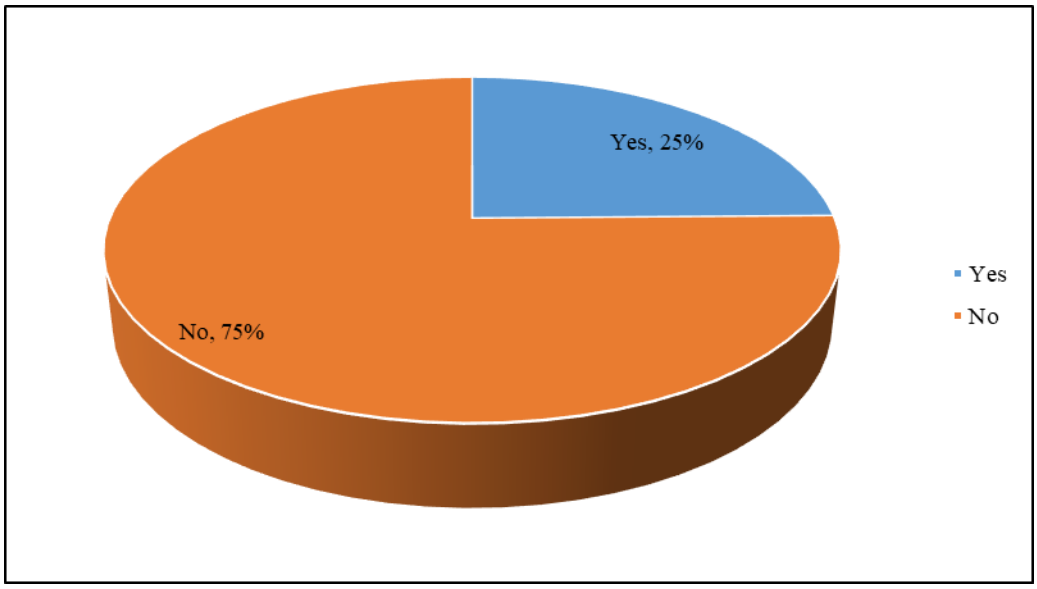

Figure 4.1: Food Sufficiency for the Family

(Source: Field Data, 2021)

Based on the Figure 4.1, 301 (75.0%) of the respondents indicated that there was no sufficient food for their families in most times. On the other hand, 99 (25.0%) indicated that their families enjoyed food sufficiency in most times. They pointed out that they bought the food they used in their households when there are deficits. The results suggest that over 75 % of the respondents were prone to suffer from food insecurity most of the times. In line with this, a study conducted by Mwangangi, Mutie and Mango (2012) indicated that only two percent of the households in Makueni County were food secure throughout the year and that only one percent had enough food to last their families for at least ten months.

4.3.2 Food Crops Type Consumed in Households

The study revealed the kind of food crops that were consumed in various households. The findings are shown in Table 4.1

Table 4.1: Food Crops Type Consumed in Households

Food crop type consumed	Frequency	Percentage
Cereals		
Maize	322	81.0
Beans	356	89.0
Peas	288	72.0
Green grams	59	15.0
Rice	4	1.0
Vegetables		
Pumpkins	4	1.0
Sukuma wiki	4	1.0
Cabbages	77	19.0
Grains		
Millet	57	14.0
Wheat	3	1.0
Tubers		
Arrow roots	3	1.0
Cassava	321	80.0
Sweet potatoes	3	1.0
Fruits		
Mangoes	332	83.0

(Source: Field Data, 2021)

The study established that approximately 90 % of the respondents consumed cereals such as beans, 356(89%); maize, 322 (81%); peas, 288(72%); and green grams. The main tuber that was consumed is cassava which constituted 59(15%) and vegetables such as cabbage, 321(80%) and grains such as millet 77(19%). 57(14%). The main fruits that were consumed were mangoes and these comprised of 332(83%). Pumpkins, rice, Sukuma wiki, wheat, sweet potatoes and arrow roots were consumed less often by the various households. The findings therefore reveal that beans, maize, mangoes, peas, cassava, cabbage and millet were the major food crops consumed by the households in Makueni County. The staple food crop in Makueni County is maize. Apart from beans and cassava as revealed in the current study, Mwangangi, Mutie and Mango (2012) also found out that pigeon peas, maize, and cowpeas were the majorly consumed crops in the region.

These crops are available locally as corroborated by results from an observation schedule that was used to gather data at the time of visit of the households. The type of food crops that were present in the farms based on the observation schedule (conducted during the short rain season) are shown in table 4.2.

Table 4.2: Type of Food Crops

Food crop	**Frequency**	**Percentage**
Cereals		
Maize	320	80.0
Beans	340	85.0
Cow Peas	339	85.0
Pigeon peas	348	87.0
Vegetables		
Pumpkins	69	17.0
Tubers		
Cassava	186	47.0

(Source: Field Data, 2021)

It was observed that most of the respondents grew cereals such as pigeon peas 348(87%), beans 340(85%), cow peas 339(85%) and maize 320(80%). The main tuber that is grown is cassava which comprised of 186(47%) respondents fewer households grew pumpkins 69(17%). The findings based on the observation schedule therefore indicate that pigeon peas, beans, cowpeas, maize and cassava were the major food crops grown in the region.

4.3.3 Types of Food Eaten During Dry Season

With regard to the types of foods that were consumed by the respondents during the dry season the outcomes are shown in Table 4.3

Table 4.3: Types of Food Eaten During Dry Season

Food crop type consumed during dry season	Frequency	Percentage
Cereals		
Maize	188	47.0
Beans	159	40.0
Peas	230	58.0
Green grams	57	14.0
Rice	66	17.0
Vegetables		
Pumpkins	122	31.0
Sukuma wiki	3	1.0
Cabbages	190	48.0
Tubers		
Cassava	288	72.0
Sweet potatoes	29	7.0

(Source: Field Data, 2021)

Based on the above the study established that over 70 % of the respondents indicated that they consumed tubers such as cassava, 288(72%) and sweet potatoes, 29(7%). The cereals consumed that were consumed during the dry season were: peas, 230(58%); maize, 188 (47%); beans, 159(40%) and rice, 66(17%). The main vegetables consumed were cabbages 190(48%) and pumpkins, 122(31%). However, the consumption was low as indicated by the number of respondents for green grams, 57(14%); and Sukuma wiki, 3(1%). The findings therefore reveal that cassava, beans, maize, peas, pumpkins and rice were the major foods consumed during the dry season with low consumption of sweet potatoes and Sukuma wiki by the households in Makueni County. The findings reveal that cassava and pumpkins are drought resistant crops and therefore more available for consumption during the dry season. Indeed, scholars such as Thiongo and Ngaira (2016) in their study on strategies used by farmers to cope with drought in Machakos revealed that growing of drought resistant crops such as cassava was a coping strategy used to address food insecurity.

4.3.4 Types of Food Eaten During Rainy Season

On the types of foods that were consumed by the respondents during the rainy season the results are shown in Table 4.

Table 4.4: Types of Food Eaten During Rainy Season

Food crop type consumed during rainy season	Frequency	Percentage
Cereals		
Maize	323	81.0
Beans	311	78.0
Peas	320	80.0
Green grams	13	3.0
Vegetables		
Pumpkins	16	4.0
Sukuma wiki and vegetables	102	26.0
Tubers		
Cassava	30	8.0
Sweet potatoes	12	3.0
Arrow roots	42	11.0
Fruits		
Mangoes	10	3.0

(Source: Field Data, 2021)

The study established that over 80% of the respondents consumed cereals such as maize, 323 (81%); peas, 320(80%) and beans, 311(78%) during the rainy season. However, the consumption was low as indicated by the number of respondents for food crops such as arrow roots, 42(11%); cassava, 30(8%); pumpkin, 16(4%); green grams, 13(3%); sweet potatoes, 12(3%) and mangoes, 10(3%). The findings therefore reveal that beans, maize and peas were the major foods consumed during the rainy season with low consumption of arrow roots, cassava, pumpkins, green grams, sweet potatoes and mangoes by the households in Makueni County. These findings imply that there is usually a shift of types of food consumed during the dry season and wet season. During the wet season, the staple crops such as maize and beans are consumed by over 80 per cent of the respondents compared to cassava and other indigenous

crops such as pumpkins during the dry season. These changes in food consumption are therefore an indicator of lack of consistent food production patterns and changes in diet as a coping strategy.

The above findings show that the staple crop, mainly maize as well as beans and peas are largely consumed during the rainy season. However, draught resistant crops such as cassava and pumpkins have low level of consumption during the rainy season. This is because the staple crops are more readily available during the rainy season than during the dry season. These results are partly confirmed by Huho and Mugalavai (2010) in their study on the effects of drought on food security in Kenya. Their study revealed that drought affects different crop species in a different manner hence the farmers tend to intercrop different types of crops with the hope of harvesting one of the crops which may be less affected by drought.

4.3.5 Change in Types of Food Consumed in the Last 10 Years

The study also made an investigation as to whether there had been changes in the types of foods consumed by the respondents during the last 10 years. The findings are shown in Figure 4.2

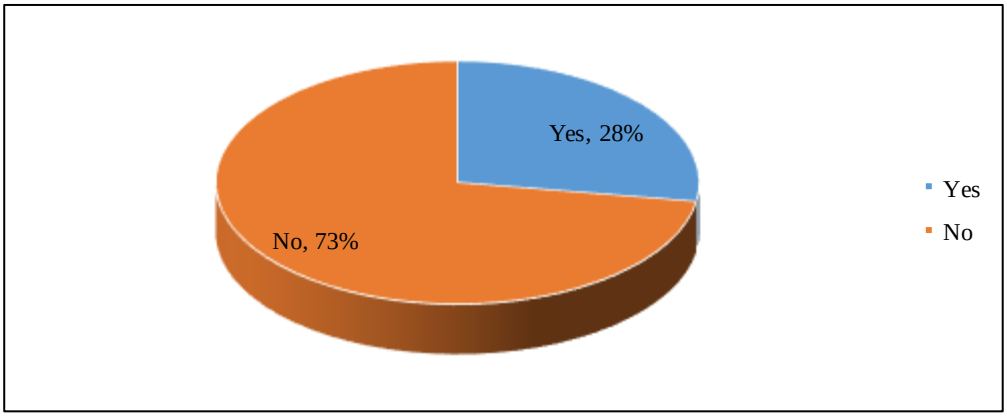

Figure 4.2: Change in Types of Food Consumed in the Last 10 Years (Source: Field Data, 2021)

Based on the study findings, 290 (73.0%) of the respondents indicated that their food consumption habit had not changed over the last 10 years. The respondents explained that their food consumption habits had not changed because maize and beans were the common foods and that most of the foods used were the stable food in the area. However, 110(27%) of the respondents indicated that their food consumption patterns had changed over the last 10 years. They attributed this to the challenges experienced during food production such as climatic changes making them adjust the food crops produced. Employment opportunities had made it possible to acquire different varieties of foods and there was inadequate supply of food during dry seasons necessitating for other food options. The baseline household survey conducted by Mwangangi, Mutie and Mango (2012) also revealed that households made changes to their crops and livestock mainly due to climate change and market-oriented reasons.

The results from this section imply that weather patterns partly influence food insecurity in Makueni county since data from the households confirmed that the number of meals eaten per day; types of food eaten; change of types of food consumed in the last ten years and frequency of missing meals, all varied with the season.

4.3.6 Statements on Food Insecurity

The researcher requested respondents to express the level of their agreement with two statements about food insecurity within their households in terms of Strongly Disagree (DS), Disagree (D), Don't Know (DK), Agree (A), and Strongly Agree (SA). Table 4.5 shows analysis of their responses;

Table 4.5: Statements on Food Insecurity

Statement	SA	A	DK	D	SD	N	Mean	Std. Dev
I do not get enough harvest to cater for my family food requirement most of the time	291	48	12	49	0	400	4.45	1.022
I cannot afford food for my family most of the time	60	231	0	49	60	400	3.46	1.303

(Source: Field Data, 2021)

The analysis shows that a good number of the sampled respondents expressed strong agreement that their harvest was not adequate to meet their family food requirements most of the time was a sign of food insecurity with 4.45 mean score. Also, most of them agreed that they were unable to afford sufficient food for their family most of the time was an indication of food insecurity with a mean score of 3.46.

From the observation schedule, it was also clear that the region's crops do not do well as the conditions of the crops at the time of the data collection was not good. The findings from the observation schedule are indicated in table 4.6

Table 4.6: Crop Condition

Crop Conditions	Frequency	Percentage
Withering with some dried up	266	67%
Almost drying up	111	28%
Moderate yields	30	8%
Not withering	9	2%

(Source: Field Data, 2021)

Based on the observations made, majority of the crops, 266(67%) had withered with some already dried up, 111(28%) of the crops were almost drying up, 30(8%) had

moderate yields and 9(2%) had not withered. The findings therefore indicate a poor crop condition which has an overall effect on the food security in the region. According to GOK (2019), Huho and Mugalavai (2019), inadequate and unreliable rainfall is the main cause of drought and crop failure in the ASALs such as Makueni county. Figure 4.3 indicate the condition of some food crops as observed during data collection in Makueni County.

Figure 4.3: One of the Research Assistants in a farm with drying maize crops in Makueni Sub County during the period of data collection – *20th November, 2017*

(Source: Field Data, 2021)

From the foregoing, the results clearly confirm that households in Makueni County encounter perpetual food insecurity and thus the need to explore the socio-economic determinants of the recurrent food problem and possible solutions. Amwata, Nyariki and Musimba (2016) in their comparative study of Kajiando and Makueni Counties confirm that Makueni county households are vulnerable to food insecurity. They argue that this vulnerability is due to households' land size, rainfall, household size and herd size. The following section highlights findings on the socioeconomic determinants of food insecurity in the region.

4.4 Socio-Economic Determinants to Food Insecurity

In the first objective the study sought to determine how socio-economic factors impact household food insecurity in Makueni County. Analysis within the first objective involved examination of various socio-economic facets which were found to influence food insecurity within the County as shown in the following subsections;

4.4.1 Respondents' Age

The findings on the age bracket of the respondents is as indicated in Table 4.7

Table 4.7: Respondents' Age

Age Bracket	Frequency	Percent
21-30	36	9.0%
31-40	124	31.0
41-50	108	27.0%
51-60	44	11.0
61-70	51	13.0
71-80	31	8.0
81-90	6	1.0
Total	**400**	**100%**

(Source: Field Data, 2021)

The findings in Table 4.7 show that 124 (31.0%) of the respondents were within the age bracket of 31-40 years, 108 (27.0%) were aged between 41-50 years. The respondents who were in the age brackets 61-70, 51-60, 21-30 and 71-80 years were 51, 44, 36 and 31 in number representing 13%, 11%, 9% and 8% respectively. Only 6 respondents were in the age bracket of 81-90 years representing 1%. The findings show that majority (78%) of the respondents were aged between 21 and 60 years. This age category is important for agricultural activities as it is not only energetic but also capable of being trained on food production technology that can boost food production in the households. According to Babatunde *et al.* (2008), vulnerability to

food insecurity increases not only with size of the household but also based on the household head's age. Obayelu (2018) in his study on food insecurity in urban slums in Ibadan Metropolis in South west Nigeria reported that about 40% of the household heads were aged between 31 and 40 years. The implication is that over 75% of them were in their economically active years. In addition, Oduniyi and Tekana (2020) pointed out that an increase in household head's leads reduces the chances of food security in Ngaka Modiri Molema district of South Africa. Owour and Shem (2009) argued in the same line pointing out that older farmers in Kenya are not able to use up to date farm management methods. This means that they are less adaptive to modern technologies and therefore this negatively affects efficiency in agricultural production. The issue of age is also pointed out by Thiongo and Ngaira (2016) who observed that the elderly people tend to embrace drought resistant traditional crops such as cassava and yams than the young.

4.4.2 Respondents' Gender

The study analyzed the distribution of the sampled respondents by their genders. Figure 4.4 presents results of the analysis;

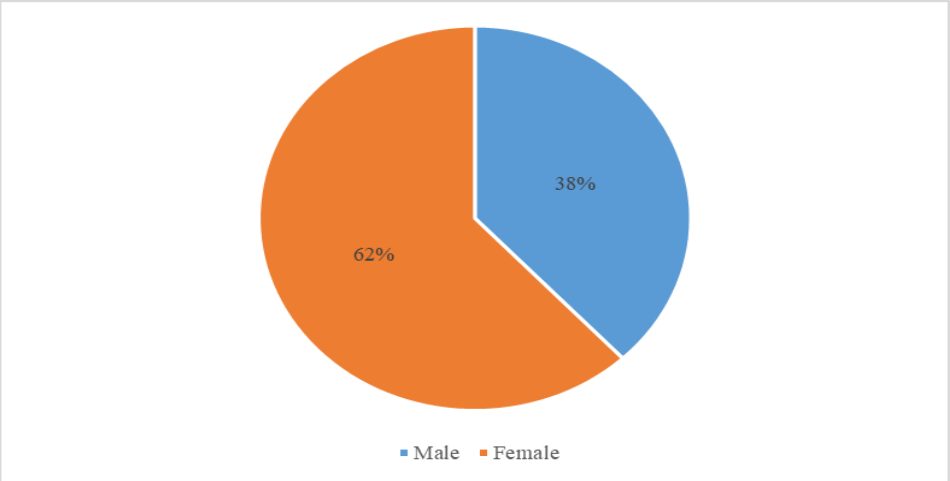

Figure 4.4: Respondents' Gender

(Source: Field Data, 2021)

Based on the study findings, 248 (62.0%) of the respondents were females while 152 (38.0%) were males. The results suggest that more female respondents took part in the study insinuating that women, who were the majority (62%), participate in activities in regard to solving the household food insecurity situation within Makueni County. The implication is that food security programs targeting women who are the majority can have a positive impact towards food sufficiency. Gender is also an important factor influencing food security in the area since it affects accessibility to resources like credit and land. In many households, land is owned by men and therefore are likely to influence crops grown at the household level. Owour and Shem (2009) revealed that households headed by females in Kenya were inefficient in terms of agricultural technological application in agriculture. The reason behind this was that most women in African culture do not own property making them unable to offer asset securities to access the market for inputs. On the other hand, Oduniyi and Tekana (2020) points out that in Ngaka Modiri Molema district of South Africa, female headed households tended to be more food secure compared to male headed households.

4.4.3 Respondents' Marital Status

The respondents were requested to indicate their marital status. Figure 4.5 shows their responses analyzed as;

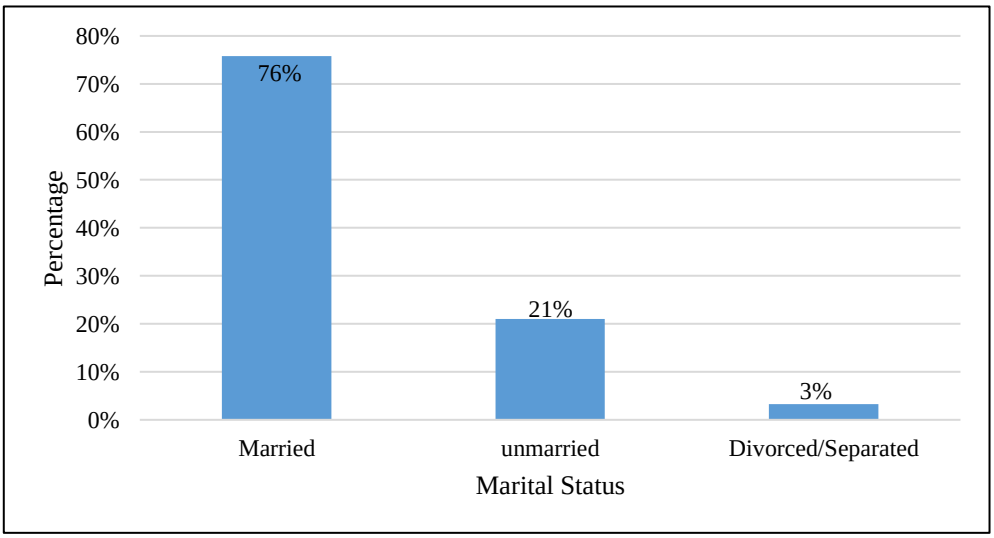

Figure 4.5: Respondents' Marital Status

(Source: Field Data, 2021)

From the study findings, 303 (76.0%) of the respondents were married while 84 (21.0%) were unmarried. The findings also revealed that 13(3.0%) of the respondents were either divorced or separated. The results suggest that 76 per cent of the respondents were in married family units. A stable family unit is indeed a core factor in boosting food production. Families will play a crucial role in ensuring that food insecurity interventions are effectively implemented within every household the County. According to Rose, (1999), higher rates of food insecurity were linked to both larger households and households composed of single adults with children. Rose, (1999) observes that single parent families may have extra expenditures connected with child care. A married stable family is therefore more likely to be food secure because of the support provided by both partners as opposed to single parent families.

4.4.4 Respondents' Highest Education Level

Figure 4.6 shows the distribution of the sampled respondents according to their highest education level;

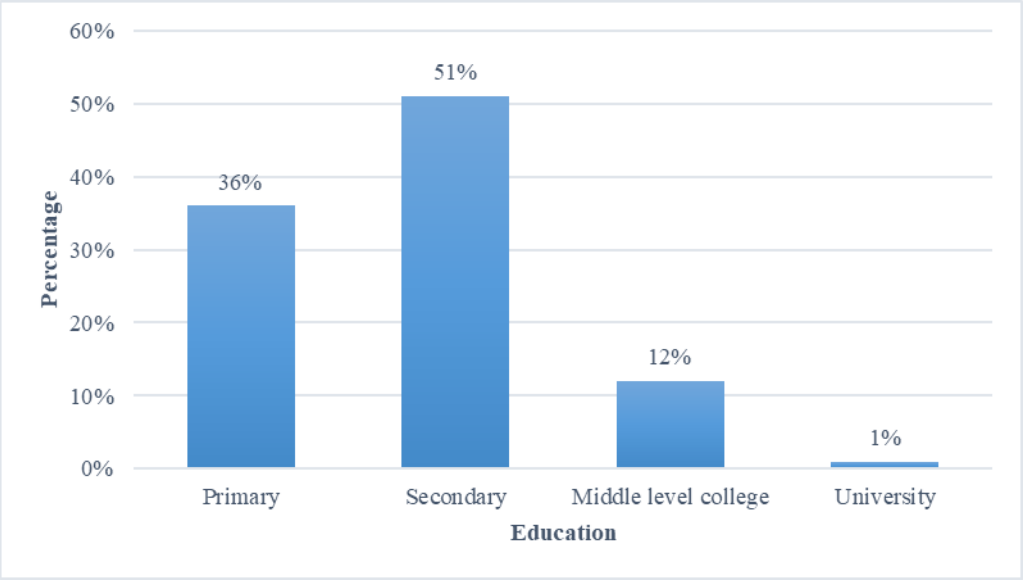

Figure 4.6: Respondents' Highest Education Level

(Source: Field Data, 2021)

Based on the study findings, 204(51.0%) of the respondents had a secondary school education level, 144(36.0%) had a primary school education level, 48(12.0%) were graduates from a middle level college while only 4(1.0%) university graduates. The results suggest that 87% of the respondents had attained basic literacy levels (Primary and secondary schooling) and therefore they can easily be able to acquire skills and training on effective interventions to curb household food insecurity within Makueni County. Although, about 90% of the respondents had attained basic education level, they lacked specific training that could help to boost food production for their households. According to Owour and Shem (2009) formal schooling does not increase efficiency in agricultural production. This is probably because in the developing countries, technical skills in agricultural production are influenced more by hands on training rather than formal schooling. They argue that agricultural training is more important in enhancing food security than formal schooling which is basically general. However, Obayelu and Oyekola (2018) observed that households with low

levels of education had greater chances of being food insecure compared to their peers with higher level of education. The issue of effect of education on food security is also contributed by Thiongo and Ngaira (2016) who observed that higher level of education made farmers to adopt irrigation technology as a way of boosting food production. Despite difference in opinion on the issues of influence of education to farmers, it is crucial to observe that both formal schooling and training of specific skills in good agricultural practices should be embraced since they reinforce each other.

4.4.5 Respondents' Number of Regular Dependents and their Age

With regard to the respondents' number of regular dependents in their respective households. The findings are shown in Figure 4.7

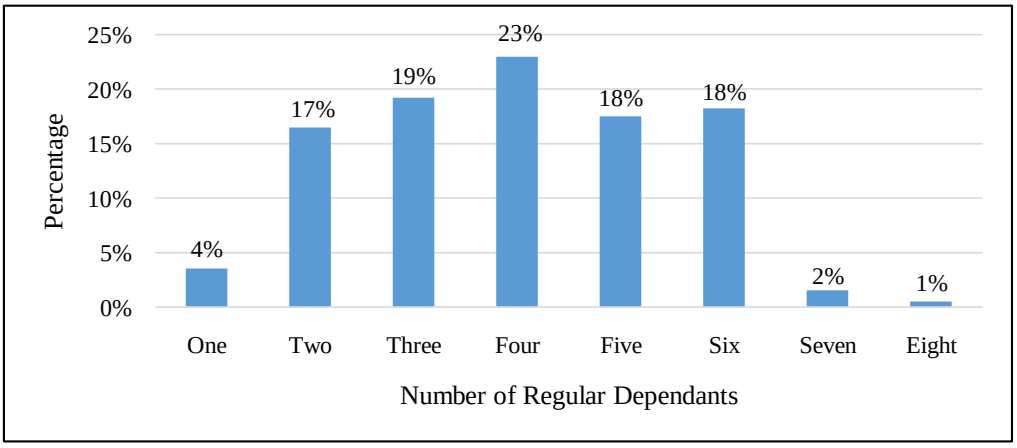

Figure 4.7: Respondents' Number of Regular Dependents (Source: Field Data, 2021)

Figure 4.7 indicates that 92 (23.0%) of the respondents had 4 dependents, 77(19%) had 3 dependents, 73(18%) and 70(18%) with 5 and 6 dependents respectively. Additionally, 66(17%) of the respondents had 2 dependents, 14(4%) had 1 dependent, 6(2%) with 7 dependents and 2(1%) with 8 dependents. The results imply that 78% of the respondents had 3-6 regular dependents in their household units. The number of

regular dependents has a bearing on the extent of food insecurity within a household. Hence, it affects the efficacy of the food insecurity interventions at the household level. The implication of these results is that as the family size increases the higher the chances of the household becoming food insecure. This is indeed confirmed by the respondents when they agreed that they were unable to produce sufficient food to meet the needs their large families as indicated in table 4.11. Rose, (1999) in her study on the economic influences and dietary consequences of food insufficiency in the United States confirmed that larger households involve superior expenses to meet consumption requirements and therefore are more food insecure. However, Dharmaraju, *et al.* (2018) in a study on household food security in an urban slum found out that there was no statistical significance association between family size, family type and food insecurity.

Sidhu *et al.* (2008) asserts that family size is a crucial determinant to food security. According to the study, an additional family member increases the family's exposure to food insecurity by 96%. In a similar study in Nigeria, Amaza *et al.* (2006) affirmed that every additional family member reduces the household's food security by 1.5%. Bashir *et al.* (2010) also concluded that households having 4 to 9 members were 97% food insecure. Given that every household member consumes a significant portion of the family basket, family size is a key determinant to food security. In the same line, Oduniyi and Tekana (2020) reports that an increase in family size, by one member, reduces the likelihood of the household being food secure. Owour and Shem (2009) observes further that as the households become larger, the dependency level increases and this affects acquisition of inputs that can boost agricultural production.

As pertains the age of the regular dependents in the respondents' respective households, the findings are shown in Figure 4.8

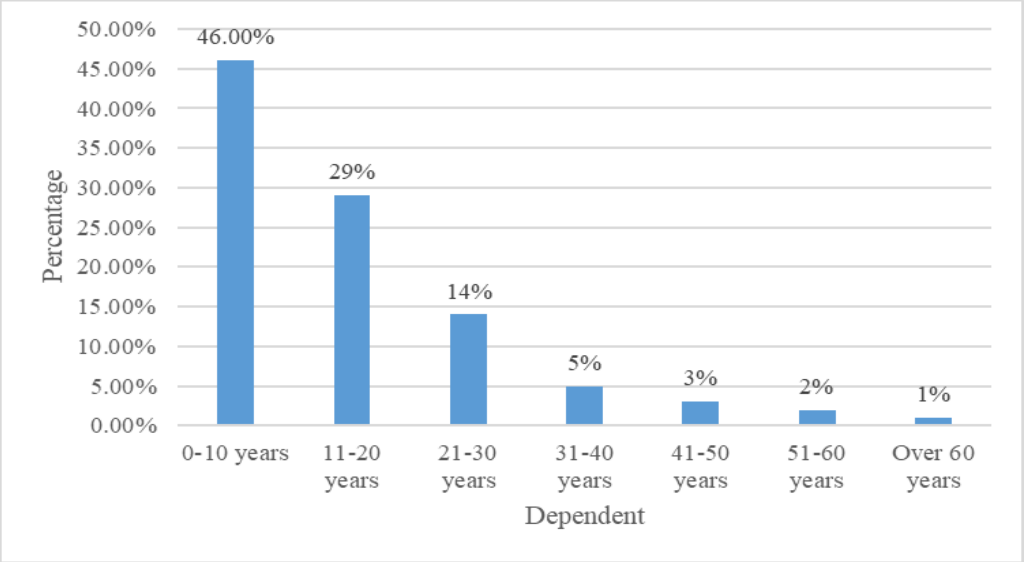

Figure 4.8: Age of Regular Dependents

(Source: Field Data, 2021)

From the study findings, 184 (46%) of the dependents were in the age bracket 0-10 years, 116(29%) were in the age bracket 11-20 years, 56(14%), age bracket 21-30 years, and 20(5%) age bracket 31-40 years. The findings also revealed that 12(3%) of the dependents were in the age bracket 41-50 years, 8(2%) were in age bracket 51-60 years while 4(1%) were over 60 years of age. The analysis shows that 75% of the households had dependents in the age bracket of zero to 20 years. This high number of dependents tend to increase food requirements of the family hence making the households more food insecure. These dependents rely on the respondents for their daily provisions which can be a challenge in ensuring there is food security. These results are consistent with Gebre (2012) who found out that increase in family size worsened food insecurity situation among households in Ethiopia's city of Addis

Ababa. He recommended that there is need to reduce household size in order reduce their dependency ratio. On their part, Tantu, Gamebo, Sheno and Kabalo (2017) revealed that households with more than two dependents were more likely to be food insecure compared to those with less than two dependents. It is however important to note that children can also contribute to food security through provision of unpaid family labour when they are out of school.

4.4.6 Household Head's Occupation

On the aspect of the household head's occupation, the respondents were asked to indicate the type of occupation they were engaged in. The findings are shown in Figure 4.9

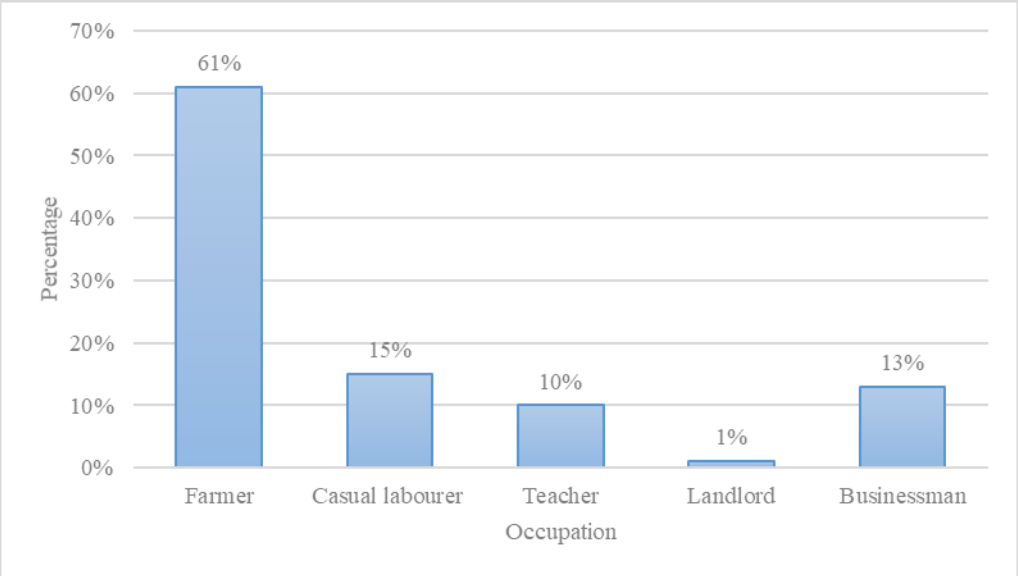

Figure 4.9: Household Head's Occupation

(Source: Field Data, 2021)

Based on the study findings, 244 (61%) of the household heads were farmers, 60(15%) were casual laborers, 40(14%) were teachers, 52(13%) were businessmen, and 4(1%) were landlords.

Findings on further enquiry on economic activity that they engaged are as shown in figure 4.10

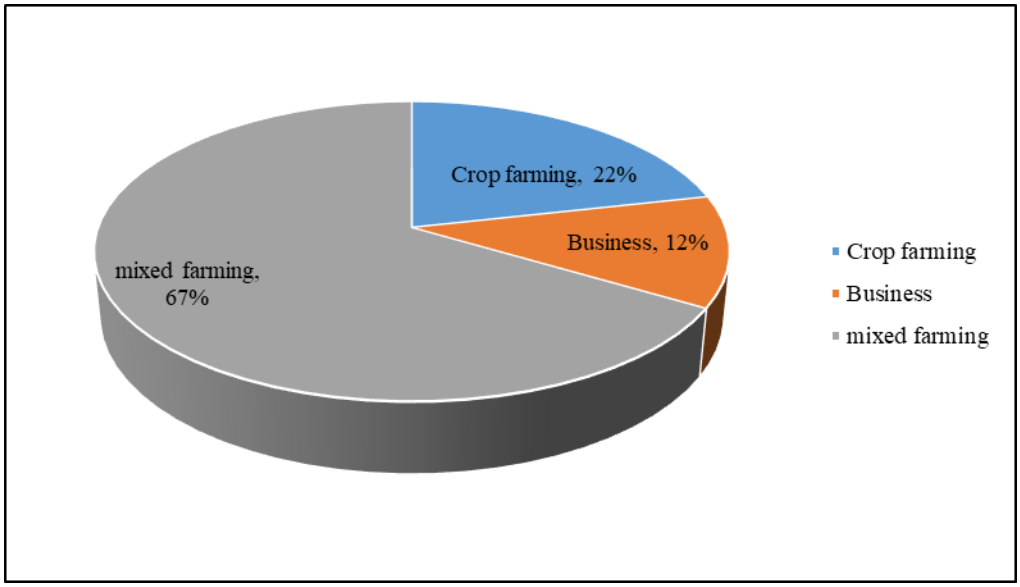

Figure 4.10: Respondents' Livelihood Activities

(Source: Field Data, 2021)

Based on the study findings, 266 (67.0%) of the respondents were engaged in mixed farming, 86(22.0%) engaged in crop farming while 48 (12.0%) were engaged in business activities. The results suggest that over 85% of the respondents that took part in the study were in farming activities. Despite this, over 80% of the households faced food insecurity challenge and this implies that farming was not a highly dependable source of income for their livelihood.

Observation schedules also revealed that the households also engaged in other economic activities apart from farming. The findings are indicated in figure 4.11.

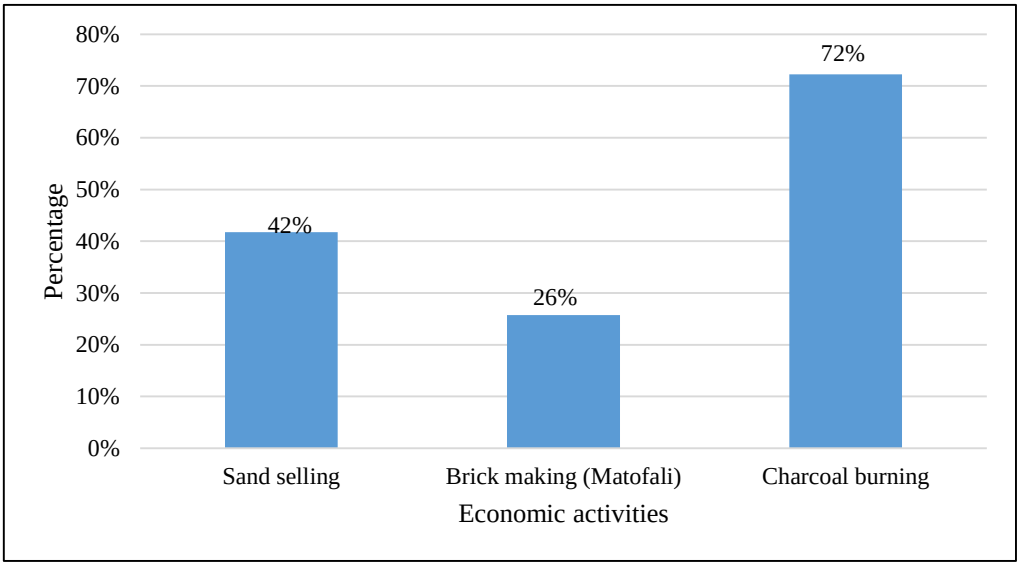

Figure 4.11: Other Economic Activities engaged in apart from Farming (Source: Field Data, 2021)

According to the observations made, there were other economic activities that the residents engaged in such as charcoal burning (72%), sale of sand (42%) and brick making (26%). The findings imply that the residents were able to earn income from the other activities and therefore not reliant only on farming. In cases where the yields were low due to poor weather conditions, they can buy food from other regions. However, these economic activities do not provide them with reliable sources of income and therefore do not adequately enhance household food security situation at the household level. Figure 4.12 shows sand harvesting activity in Makueni County.

Figure 4.12: Sand harvesting in Makueni Sub County– *20th November, 2020* (Source: Field Data, 2021)

The results shown in figure 4.9 suggest that over 60 % of the household heads were involved in farming activities with another big number being casual laborers in the farms which will directly have an effect on the efficacy of interventions in solving household food insecurity within Makueni County. The findings imply that over 60 % of the heads of the households do not have reliable sources of livelihood such as formal employment and therefore largely depend on farming which often fails and hence makes them food insecure. Reliable sources of income for livelihood such as formal employment can significantly boost household food security. To corroborate this argument, a study conducted by Ajani, Adebukola and Oyindamola (2006) revealed that households of secondary school teachers were more food secure than those of primary school teachers. The reason for this is that secondary school teachers earned better salaries than their primary school counterparts. The households head occupation is related to amount of income and this influences food security. Tantu, Gamebo, Sheno and Kabalo (2017) in their study in Wolaita Sodo town revealed that daily laborer household head tended to be more food insecure. They found out that daily labourers were 16 times more likely to be food insecure than those who are self-employed. Households with higher monthly income tended to be more food secure than those with low income earnings. In addition, Mitiku, Fufa and Tedese (2012) found out that the availability of off-farm income was positively associated with food security. Indeed, they found out that the likelihood of the household to be food secure increases by the factor of 1.0035 as the household earned more off-farm proceeds.

4.4.7 Respondents' Income Level

The respondents were also required to indicate their income levels per month and their responses are as summarized in Figure 4.13.

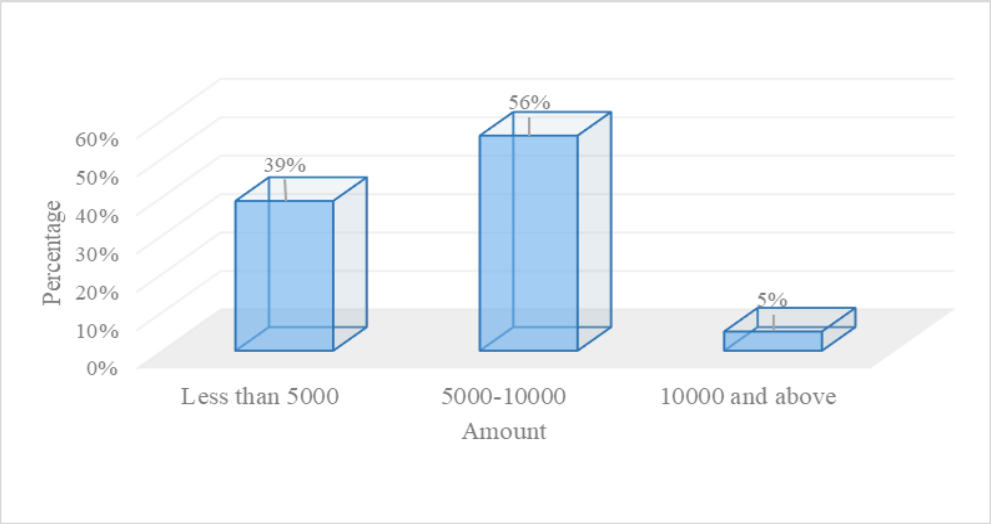

Figure 4.13: Respondents' Income Level

(Source: Field Data, 2021)

Figure 4.13 indicates that 224 (56%) of the respondents had an income level of between KSh. 5,000-10,000 every month, 156(39%) earned KSh less than 5,000 every month and 20(5%) earned KSh 10,000 and above every month. The results imply that majority (95%) of the respondents' income was KSh 10,000 and below every month. According to the GOK (2020), the estimated real average wage earnings per employee in the private agriculture, forestry and fishing sector was KSh. 15,066.5 per month in 2019. In the public sector, the estimated real average wage earnings per employee in the agriculture, forestry and fishing sector in 2019 was KSh. 19,482.7 per month (GOK, 2020). This therefore implies that the average income of less than KSh. 10,000 among the households in Makueni County is far much below the average wage earning in the private and public sectors in Kenya. The low income exhibited by the households in Makueni County seriously impacts their purchasing power of the basic needs especially food stuff and affects the food security situation in Makueni County. According to Rose, (1999), those in poverty were more than 3.5 times likely to be food insufficient compared with those whose incomes are above the poverty thresholds. Tantu, Gamebo, Sheno and Kabalo (2017) also revealed that households

with higher monthly income levels were more food secure than those with smaller income levels.

4.4.8 Respondents' Household Food Expenditure in KSh/Month

When asked how much they spent on food items per month, their responses are shown in Figure 4.14

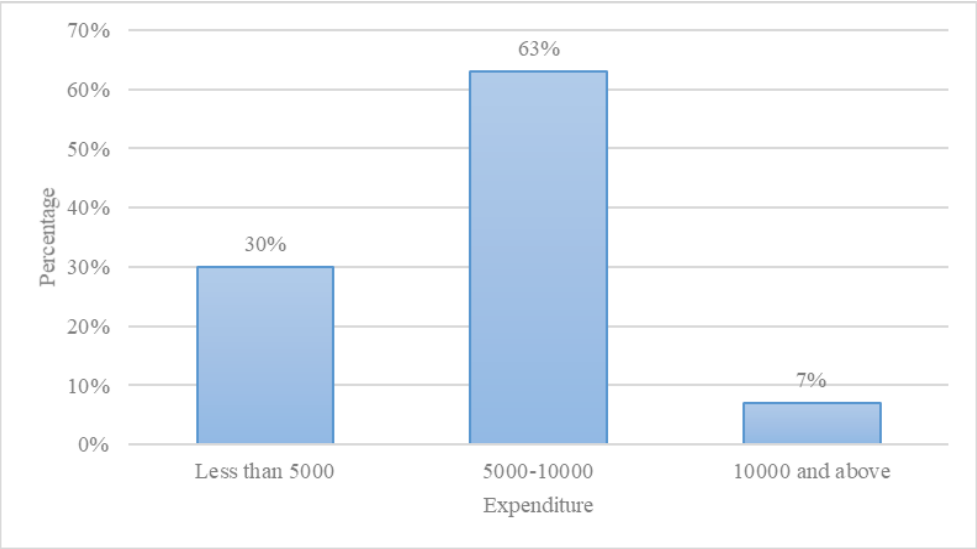

Figure 4.14: Respondents' Household Food Expenditure in KSh/Month (Source: Field Data, 2021)

Analysis in Figure 4.14 shows that 252 (63%) of the respondents spent between KSh 5,000-10,000 on food items every month, 120 (30%) spent less than KSh 5,000 every month on food items and 28 (7%) spent more than KSh 10,000 every month on food items. The results suggest that much of the household income was spent on food items which insinuates that food production was not in sufficient quantities so they had to use a large part of their incomes in purchasing food and this bolstered their food insecurity situation.

4.4.9 Respondents' Land Size and Proportion Utilized for Food and Cash crops

The size of the household's land and the cultivated proportion of the land were explored as way of determining how they affect food insecurity among the households. The researcher requested respondents to estimate the acreage of their farms. Majority of them 123 (31%) had land equaling an acre while 5(1%) had 5 acres, 8(2%) owned 7, 12(3%) had 0.5 acres, 13(3%) had land spanning 10 acres, 18(5%) had 6 acres, 26(7%) had 4 acres, 33(8%) had 3 acres, 36(9%) had 2 acres, 57(14%) had 2.5 acres, and 69(17%) had1.5 acres. It is apparent that the land sizes for the sampled households ranged from 1 to 10 acres. However, only those with at least 1.5 acres had higher chances of engaging in agricultural activities with greater potential to yield adequate food for household consumption and for small-scale sales. However, agricultural produce among households whose farm were less than 1.5 acres (about 48%) was significantly limited and could not satisfy their domestic need for food. Indeed, according to GOK (2018), the average farm size in Makueni county is 2.97 acres which is below an average farm size of 6.2 acres for the country. 30% of the households have land title deeds and this hinders investment in agriculture. GOK (2018) also notes further that the county lacks a land use policy and due to population growth, land has been fragmented to uneconomical sizes and this affects food production in the region.

The study also established that the households were cultivating some portions of their land for food crops. Different sizes were set aside by various households while other households had not reserved any portion of their land for cultivating food crops. For instance, 33(8%) of the respondents had no designated portion of the land for cultivation of food crops. However, 2(1%) had 4 acres, 8(2%) had 1 acre, 14(4%) had

3 acres, 17(4%) had 3.5 acres, 26(7%) had 0.25 acres, 38(10%) had 1.5 acres, 47(12%) had 0.5 acres, 51(13%) had 0.75 acres, 58(15%) had 0.125 acres, and majority of the respondents, 65 (16%), had 0.4 acres set aside for cultivating food crops. As such, relatively a small portion of the households' land was preserved for food crops cultivation. Majority of the respondents had merely preserved between 0 to 0.75 acres for cultivating food crops partly due to the fact that they rely on rain fed agriculture which is not reliable. This trend seems to be one of the factors contributing to food insecurity in the County.

The study also found that the households had preserved portions of their farm for cultivating cash crops. For instance, majority of them, 122 (31%), preserved 0.2 acres for producing cash crops while the respondents, 7(2%), with largest piece of land for cash crop had 10 acres preserve for the same. Additionally, 6(4%) preserved 6 acres, 16(4%) preserved 4 acres, 22(6%) preserved 0.5 acres, 39(10%) preserved 1 acre, 43(11%) preserved 1.5 acres, 68(17%) preserved 5 acres, and 77(19%) preserved 0.25 acres for cultivating cash crops. The implications of the above is that minimal land is being used for cultivating cash crops. Therefore, there is little income for the households from farming to supplement their income for buying foods that are not produced locally. The observation schedule also helped to identify some of the cash crops that are cultivated within Makueni County. Such crops included mangoes which was observed in 351(88%) of the farms and coffee as observed in 33(8%) of the farms. Therefore, coffee and mangoes are Makueni county's major cash crops. Income raised from sale of coffee and mangoes helps to cushion households during periods of food insufficiency.

Some of the studies that have been done with regard to the influence of land on food security agree with these results. For example, Mitiku, Fufa and Tedese (2012) conducted a study in Shashemene District in Ethiopia and established that size of land cultivated had a positive influence on food security. According to these scholars, the larger the land the household had, the higher the chances of the household becoming food secure and vice versa. The reason for this is that large land sizes are associated with more wealth and income, larger capital and increases the likelihood of investment in buying farm inputs that raises food production and thus enhances food security. Obayelu (2013) pointed out that there are various variables that influence household food security. Among those factors is the agricultural land holding size which is positively associated with household security status. However, Sivestri *et al.* (2015) gives a contrasting view. They found out that large farms are not necessarily more food secure compared to those with small land sizes. Despite this, large farms tend to have a higher per capita total income.

4.4.10 Respondents' Land Tenure

The study also inquired about the land tenure system among the respondents. figure 4.15 shows results of the analysis;

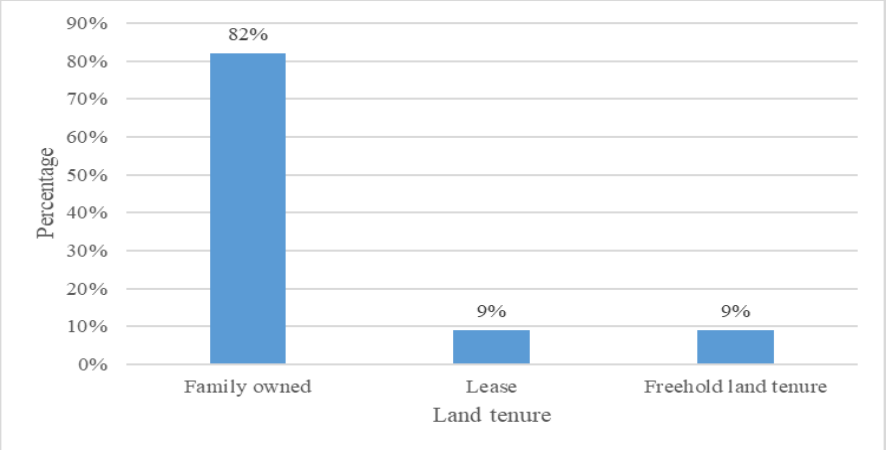

Figure 4.15: Respondents' Land Tenure
(Source: Field Data, 2021)

Figure 4.15 shows that majority of the respondents, 328(82%), were occupying family lands while 37(9%) and 35(9%) of them had their land through freehold means and leases respectively. Therefore, a higher percentage of the land in Makueni County seems to be family land whose ownership had no financial obligations for the residents. Therefore, 80 % of the respondents incurred little costs in acquiring their pieces of land. Despite land being family owned by over 80 % of the respondents, majority of them still remain food insecure. It is also important to observe that according to GOK (2018) Makueni County has only 30% of the households with land titles and this negatively affects development of land for agricultural production. In Kenya, rented land comprises of about 40% of the total operated area and this is continuing to grow as more households seek to acquire more land for cultivation (Muraoka, Jin and Jayne (2018). They further state that productivity and investment such as use of organic fertilizer is lower in rented land than in owned parcels. Therefore, lack of land ownership contributes to food insecurity in that one is not able to make full use of the land for example planting of cash crops and use of technology.

4.4.11 Main Activities Undertaken on Land

The study also sought to ascertain the main activities that were being done by the respondents on their respective pieces of land. The respondents ranked the activities in terms of their dominance such that the most dominant activity was given numeral 5 while the least dominant activity was ranked “1” as presented in Table 4.8;

Table 4.8: Main Activities Undertaken on Land

Main Activity	1		2		3		4		5	
	Freq	Perc	Freq	Perc	Freq	Perc	Freq	Perc	Freq	Perc
Cash crops	229	57.3	96	24.0	37	9.3	25	6.3	13	3.3
Food crops	49	12.3	12	3.0	48	12.0	85	21.3	206	51.5
Grazing	49	12.3	217	54.3	85	21.3	49	12.3	0	0.0
Wood lot	296	74.0	39	9.8	13	3.3	39	9.8	12	3.0

(Source: Field Data, 2021)

Table 4.8 shows that 229 (57.3%) and 296 (74%) of the respondents had cash crops and wood lot respectively as the least dominant activities in their pieces of land. However, food crops cultivation was highlighted as the most dominant activity by 206 (51.5%) of the respondents. Grazing of household livestock was the second most dominant activity among 217(54.3%) of the respondents. Therefore, farming of food crops was the main activity on the land even though the results indicate it did not provide adequate food for the households largely due to overreliance on rain fed agriculture. Engagement in diverse farm activities could provide alternative sources of income for purchase of food whenever there is crop failure.

4.4.12 Homestead Characteristics

The research study examined homestead characteristics such as the homestead environment, availability and nature of latrines, type of house walls, and floor. The findings are as outlined in figures that follow.

The study examined the nature of the homestead environment. The findings are shown in Figure 4.16

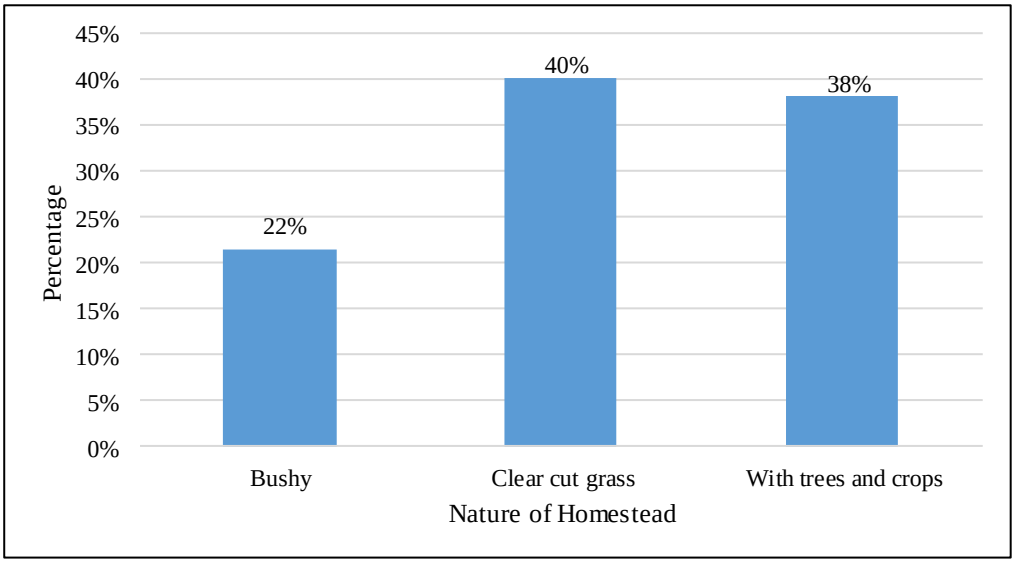

Figure 4.16: Nature of Homestead Environment

(Source: Field Data, 2021)

Based on the observations made, majority of the homes, 161(40%) had clear cut grass, 153(38%) had trees and crops in the homestead and 86(22%) had bushy environments. The findings indicate that majority of the households had not fully utilized their land for food production purposes which may enhance the food insecurity situation in the region. Scholars such as Botha, *et.al*. (2012) observe that land can be effectively utilized to enhance food security through in-field rain water harvesting.

The findings as to whether there were pit latrines in the homes visited are indicated in Figure 4.17

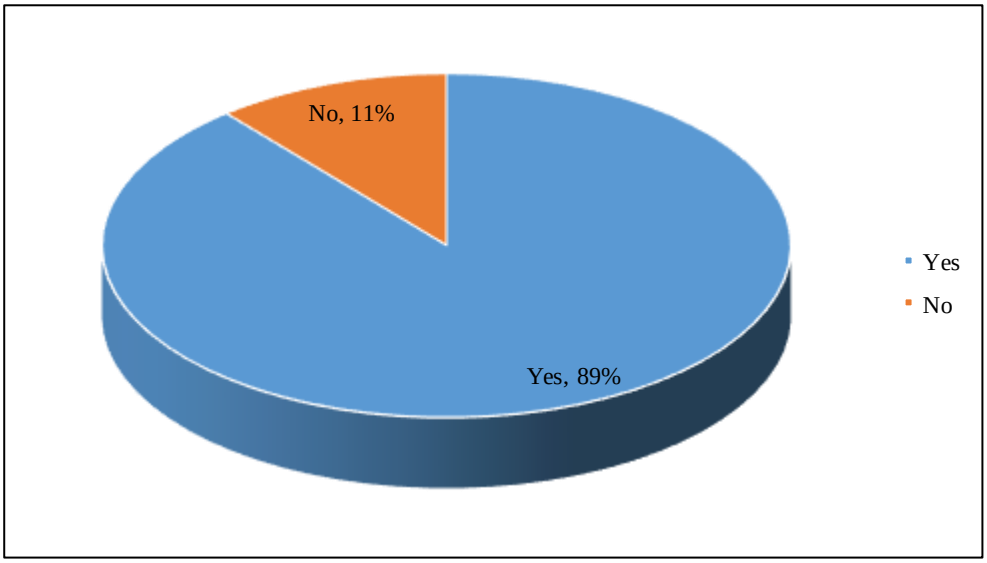

Figure 4.17: Availability of Pit Latrines

(Source: Field Data, 2021)

From the observations, majority of the homes, 354(89%) had pit latrines while 46(11%) did not have pit latrines. The homes that did not have pit latrines made use of their relatives' latrines, nearby school toilets, and use of neighbor's latrines when the children were still young. The findings therefore indicate that nearly 90 % of the households had pit latrines and those which did not had alternative means. These results are almost similar to Kimani, Gitau and Ndunge (2015) whose findings were that 95% of the respondents reported to have had toilet facilities in their homesteads while the balance of 5% used their neighbor's toilets.

On the nature of the pit latrines that were available in the homes that were visited. Table 4.9 shows the findings;

Table 4.9: Nature of Pit Latrines

Nature of Pit Latrines	Frequency	Percentage
Brick walled and iron sheets on the roof	236	59%
Mud walled and roofed with iron sheets	89	23%
Both walls and roof are made of iron sheets	29	18%
Total	**354**	**100%**

(Source: Field Data, 2021)

Observations in table 4.9 shows that majority of the homes, 236(59%) had latrines that were brick walled with iron sheets on the roof, 89(23%) had latrines that were mud walled and roofed with iron sheets and 29(18%) had pit latrines with both their walls and roofs made of iron sheets. The findings therefore indicate that over 80% of the pit latrines were semi-permanent. Some studies such as Rukundo *et al.* (2019) link food insecurity to aspects such as availability of toilets at the household level. In their cross-sectional study of two districts in Uganda that largely focused on housing, water and sanitation implications on food insecurity, they established among others that not having a toilet increased the likelihood of being food insecure. Obayelu and Oyekola (2018) in a study on food insecurity within urban slums of Nigeria established that the incidence of food insecurity was higher among households with poor water and sanitation facilities. The current studies agree with scholars such as Nyako (2013) that good toilet facilities and safe water are crucial in ensuring food security of the households through reduced health bills which could increase the cost of food available in the family.

As pertains the type of walls of the respondents' houses, the findings are shown in figure 4.18

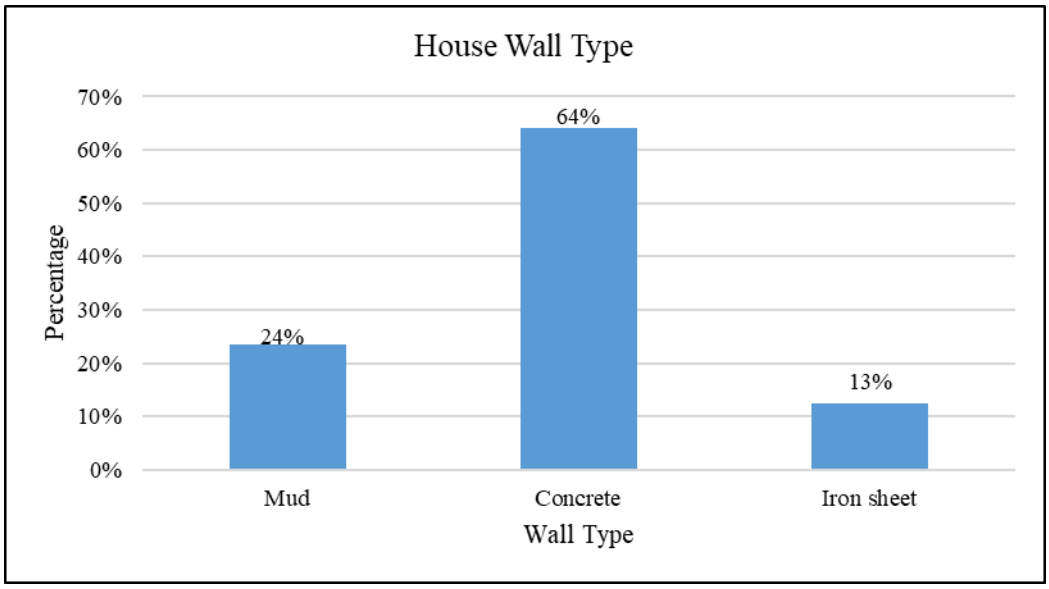

Figure 4.18: Type of House Wall

(Source: Field Data, 2021)

Observations revealed that majority of the houses, 256(64%) had concrete walls, followed by 94(24%) which were mud walled, 50(13%) had iron sheet walls. The findings therefore indicate that over 60 % of the houses had semi-permanent walls.

The study also made observation of the type of floors the respondents' houses were made of. Figure 4.19 shows the analyzed observations;

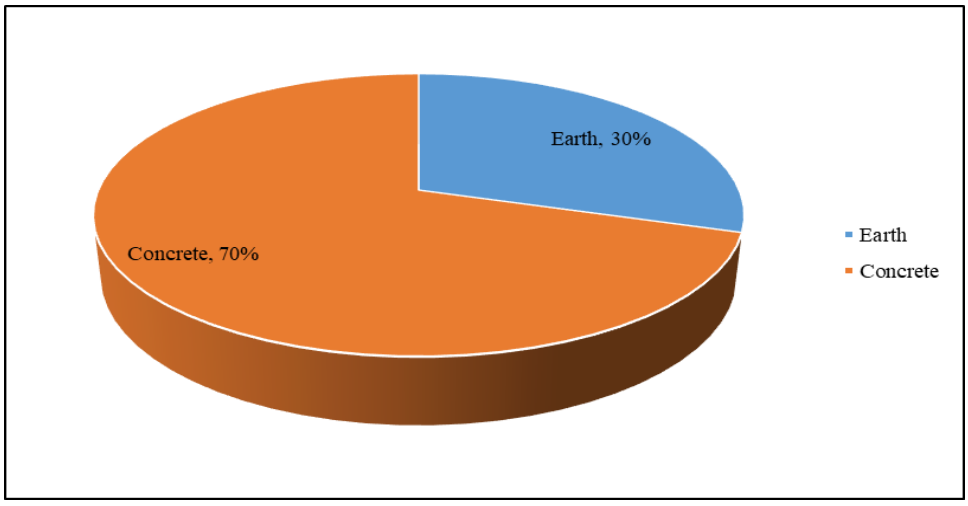

Figure 4.19: House Floor Type

(Source: Field Data, 2021)

According to the observations, majority of the houses, 281(70%) had concrete floors, followed by while 119(30%) had mud floors. The findings therefore indicate that over 70 % of the houses had stable floors. With regard, to housing, Rukundo *et al.* (2019) revealed that type of housing predicted food insecurity. They found out that disaster, food insecurity and diet were sensitive to housing, water and sanitation. These are crucial aspects for a good standard of living and food security.

The characteristics discussed in this section have some implications on food insecurity in the region. For instance, it was clear that the homestead environment was not fully utilized for growing crops. The semi-permanent nature of the pit latrines, house walls, and floor reflect that the area is relatively poor and is characteristic of food insecurity. This is because poverty at the household level is a constraint to the farmers' ability to purchase food in case of shortage. Indeed, Botha *et al.* (2012) states that poverty and food insecurity are generic to the rural communities of poor countries in Sub-Saharan Africa. They note that in Thaba Nchu region of South Africa, 54 % of the population was food insecure due to high unemployment, low levels of education and collapsed agricultural production system among others. Thus, one way of addressing food insecurity would be to address poverty levels in the households.

4.4.13 Type of House Roof, availability of Roof Catchment Gutters and Outside Water Storage Facilities

This study further examined the type of house roof, whether there were roof catchment gutters on the houses and whether there were outside water storage facilities. The findings are shown in figure 4.20, 4.21 and figure 4.22.

With regards to the type of roof that the respondents' houses had. The findings are shown in figure 4.20

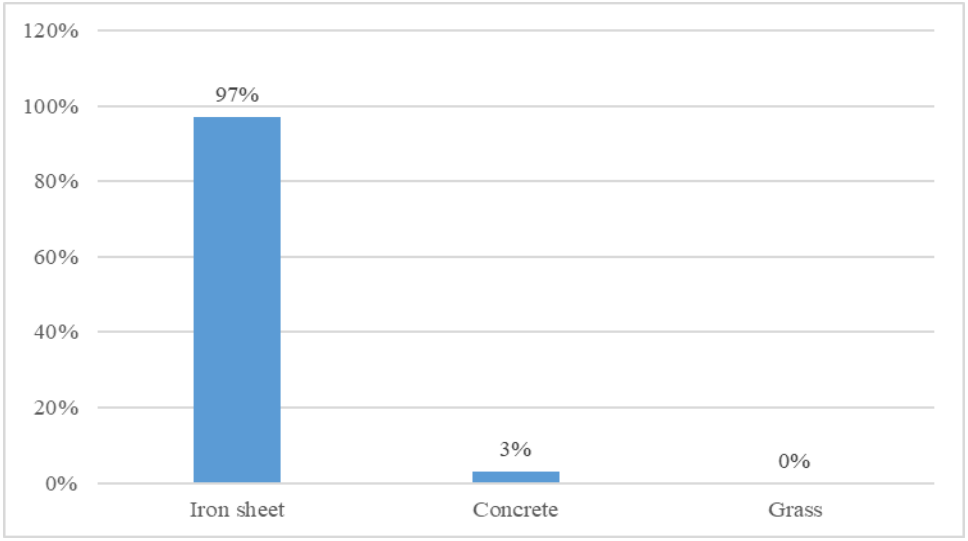

Figure 4.20: Type of House Roof

(Source: Field Data, 2021)

From the observations, majority of the houses, 388(97%) had iron sheets roof tops while 12(3%) had concrete roof tops. There were no houses which had grass or other materials used for roofing. The type of house roof is important because it influences ability of households to harvest water using gutters. From the findings, it is clear that they type of roof used can determine ability of a household to harvest rain water which can be used during the dry spell and also, if adequate can be applied to do small scale irrigation for enhancing food security. The results clearly indicate that all the households can be able to harvest rain water from their roofs.

On the other hand, figure 4.21 shows the responses on the issue of availability of roof catchment gutters.

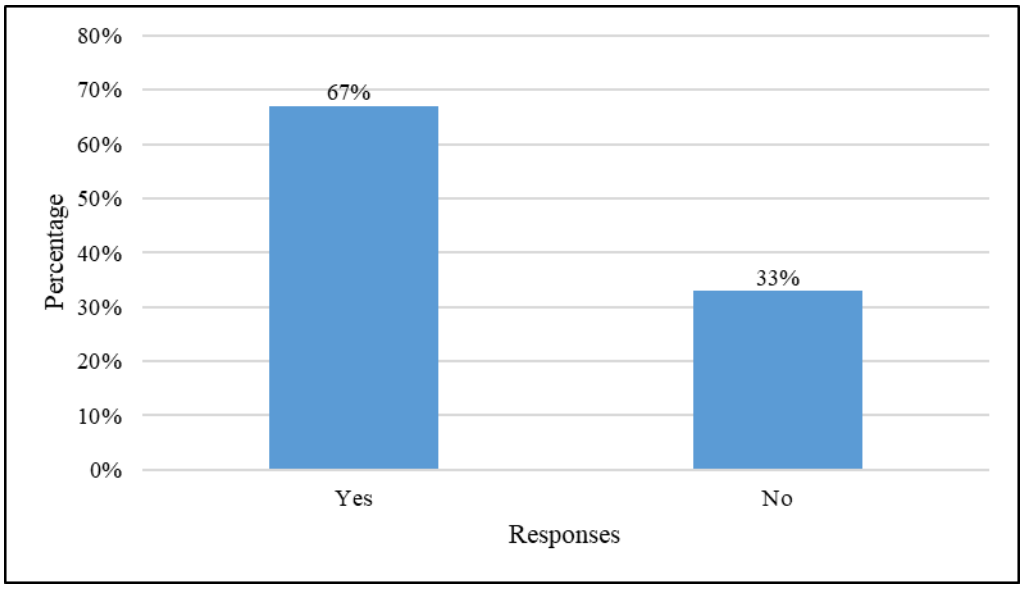

Figure 4.21: Availability of Roof Catchment Gutters

(Source: Field Data, 2021)

From the observations, majority of the houses, 268(67%) had water catchment gutters, while 132(33%) had no water catchment gutters partly due to lack of financial resources. The findings are an indicator of water shortage in the region and therefore majority of the respondents were able to catch rain water through the gutters.

It was however necessary to establish whether the respondents had adequate water storage facilities. The findings on these items are shown in Figure 4.22

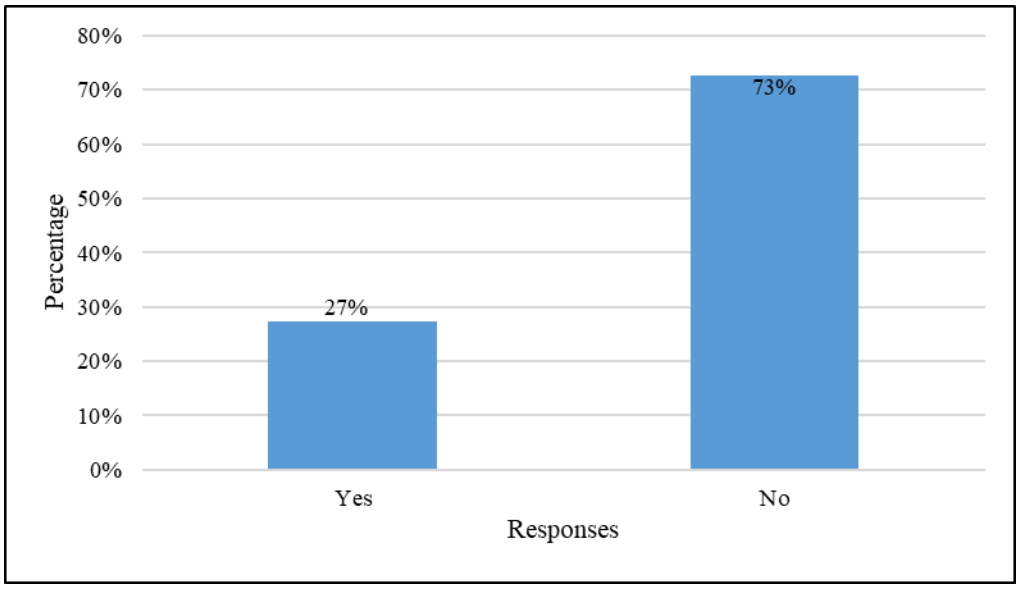

Figure 4.22: Availability of Outside Water Storage Facilities

(Source: Field Data, 2021)

According to the observations, majority of the houses, 291(73%) had no outside water storage facilities while 109(27%) had the outside water storage facilities. The findings indicate that majority of the homesteads were not in a position to store the water that was gathered through the water catchment gutters. This implies they have a financial challenge to procure such water storage facilities. This further suggests that the lack of water storage facilities can contribute to the food insecurity situation since the stored water can be used in farming activities through small scale irrigation apart from it being used for domestic purposes.

This study also examined the size and nature of the outside water storage facilities for those who had them and the findings are indicated in Table 4.10

Table 4.10: Size and Nature of Water Storage Facilities

Tanks	Frequency	Percentage
Tank (Toto tank) 1000 litres	59	54
Underground tank 15000 litres	14	13
Concrete Tank 10000 litres	0	0
Toto tank 10000 litres	36	33
Total	**109**	**100%**

(Source: Field Data, 2021)

According to the observations, majority of the households, 59(54%) had Toto tanks with a capacity of 1,000 litres, 36(33%) had Toto tanks with capacities of 10,000 litres, 14(13%) had underground tanks with a 15,000 litres water capacity and there were no concrete tanks with 10,000 litre capacity. The findings therefore indicate that the majority of the households who had outside water storage facilities were not able to store sufficient water for use after the rains. This implies that over 70 % of the households did not have sufficient water storage which could help them to undertake small scale irrigation/ home kitchen gardens to provide food for the family. As observed earlier, Botha *et al.* (2012) indicated that land can be well utilized to boost food security through in-field rain water harvesting. Galhena, Freed and Maredia, (2013) further observe that there is a positive impact of home gardens in addressing household food insecurity. These home gardens can be more effective in supporting food security through irrigation whose water source can be through rain harvest and stored in adequate water tanks. According to Rockstrom and Falkenmark (2015) in order to meet the global food needs, there must be strategies for storing rain water. They argue that water harvesting, if well managed in agriculture, improves stability of crop yields and can raise productivity from one tonne per hectare to three – to four tonnes. Mume (2014) in a study on impacts of rain-water harvesting in Eastern

Hararghe in Ethiopia established that households which participated in rainwater harvesting made improvement in diet uptake and generated more income. He argues that rain water harvesting for irrigation is critical in ensuring household food security and improving income.

4.4.14 Socio-economic factors and food insecurity at the household level

To ascertain the influence of various socioeconomic factors on household food insecurity, the respondents were directed to express the level of their agreement with statements on how different socioeconomic factors contribute to household food insecurity. This was based on Likert scale as; Strongly Disagree (DS), Disagree (D), Don't Know (DK), Agree (A), and Strongly Agree (SA). Table 4.11 shows results of the analysis.

Table 4.11: Socioeconomic factors and household food insecurity

Statements	**SA**	**A**	**DK**	**D**	**SD**	**N**	**Mean**	**Std. Dev**
There is inadequate land for producing enough food for my family	156	184	0	48	12	400	4.06	1.067
My food production is limited because farm inputs are very expensive	111	253	0	36	0	400	4.10	0.793
Non-food needs of my family such as medical care and school fees make me sell my harvests immediately	48	255	0	37	60	400	3.49	1.256
Pests destroy most of my food crops	36	144	24	136	60	400	2.90	1.286
My ability to produce adequate food for the family is hindered by the extreme costs of farm inputs	84	280	0	24	12	400	4.00	0.850
My ability to produce food that adequate for my family is hindered by the absence of extension services	180	171	0	13	36	400	4.12	1.175
The large size of my family makes it impossible for me to produce adequate food for it.	122	193	0	0	85	400	2.40	1.130
My spouse wastes a lot of our income in the consumption of tobacco and/or alcohol	36	62	0	73	229	400	2.01	1.417
Inability to access credit facilities hinders me from doing good farming	126	238	0	12	24	400	4.17	0.748
Old age prevents me from engaging in good farming	36	36	12	183	133	400	2.15	1.231
I lack good market to sell my agricultural products	12	243	12	85	48	400	3.22	1.174
I hardly access adequate information on climate and weather patterns	86	266	0	24	24	400	3.92	0.995

(Source: Field Data, 2021)

Table 4.11 shows that most of the respondents expressed strong agreement with the statement that their ability to produce food that adequate for their families is hindered by the absence of extension services as indicated table 4.12 mean score. additionally,

most of them agreed that there was inadequate land for producing enough food for their families, their food production was limited because farm inputs are very expensive, non-food needs of their families such as medical care and school fees made them sell their harvests immediately, pests destroyed most of their food crops, their ability to produce adequate food for their families was hindered by the extreme costs of farm inputs, the large size of their families makes it impossible for them to produce adequate food for every family member, their inability to access credit facilities hinders them from doing good farming, they lacked good market to sell their agricultural products, and they hardly access adequate information on climate and weather patterns as evidenced by 4.06, 4.10, 3.49, 4.00, 4.12, 2.40, 4.17, 3.22 and 3.92 mean scores respectively. However, most of them expressed strong disagreement with the statement that their spouse wastes a lot of their income in the consumption of tobacco and/or alcohol as shown by 2.01 mean score.

Further analysis of the socioeconomic determinants of food insecurity was done by use of Chi square to test the hypotheses. The hypothesis was:

H_o1: Socioeconomic factors have no significant influence on household food insecurity within Makueni County

H_1 1: Socioeconomic factors have a significant influence on household food insecurity within Makueni County

The study established a significant influence of socioeconomic factors on households' food insecurity in Makueni County. Table 4.12 contains details of the tests;

Table 4.12: Socioeconomic factors and food insecurity

Socioeconomic factors and food insecurity				
		Effect		
		Present	Not present	Total
land size	Observed Outcome	26	18	44
	Expected Outcome	22	95	117
family size	Observed Outcome	12	61	73
	Expected Outcome	42	27	69
communication on weather and climate	Observed Outcome	34	22	56
	Expected Outcome	81	11	92
availability of markets	Observed Outcome	32	67	99
	Expected Outcome	7	74	81
Capital and technology	Observed Outcome	29	99	128
	Expected Outcome	7	34	41
Total	Observed Outcome	133	267	400
	Expected Outcome	159	241	400

X^2=15.001 d=5 $p=0.05$ Critical value=12.924

(Source: Field Data, 2021)

The Chi square analysis {X^2=15.001}, established a significant relationship between socioeconomic factors and households' food insecurity within Makueni County. Based on Chi-square analysis, the main social economic factors that had a positive association with food security include land size, household size, information on weather and climate, market, capital and technology. The implication is that household food security is likely to be assured by effective socioeconomic factors as indicated by the presence of a significant relationship between the two variables with

p=0.05. Hence, the null hypothesis that socioeconomic factors had no significant effects on household food insecurity was rejected.

4.4.15 Relationship between Socioeconomic Determinants and Food Insecurity

The hypothesis was also tested using regression/logistic model. Food insecurity (dependent variable) was regressed against the independent variables (social economic determinants) as presented in tables 4.13 and 4.14.

Table 4.13: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.607[a]	.565	.563	.89132

a. Predictors: (Constant), Socioeconomic

(Source: Field Data, 2021)

Table 4.14: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	62.703	1	62.703	78.926	.000[b]
	Residual	316.192	398	.794		
	Total	378.894	399			

a. Dependent Variable: Food Insecurity

b. Predictors: (Constant), Socioeconomic

(Source: Field Data, 2021)

According the analysis presented in Table 4.13, 56.3% (R square = 0.565) of the variations in household food insecurity is explained by socioeconomic factors included in this study. Therefore, the socioeconomic factors can jointly predict about 56.3% of any change in food insecurity within Makueni County as confirmed by statistical significance in Table 4.14 of P=0.000. The p-value shows that the

socioeconomic factors are significantly associated with household food insecurity in the sampled county. Hence, the alternative hypothesis that household food security is strongly linked with socioeconomic factors was accepted.

Therefore, it is apparent that household food insecurity is influenced by several variables. The social factors that were linked to household food insecurity included number and age of dependents, age, education level, gender, marital status and occupation. Other social factors include access to climatic and weather information, and access to extension services. The economic factors influencing food security within the region were found to include but not limited to availability of markets, land size, land tenure, lack reliable alternative economic activities, lack of access to credit facilities and income levels. Other economic variables found to have an influence on food insecurity include cost of inputs, lack of adequate water storage facilities, poor technology and expenditure patterns among others. Some literature on the subject of determinants of food insecurity give mixed results. For instance, while Rose, (1999) associates food insecurity to family size, single adults with children and poverty levels, Dharmaraju *et al.* (2018) argues that there is no statistical association between family size, family type and food insecurity. Additional study by Wambogo *et al.* (2018) reported various characteristics of food insecure households. The characteristics included populations with many aged adults and women, rural residents, lower education levels, many children, high dependency levels, and lower incomes.

Ramsey *et al.* (2016) listed income levels, education, ethnicity, and parental age as some of the possible predictors of food insecurity. Foley *et al* (2009) indicated that households with large numbers of children, strained income to save, and low

education levels had the highest level of food insecurity. Loopstra (2018) associated poverty, poor management of finances, food inflation, and unavailability of food to food insecurity. The debate of determinants of food insecurity still continues as other scholars such as Iheoma (2020) add their voice. According to Iheoma (2020), food insecurity is influences by distance to the market, dependency ration, income, education level, and marital status.

Even though findings of the above studies may not be generalized to the current study, their relevance validates the link between the socioeconomic factors and the household food insecurity as ascertained in the current study. For example, factors such as size of household, income and education levels were found to influence food insecurity in the current study. The determinants of food insecurity are therefore region specific and as this study revealed, multiple socioeconomic variables are influencing food insecurity within Makueni County. This is in addition to the bio-physical factors which are common facts like altitude, soil and climate among others.

4.5 Coping and adaptive Strategies Used to Enhance Food Security at Household Level

The second objective of this study was on the coping and adaptive strategies of enhancing household food security within Makueni County. In order to address this objective on the coping and adaptive strategies that the households used in enhancing household food security, the respondents responded to several statements based on the Likert scale rating as follows: Strongly Disagree (DS), Disagree (D), Don't Know (DK), Agree (A), and Strongly Agree (SA). Table 4.15 shows analysis of their responses;

Table 4.15: Coping and Adaptive Strategies Used to Enhance Household Food Security

Statements	SA	A	DK	D	SD	N	Mean	Std. Dev
I engage in formal employment hence food secure	48	97	0	193	62	400	2.69	1.317
I engage in a small-scale business to support my family with food	24	291	12	73	0	400	3.67	0.842
I keep livestock which I sell to provide food for the family	12	351	0	25	12	400	3.82	0.719
My family receives remittances from well up relatives to buy food	36	49	0	61	254	400	1.88	1.388
My family relies on food aid from the government and the private sector	12	36	13	86	253	400	1.67	1.090
I engage in casual labour to provide food for my family	12	230	0	61	97	400	3.00	1.350
Abandonment of farming	12	38	0	66	284	400	1.57	1.085
I engage in food rationing	60	243	0	25	72	400	3.49	1.326
Buying cheapest food available	36	279	12	49	24	400	3.64	1.01
Eating a lot when food is in plenty	12	74	60	169	85	400	2.40	1.103
Trade-offs to purchase food i.e. buying food instead of buying medicine, transport, education etc.	36	277	0	51	36	400	3.57	1.106
Eating wild fruits and animals	12	145	0	182	61	400	2.66	1.199

(Source: Field Data, 2021)

From Table 4.15, most respondents reported that they engaged in small scale businesses to support their families with food, they kept livestock which they sold to provide food for their families, they engaged in casual labour to provide food for their families, with mean scores of 3.67, 3.82 and 3.00 respectively. Majority of the respondents disagreed with the statements that they engaged in formal employment

hence they were food secure with 2.69 mean score. Also, a large number of them strongly disagreed that their families received remittances from well up relatives to buy food, their families relied on food aid from the government and the private sector and that they had abandoned farming with mean scores of 1.88, 1.67 and 1.57 respectively.

Further, table 4.15 reveal that most respondents indicated that they engaged in food rationing, they bought the cheapest food available and they traded-off to purchase food for example buying food instead of buying medicine, transport, education etc. with mean scores of 3.49, 3.64 and 3.57 respectively. Several respondents disagreed with the statements that eating a lot when food is in plenty and eating wild fruits and animals with mean scores of 2.40 and 2.66 respectively. Scholars such as Quandt (2021) in a study on "coping with drought: Narrating from smallholder farmers in semi-arid Kenya" indicated that farmers used coping and adaptation strategies such as irrigation, relief food, charcoal burning, casual labour, maintain stock of food or money, livelihood diversification poultry keeping and selling livestock among others. Although Quandt's study findings adds value to the current study, his study was however not done in a specific region such as Makueni County.

Although the respondents indicated that sale of livestock was one of the coping strategies to food insecurity, the observation schedule established that not all households had livestock as indicated in Figure 4.23.

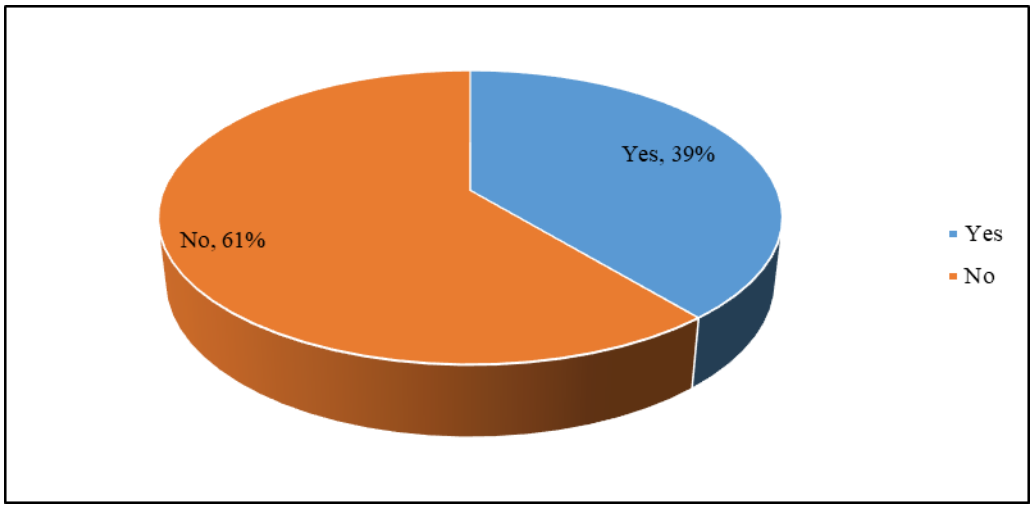

Figure 4.23: Presence of Livestock

(Source: Field Data, 2021)

According to the observations, majority of the households, 244(61%) did not engage in livestock rearing while 156(39%) of the households reared livestock. The findings indicate some of the homesteads diversify their farming activities through rearing of livestock which could enhanced their household food security. However, some of the livestock observed in the households was emancipated due to drought. Figure 4.24 shows some of the livestock that was observed in the region during the research.

Figure 4.24: Livestock grazing in Kilome, Makueni County– *1st December, 2017*

(Source: Field Data, 2021)

Further, as part of strategies of addressing food insecurity challenge, some farmers pointed out that they engage in small scale businesses. This was validated by the observation method whose findings are as indicated in table 4.16, Figures 4.25, 4.26 and 4.27.

Table 4.16: Crops Sold in the Markets

Crop Sold in the Markets	Frequency	Percentage
Mangoes	322	81%
Maize	359	90%
Beans	266	67%
Cowpeas	300	75%
Pumpkin	101	25%
Green grams	299	75%
Pigeon peas	254	64%
Tomatoes	312	78%
Bananas	152	38%
Cassava	329	82%

(Source: Field Data, 2021)

According to the observations made, the major crops that were sold in the market were: maize (90%), cassava (82%), Mangoes (81%), tomatoes (78%), Cowpeas (75%), green grams (75%), beans (67%), pigeon peas (64%), bananas (38%), and pumpkins (25%). The findings therefore indicate that there was a great variety of food crops in the nearby markets which enhances the household food security in the region of Makueni County. Figure 4.25 below indicate the food crops sold in the market areas.

Figure 4.25: Tomatoes sold in a market place in Kibwezi East– *20th November, 2017*

(Source: Field Data, 2021)

Figure 4.26: Bananas sold in Kaiti sub county market places– *30th November, 2017*

(Source: Field Data, 2021)

Figure 4.27: Mangoes sold in market places in Kibwezi West – *5th December, 2017*

(Source: Field Data, 2021)

The study also established which assets the respondents chose to invest in or run down in the face of food insecurity. The findings are shown in Table 4.17

Table 4.17: Asset Investment and Assets Run Down during Food Insecurity Situations

Assets invested on	Reason for investment	Freq	Perc	Assets run down	Reason for running down assets	Freq	Perc
Business	To make profit	322	81%	Entertainment	Save money	369	92%
Poultry farming	To get profit	126	32%	Travelling	Save money	237	59%
Construction work	Get cash	95	24%	Beer taking	To save money	298	75%
Grazing	Increase number of cattle	44	11%	sale of food	Save food	344	86%
Education	To improve standards of living	289	72%	Sale of second-hand clothes	Utilize the money in buying food	325	81%
Vegetable irrigation	To get money	312	78%	Paying fees	To buy food	286	72%
Cattle trade	To make enough capital	128	32%	Reduce women groups	To reduce the money lending out	139	35%
Vegetable selling	To meet basic needs	258	65%	N/A	N/A	N/A	N/A
Real estate	High returns	13	3%	N/A	N/A	N/A	N/A
Selling cereals	To cater for other household needs	342	86%	N/A	N/A	N/A	N/A
Hawking	To satisfy basic needs	215	54%	N/A	N/A	N/A	N/A

(Source: Field Data, 2021)

The results show that majority of the respondents, 322 (81%) chose to invest in business with an aim of making profits, 126 (32%) engaged in poultry farming to get profits, 95(24%) engaged in construction jobs to get cash, 44(11%) grazing by increasing the number of livestock, 289(72%) getting an education which will improve their standards of living, 312(78%) did invest in vegetable irrigation to get money, 128(32%) engaged in cattle trade to make enough capital, 258 (65%) sold

vegetables to meet their basic needs, some few respondents, 13(3%) engaged in real estate business because of the high returns, 342(86%) sold cereals in order to cater for other household needs, and 215 (54%) engaged in hawking in order to satisfy their basic needs.

On the assets that were run down, majority of the respondents, 369 (92%) indicated that they run down entertainment, 237 (59%) travelling and 298 (75%) beer taking in order to save money, 344(86%) reduced the sale of food so that they had enough for their own consumption, 325(81%) selling second hand clothes, utilizing the money in the purchase of food, 286 (72%) they differed the payment of fees using that money instead in purchase of food and 139 (35%) reduced the number of women groups and in so doing reduced the money they give to the groups and use it for buying food..

The study compared the number of meals eaten per day by the households during the dry and wet season. The study findings indicate that most families had more meals in a day during the wet season than during the dry season. This implies that food rationing as a coping strategy was a common phenomenon during the dry season as food shortage was common.

The findings on the number of meals that the respondents and their families consumed per day during the dry season are shown in Figure 4.28.

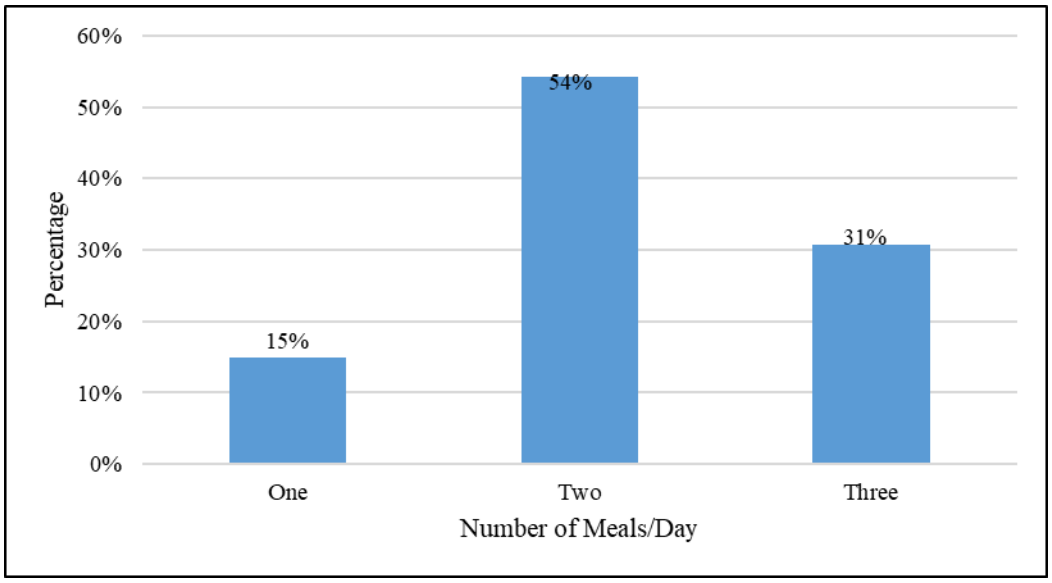

Figure 4.28: Number of Meals Eaten per Day-Dry Season

(Source: Field Data, 2021)

Based on the study findings, majority of the respondents, 217 (54.0%) indicated that they had two meals per day during the dry season, 123(31%) indicated they had three meals per day during the dry season and 60(15%) indicated they only consumed a single meal per day during the dry season. The findings indicate that most of the respondents afforded 1-2 meals per day during the dry season which is an indication of lack of sufficient food which is not the case normally where majority consumed 2-3 meals per day during the wet season as shown in the following section.

During the wet season, the number of meals that the respondents and their families consumed per day are different from those of the dry season. During the wet season, majority of the households could afford three meals a day. Figure 4.29 presents the analysis;

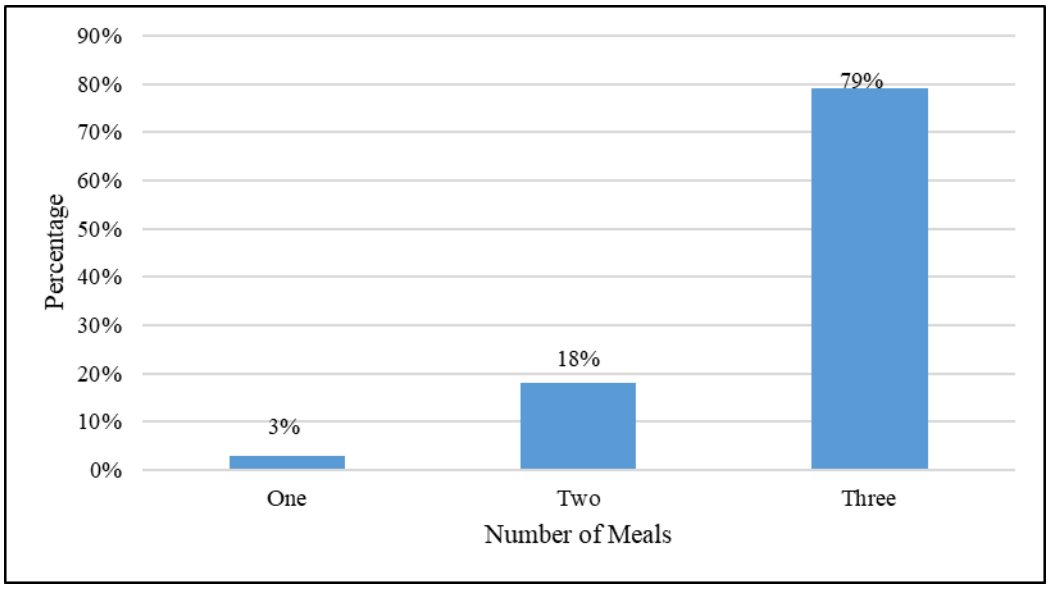

Figure 4.29: Number of Meals Eaten per Day-Wet Season

(Source: Field Data, 2021)

Based on the study findings, most respondents, 316 (79.0%) indicated that they had three meals per day during the wet season, 72(18%) indicated they had two meals per day during the wet season and 12(3%) indicated they only consumed a single meal per day during the wet season. The findings indicate that most of the respondents afforded 2-3 meals per day during the wet season which is an indication of sufficient food since the food crops are able to do well and the yield is good.

The respondents were further asked to indicate how often they went without meals during the dry season. The results are indicated in Table 4.18.

Table 4.18: Frequency of Missing Meals during Dry Season

	Frequency	**Percent**
Very often	157	39.3
Often	205	51.3
Not often	38	9.5
Not at All	0	0.0
Total	**400**	**100**

(Source: Field Data, 2021)

The study results revealed that majority of the respondents, 205(51.3%) often went without meals during the dry season, 157(39.3%) indicated very often. The findings therefore imply that during the dry season majority of the respondents quite often went without meals because there was lack of enough rainfall, poor harvests led to reduction of meals in the households and famine led to skipping of meals. In addition, 38(9.5%) of the respondents indicated that it was not an often occurrence for them to go without food in the dry season because they got assistance from their relatives, income from formal employment and business activities allowed them to buy food, the two seasons per year of rainfall yielded enough food that sustained them to the next harvesting time and the non-dependence on farming allowed them to diversify on other activities thus ensuring food security.

The respondents were asked to indicate how often they went without meals during the rainy season. The findings are indicated in Table 4.19.

Table 4.19: Frequency of Missing Meals during Rainy Season

	Frequency	**Percent**
Very often	97	24.3
Often	60	15
Not often	193	48.3
Not at all	50	12.5
Total	**400**	**100**

(Source: Field Data, 2021)

The results show that 193(48.3%) of the respondents indicated that it was not often for them to go without meals during the rainy season, 97(24.3%) indicated very often and 60(15%) indicated that it was an often occurrence for them to go without food in the rainy season. In addition, 50(12.5%) stated that they did not miss food at all during the rainy season. The findings therefore imply that during the rainy season a

great majority of the respondents did not miss their meals which is an indication of sufficiency of food.

From the data on frequency of missing meals during dry and wet season, it is clear that food insecurity was felt much during dry season than during the wet season when farmers at least got some food crops.

From the foregoing, it is clear that the coping strategies largely applied by the households during food insecurity include engaging in small scale businesses, food aid from government and private sectors, engaging in causal labour and food rationing. Other coping strategies that some households mentioned include eating wild fruits, eating more food when there is plenty of harvest, remittances from relatives and friends, buying cheap food and tradeoffs (buying food at the expense of other necessities such as medication and education). The adaptive strategies used though by a few households included keeping of livestock, seeking for formal employment, small scale irrigation, proper utilization of available resources and some abandoned farming all together and engaged in non-farm activities such as full engagement in business and agroforestry. A study by Huho and Mugalavai (2010) is relevant in this study as it confirms some of the coping and adaptive strategies addressed in the current study. Their study revealed that farmers in Kenya engaged in the following coping and adaptive strategies to address food insecurity: cultivating large portions of land in order to compensate for low yields, use of small scale irrigation to enhance food productivity, keeping small herds of livestock and shifting to urban areas in search of work among others.

The current study established a number of coping and adaptive strategies applied but they have however not eradicated household food insecurity. Nevertheless, they have helped to reduce the impact of food insufficiency. The households therefore still remain vulnerable to food insecurity situations. The respondents were asked to provide the reasons for lack of success of coping and adaptive strategies in food security enhancement at the household level in Makueni County. Table 4.20 presents results of the analysis;

Table 4.20: Reasons for lack of Success of Coping and Adaptive Strategies in Food Security Enhancement

Reasons	**Frequency**	**Percentage**
Death of cattle due to drought	297	74.3
Lack of employment	30	7.5
Drought	289	72.3
Low rainfall	159	39.8
Poor climatic conditions	349	87.3
Arid conditions hence only a few cattle can be sustained	321	80.3
Business gives very little income	344	86.0
Climatic conditions in the region at times makes basic food commodities rare and very expensive	335	83.8
Lack of government enforcement to ensure the households are food secure	376	94.0
Absence of dams in the study area	386	97
Lack of knowledge on soil conservation and lack of finance to buy enough water for irrigation	367	92
Deficient knowledge on how to curb food insecurity	319	80

(Source: Field Data, 2021)

From the table above, majority of the respondents , 297 (74.3%) cited the death of cattle due to drought, 289 (72.3%) attributed the problem to the drought conditions,

349(87.3%) suggested poor climatic conditions, 321(80.3%) blamed the arid conditions hence only a few cattle can be sustained, 344(86.0%) pointed out that their business gave very little income, 335(83.8%) said that climatic conditions in the region at times makes basic food commodities rare and very expensive, 376(94.0%) blamed the non-success of coping strategies in the food security enhancement on the lack of government enforcement of policies that can ensure the region is food secure.

From Table 4.20, it is also apparent that most respondents gave the following reasons for non-success of the coping and adaptive strategies: 386(97%) reported the absence of dams in the study area; 367(92%) cited the lack of knowledge on soil conservation and lack of finance to buy enough water for irrigation and; 319(80%) mentioned deficiency in knowledge on how to curb food insecurity.

4.5.1 Actions Taken to Improve Coping and Adaptive Strategies of addressing food insecurity

The respondents were asked to give the various actions that can be put in place to improve the coping and adaptive strategies used to deal with food insecurity. Table 4.21 provides the findings.

Table 4.21: Actions Taken to Improve Coping and Adaptive Strategies

Strategy	Action of improving the coping and adaptive strategy	Frequency	Percentage
Growing vegetables	Drilling boreholes and harvesting water to use during dry season	302	75.5
Small scale business	Increase stock, getting loans to increase stock	349	87.3
Poultry farming	Buying chicken feed, use modern technology to keep poultry	287	71.8
Dairy Farming	Buying and treating cattle, rearing of exotic breeds and artificial insemination	313	78.3
Education	Saving for fees	215	53.8
Food rationing	farmers should be encouraged to exercise food rationing	239	59.8
Construction of dams	Through government support	359	89.8
Buying cheapest food available	Encourage locals to buy cheapest food products	297	74.3
Abandonment of farming	Peasants should not abandon farming since it is the only source of income	363	90.8

(Source: Field Data, 2021)

Based on the findings, there were several actions that the respondents felt can be taken to improve the coping and adaptive strategies. Majority of the respondents, 302(75.5%) stated that the growing of vegetables had been made possible through the drilling of boreholes and harvesting water for use during the dry season; 349(87.3%) stated that their small scale businesses can be boosted through getting of loans to increase stock; 287(71.8%) stated that buying of chicken feeds, use of modern technology in keeping poultry are some of the actions that will improve poultry farming. On keeping dairy farming, 313(78.3%) pointed out that the action to be taken was purchasing and treating cattle, rearing of exotic breeds and artificial insemination. Education is also an important coping strategy to which 215(53.8%) of the respondents indicated that there should be savings made towards school fees. For the

farmers to ensure that the little food available sustains them to the next harvest season, 239(59.8%) stated that farmers should be encouraged to exercise food rationing; on dam construction, 359(89.8%) of the respondents suggested the need of government support in the construction of dams; 297(74.3%) stated that the locals should to buy cheapest food products. The findings also indicated that some farmers had begun abandoning farming, however, 363(90.8%) of the respondents pointed out that peasants should not abandon farming since it is the only source of income.

A hypotheses test was conducted using chi square. The hypotheses tested is:

H_0: There is no significant effect of coping and adaptive strategies of enhancing household food security within Makueni County

H_1: There is a significant effect of coping and adaptive strategies of enhancing household food security within Makueni County

The results of the analysis are indicated in Table 4.22.

Table 4.22: Contingency table for the coping and adaptive strategies and food insecurity

Contingency table for coping and adaptive strategies and food insecurity				
		Effect		
		Present	Not present	Total
Formal employment	Observed Outcome	59	12	71
	Expected Outcome	33	44	77
Keeping of livestock	Observed Outcome	41	8	49
	Expected Outcome	28	30	58
Engaging in casual labour	Observed Outcome	49	9	58
	Expected Outcome	39	23	62
Irrigation replacing rain-fed agriculture	Observed Outcome	67	13	80
	Expected Outcome	21	40	61
Food aid from the Government and the private sector	Observed Outcome	45	17	62
	Expected Outcome	29	31	60
Remittances from relatives among others	Observed Outcome	36	44	80
	Expected Outcome	47	35	82
Total	Observed Outcome	297	103	400
	Expected Outcome	197	203	400

X^2=27.468 d=15 $p=0.05$ Critical value=4.073

(Source: Field Data, 2021)

Analysis in Table 4.22 reveals that coping and adaptive strategies significantly affect food insecurity among households in Makueni County (X^2=27.468; $p=0.05$). Therefore, the more effective coping and adaptive strategies, the more likely to minimize food insecurity. The null hypothesis that coping and adaptive strategies and food insecurity were not significantly linked was rejected. The possibility of attributing the observed relationship to chances of random sample was eliminated by

the p-value ($p<0.05$) which indicated greater confidence level and statistical significance of the relationship.

The Relationship between Coping and Adaptive strategies and the enhancement of Food security was also considered using regression model. The hypothesis analyzed was:

H_0: There is no significant effect of coping and adaptive strategies of enhancing household food security within Makueni County

H_1: There is a significant effect of coping and adaptive strategies of enhancing household food security within Makueni County.

In the model, independent variables were coping and adaptive strategies while food insecurity remained the dependent variable. The analysis outcome are presented in tables 4.23 and 4.24.

Table 4.23: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.861[a]	.73	.726	.88993

a. Predictors: (Constant), Coping and adaptive strategies

(Source: Field Data, 2021)

Table 4.24: ANOVA

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	65.273	3	21.758	27.473	.000[b]
	Residual	313.621	396	.792		
	Total	378.894	399			

a. Dependent Variable: Food Insecurity

b. Predictors: (Constant), Coping and adaptive strategies

(Source: Field Data, 2021)

According the analysis presented in Table 4.23 above, 73.0% (R square = 0.73) of the variations in household food insecurity is explained by coping and adaptive strategies whereas only 27.0% can be attributed to other factors beyond the scope of this study. Table 4.24 provides additional statistics indicating that coping and adaptive strategies are strongly associated with household food insecurity (P=0.000). Evidently, the observed P-value was much smaller in comparison to the 0.05 threshold, 95% confidence level. Thus, the alternative hypothesis that there is a significant effect of coping and adaptive strategies of enhancing household food security within Makueni County was accepted.

The results on coping and adaptive strategies to food insecurity suggest that though they are unsuccessful in eradicating food insecurity, the households are able to continue with their livelihood even in situations of food insufficiency especially resulting from drought. This means that despite the fact that the coping and adaptive strategies have not wiped out food insecurity in the area, it is clear that the when applied, these strategies help to cushion them against food insecurity challenges. A

number of scholars, suffice to mention, (Derbile, 2009; Molua, 2009; Pottier, 2015; Berlie, 2015 and Law, *et al.*, 2018) among others have examined ways in which households address food insecurity. The studies concur that households look out for a variety of coping and adaptive strategies when they are faced with food insecurity. Derbile (2009) for example observed that households in North-Eastern Ghana adopted planting of multiple indigenous drought resistant crops and used indigenous organic manure. In Northern Cameroon, farmers diversified their livelihood and engaged in non-farm income generation activities (Molua, 2009)

Whereas households in Kampala, Uganda coped by dropping or decreasing consumption of their plantain stable (*matoke*) and eating one meal a day, in Ethiopia, households coped with food insecurity by livestock diversification, sold fuelwood and charcoal and also sought for credit facilities including borrowing from friends (Pottier, 2015 and Berlie, 2015). In Makueni county, Kenya, the current study established that households reduced their vulnerability to food insecurity through seeking formal employment, keeping of livestock, engaging in casual labour, doing some irrigation, seeking for food aid, food rationing, trade-offs to buy food instead of other essentials and remittances from family members and friends among others. Other scholars such as Law, *et al.* (2018) observed that farmers in Peninsular, Malysia embraced strategies such as dietary changes, diversification of food, food rationing, reducing expenses on daily necessities, reducing expenses on schooling and increasing household income.

4.6 Presence of Food Security Institutions

The third objective of the study was to assess the institutional frameworks used in addressing household food insecurity within Makueni County. The households were

asked whether there were food security institutions in the area which assisted them in cases of food insecurity. Figure 4.30 shows the analyzed results;

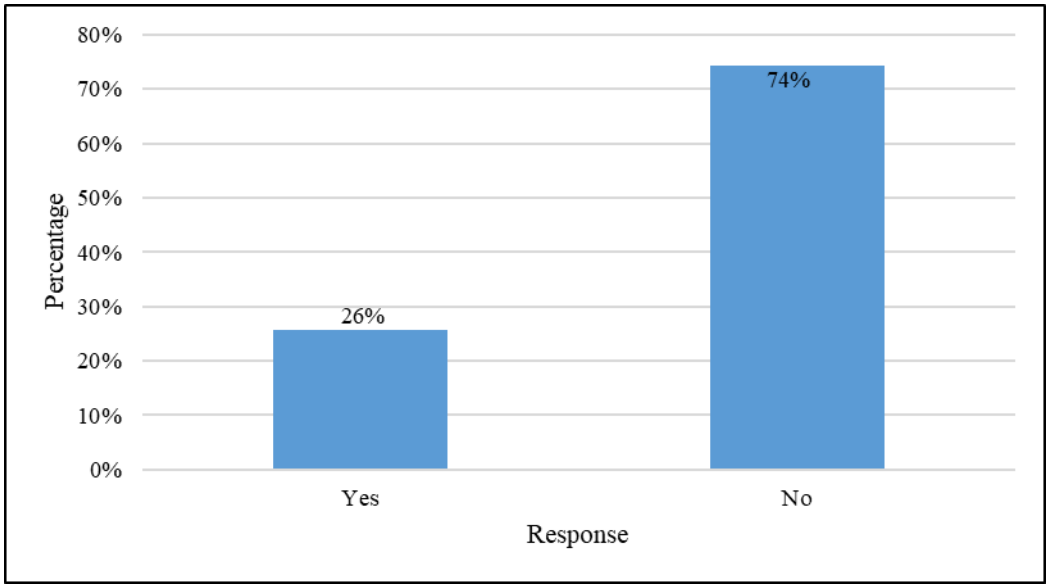

Figure 4.30: Presence of Food Security Institutions

(Source: Field Data, 2021)

Results in figure 4.30 shows that most (297, 74%) of the respondents indicated that there were no food security institutions in their areas, while 103(26%) indicated that there were food security institutions which came to their aid in the cases of food insecurity. Some of the institutions that were present included government based institutions which provided relief food and extension services; GAA which supplied seeds for planting; World Food Programme (WFP) which provided food to the residents and NGOs which provided relief food. The findings therefore denote that the majority of the respondents did not have institutional interventions and were therefore prone to experience food insecurity.

The respondents who got institutional interventions during food insecurity were asked to provide more information regarding the nature of support that they received. The results of this are provided in the following sections.

4.6.1 Food Security Institutions Level of Support

The respondents were asked to rank the level of support provided to them by the available food security institutions. They were asked to use the following level of ranking: Most supportive (M.S); Supportive (S); Less Supportive (L.S), Don't Know (DK); and Not supportive (NS). The findings are indicated in Table 4.25

Table 4.25: Food Security Institutions Level of Support

Institution	MS	S	LS	DK	NS	N	Mean	Std. Dev
Local administration-County/Sub-County Commissioners/chiefs	0	63	86	162	89	400	2.69	0.988
Government Ministries	0	75	12	229	84	400	2.81	0.977
Political representatives - MPs, Ward Representatives	0	97	35	193	75	400	2.62	1.049
NGOs	0	171	12	133	84	400	2.33	1.224
CBOs	0	249	115	12	24	400	1.53	0.819
Churches	0	151	92	109	48	400	2.14	1.056

(Source: Field Data, 2021)

According to the results in table 4.25, 162 (40.5%) of the respondents stated that they did not know the level of support given by the local administration (County Commissioners, Sub-County commissioners, chiefs) as far as food security is concerned. 229 (57.3%) stated they were not aware of any support on food security given by Government Ministries and 193 (48.3%) stated they were not aware of the support from Political representatives - MPs, Ward Representatives provided to them in regard to food security. However, 171 (42.8%), 249(62.3%), and 151 (37.8) respondents indicated that they received support from NGOs, CBOs and churches respectively in regard to food security. The findings therefore imply much of the support on food security did not come from different levels government institutions but from non-government institutions. For example, only 63 (15.8%) of the respondents indicated that there was some support of food items from the local

administration and 75 (18.8%) agreed that the Government ministries also did offer some support of food to the households.

4.6.2 Membership to Groups Offering Food Security Support

The respondents were asked to indicate whether they belonged to any groups such as Women group, youth group, self-help group, faith-based group etc. Figure 4.31 shows the analyzed responses;

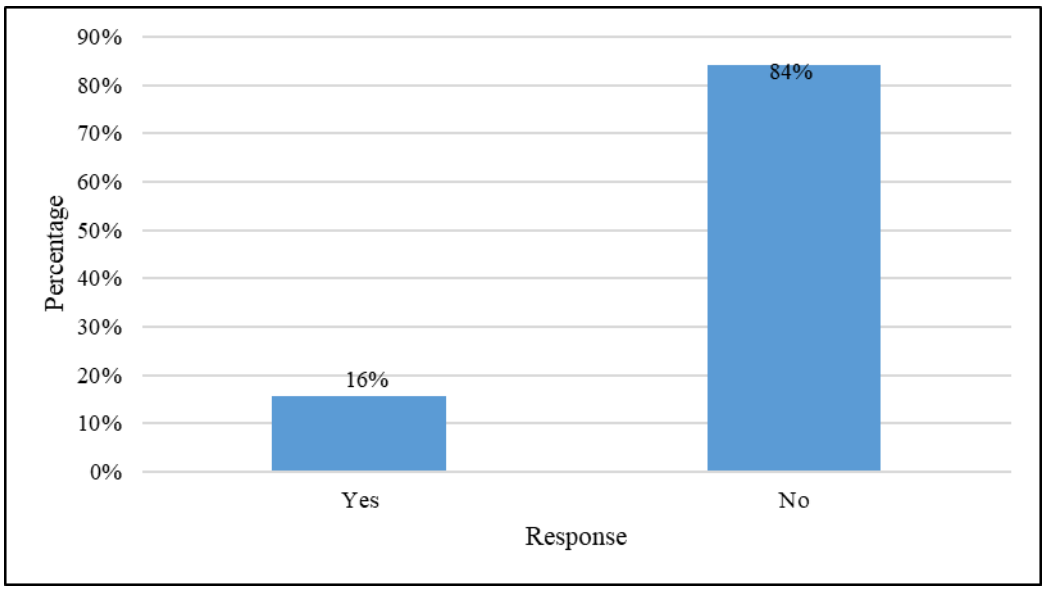

Figure 4.31: Group Membership

(Source: Field Data, 2021)

According to Figure 4.31, most (336, 84%) of the respondents indicated that they did not belong to any group while 64 (16%) indicated that they were members of some groups. The faith-based groups provided seedlings for planting, the women groups provided saving and loan facilities to the members and training women involved in farming. Self-help groups on the other hand assisted the members in the raising of capital for food production purposes. The results imply that most of the households struggle with food insecurity on their own as many of them do not receive any support from the groups as they are not in their membership.

The few respondents who were members of the groups were asked to state how the different groups which they belonged to assisted them in dealing with food related challenges. First, the respondents stated that the groups provided them with some food for their families during the dry seasons. Secondly, the groups bought food which they shared at the end of the year. Third, the groups provided credit facilities assisting them to acquire farm input facilities.

4.6.3 Effectiveness of institutional interventions used in addressing household food insecurity

The third objective of the study aimed at establishing whether the institutional frameworks used in addressing household food insecurity within Makueni County are effective. Thus, the respondents were asked to rank several statements using the ranks: Strongly Agree (SA), Agree (A), Don't Know (DK), Disagree (D), and Strongly Disagree (SD). The findings are shown in Table 4.26

Table 4.26: Statements on Effectiveness of institutional interventions used in addressing household food insecurity

Statements	SA	A	DK	D	SD	N	Mean	Std. Dev
The institutions provide adequate and regular food aid to households	12	25	0	171	192	400	1.74	0.965
The institutions support households with relief seeds to enhance food production	0	50	0	181	169	400	1.83	0.946
The institutions have trained farmers on good agricultural practices and technology to be able to produce adequate food for the family - Extension services	12	37	13	265	73	400	2.13	0.917
Farmers have been assisted through provision of water for irrigation to boost food production	0	50	0	242	108	400	1.98	0.878
Farmers are given adequate and timely information on weather and climate	0	24	13	291	72	400	1.97	0.673
The institutions support households with credit for boosting food production	12	38	0	217	133	400	1.95	0.991
Provide marketing support	12	38	0	266	96	400	1.95	0.787
Provide quality assurance	12	25	0	206	157	400	1.82	0.940
Provide Information communication technology support	12	25	0	206	157	400	1.98	0.908
Provide inputs support	26	85	0	192	97	400	2.38	1.241

(Source: Field Data, 2021)

Table 4.26 shows that a greater percentage of the respondents expressed strong disagreement that the institutions provided adequate and regular food aid to households with 1.74 mean score. Similarly, most respondents disagreed that the institutions support households with relief seeds to enhance food production, the institutions have trained farmers on good agricultural practices and technology to be able to produce adequate food for the family - extension services, farmers have been

assisted through provision of water for irrigation to boost food production, farmers were given adequate and timely information on weather and climate, the institutions supported households with credit for boosting food production, provided marketing support, provided quality assurance, provided information communication technology support and provided inputs support to the respondents with mean scores of 1.83, 2.13, 1.98, 1.97, 1.95, 1.95, 1.82, 1.98 and 2.38 respectively.

Further analysis was conducted using chi square to test the hypothesis that the Institutional frameworks applied have not significantly enhanced food security at household level in Makueni County. Table 4.27 presents outcome of the analysis;

Table 4.27: Contingency table for Institutional frameworks and food insecurity

Institutional frameworks and food insecurity Cross tabulation				
	Institutional Frameworks			Total
		Present	Not present	
provision of general relief food, relief seeds	Observed Outcome	50	51	101
	Expected Outcome	20	108	128
Irrigation	Observed Outcome	93	99	192
	Expected Outcome	94	94	188
provision of inputs	Observed Outcome	64	43	107
	Expected Outcome	69	15	84
Total	Observed Outcome	207	193	400
	Expected Outcome	183		400

X^2=6.869 d=5 $p=0.05$ *Critical* value=16.347

(Source: Field Data, 2021)

H_0: The Institutional frameworks applied have not significantly enhanced household food security within Makueni County

H_1 : The Institutional frameworks applied have significantly enhanced household food security within Makueni County

The tests in table 4.27 failed to show a statistically significant impact of Institutional frameworks on household food insecurity within Makueni County (X^2=6.869, p= 0.05). The implication is that institutional frameworks have not enhanced household food security. The null hypothesis that Institutional frameworks applied have not significantly enhanced food security at household level was accepted.

The findings therefore indicate that the institutional interventions of addressing household food insecurity within Makueni County were not effective. The implication of these findings is that the region continues to suffer from food insecurity since both the government and non-government institutions have failed to put adequate measures of addressing food insecurity challenge. A few studies on interventions of food insecurity have been conducted. Loopstra (2018) for example conducted a study among countries with high income to establish the strategies they use to curb food insecurity within their households. She revealed that countries with high income are serious concerned about food insecurity as a public health issue. According to Loopstra (2018) countries like USA and Canada have social protection policies which help to reduce household food insecurity. The USA has a social protection program known as Supplemental Nutrition Assistance Programme (SNAP). It works by ensuring that the affected citizens' food payment card is loaded with money to be exclusively used for buying authorized foods. The eligibility conditions for this programme entails that families to have a maximum net annual income of $20 400

which is the poverty line for a family of three persons and a maximum assets and savings value of US$2250. SNAP programme is said to be connected to a substantial decrease in food insecurity. Another intervention that is also common in the USA is the food bank (food pantries). A food bank is a place where persons can go to obtain groceries without payment. Food banks are also common in Canada and Australia. Food banks rely on donated food from communities and from industry among others volunteers. Loopstra (2018) argues that pre and post intervention trials evaluations are yet to be done to establish the impact of receiving food aid from food banks. Some studies however have shown that some people feel shame to go to get food from the food banks, other studies also question the quality and nutrition adequacy of food in food banks and others point out that food banks rely on donated food. Other interventions common in the high-income countries are the community programmes that offer low-cost or free food. These in UK and Canada include community food centres where people receive not only food but also other services such as fuel vouchers, cooking classes, and debt counselling among others. Another intervention is the use of community kitchens. In this food programme, people jointly make huge quantities of food some of which they carry to the family, and they are concurrently trained on good cooking skills and budgeting. According to Loopstra (2018), scholars have raised questions regarding application of community food programmes as strategies aimed at addressing food insecurity since they put attention on skills, behavior and physical accessibility of food. However, empirical documentation of the above as household food insecurity drivers is yet to be done.

Butcher, *et al.* (2014) using a case study approach evaluated Food Bank for West Australia Healthy Food for All programme. The findings revealed that since its inception in 2007, the food bank programme has enhanced food delivery and education in the region. The programme is said to have had a positive impact upon food security, health and wellbeing of the people.

Culas and Tek (2016) in a study of food security in Cambodia established that the country has not experienced severe food insecurity because the agricultural sector maintains adequate food availability for the country. However, there is a small proportion of the population who are poor, live in remote areas of the country and face food insecurity. As an intervention measure, the government of Cambodia pursues long-term solutions for food insecurity by focusing on food- based social safety nets which are targeting development of productive assets/ livelihoods, nutrition, and education.

Previous studies on food insecurity interventions include Adeyeye (2017) examined the feasibility of making food adequately available in Africa and making the continent food secure through suitable technologies for food storage and processing. Adeyeye (2017) observed that there is a possibility of increasing shelf-life of food stuff and doing value addition by promoting the use of agro-processing technologies and storage facilities which are simple enough to be used effectively on and off-farm. In addition, there is need to modernize, strengthen and upgrade the Strategic Grain Reserve Scheme to the level of a National Food Reserve Program. It is through such revamping that the scheme can be capable of handling all the essential and staple food products effectively. This will help in attainment of national food security goal. Adeyeye (2017) finally underscored the importance of promoting and developing

agro-processing across the different countries in Africa to jumpstart evolution of rural micro-enterprises and agro-allied industries. Petrikoya (2013 indicates that the intervention to food insecurity should be policy based. The study reveals that more equal land distribution, higher domestic food production and greater degree of trade openness can impact food security positively.

Zivkovik (2017) questions the value of dealing with food insecurity through food support programmes and by splitting food security pillars. The findings of his study are that food insecurity problem requires to be dealt with holistically and the focus ought not to be on the programmes but on growing the coherence and creation of the adaptive capability of food insecurity solution ecosystems. Adu *et al*. (2018) on other hand did a systematic review on how agricultural interventions affects food security in Northern Ghana. The reveal reported that Ghana had remarkably progressed towards the realization of food security except in Northern Ghana. The scholars found out that despite the implementation of several interventions in Northern Ghana between 2006 and 2016, the interventions had no impact on food insecurity. The interventions entailed building capacity through extension training, market access, infrastructure development, input supply, and processing and value addition. The study revealed further that, by nature of their designs, most of the interventions omitted suitable counterfactuals. Instead of reporting result goals, it reported process. This made quantitative evaluation impossible. The study observed that interventions such as extension training, which had a longer duration appeared to be more important for effectiveness. The study recommends that interventions aimed at developing storage facilities as well as water and irrigation should be prioritized due to long-term benefits.

The above studies on interventions to food insecurity have mixed results on effectiveness of the measures undertaken especially by the Governments. The high-income countries such as the USA, Canada and Australia have some of the interventions that have some effect on food insecurity. For example, SNAP programme in USA and Food Banks in Australia were said to contribute to a decline in food insecurity. On the other hand, the various interventions put in Northern Ghana have not helped to make the region food secure. The findings of the present study conducted in Makueni County, Kenya revealed that there was insignificant effect of interventions by both government and non-government institutions and therefore this is an area that requires a concerted effort to see to it that farmers are fully supported with systematic and integrated intervention measures aimed at making the region food secure.

4.7 Presence of Alternative Strategies/Best practices for addressing the cyclic food shortage in Makueni County

The study's last objective was to evaluate alternative strategies/best practices that can be used to enhance household food security within Makueni County. Consequently, the researcher asked the respondents if they were aware of best strategies that are used in addressing the cyclic food shortages in Makueni County. Figure 4.32 shows the findings;

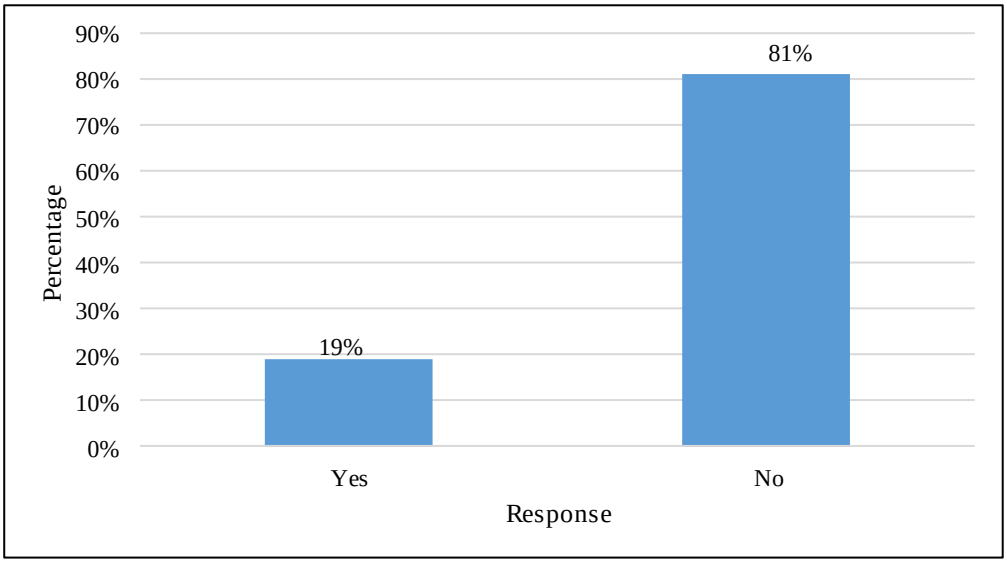

Figure 4.32: Presence of Alternative Strategies/best practices in addressing the cyclic food shortage in Makueni County
(Source: Field Data, 2021)

Based on the Figure 4.32, most 324(81%) of the respondents reported that there were no alternative strategies applied for addressing the cyclic food shortages in Makueni County while 76(19%) affirmed the presence of alternative strategies/best practices of ensuring food security. The findings therefore are an indication of lack of adequate alternative strategies/ best practices to address the food insecurity situation in the County.

Those (19%) who indicated applied alternative strategies/best practices were asked to specify which strategies they used in addressing food insecurity in their area. They pointed out the following: first, they construct water dams which act as a reservoir of water. The water harvested in these dams is used for domestic and farming activities during the dry seasons; secondly, there is establishment of a few irrigation schemes which assist the farmers to water their crops when there is little or no rainfall at all; thirdly, some farmers are trained on good agricultural practices which they apply to improve their agricultural yield; and fourthly, some farmers acquire adequate and

timely information through media on weather patterns in the area which enables them to know when to plant their crops so that they can have maximum yield; and fifthly, some have diversified their activities such as livestock rearing and engaging in business. These alternative strategies assist these households to address food insecurity in their households.

Based on observation schedule that was used to gather data, it was also clear that a few households were using some of the best practices of enhancing food security such as irrigation. However, it was only about 15% of the households who had irrigation being carried out presented in Figure 4.33

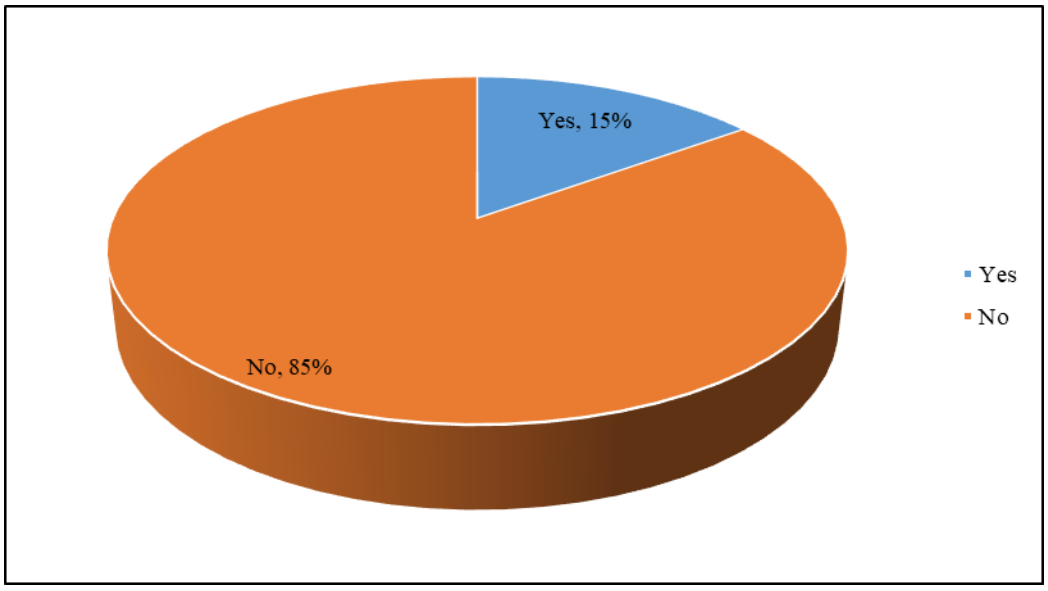

Figure 4.33: Availability of Irrigation on the Farms

(Source: Field Data, 2021)

According to the observations, majority of the households, 340(85%) had no irrigation taking place while 60(15%) of them were on small scale irrigation. The findings indicate that majority of the farms were not under irrigation and therefore relied on rain fed agriculture activities in Makueni County. With regard to the size

and nature of the irrigation that was carried out on the farms that were visited. Table 4.28 shows the findings;

Table 4.28: Size and Nature of Irrigation

Size and Nature of Irrigation	Frequency	Percentage
Small scale in size, use of earth dams	26	43%
Irrigation using water from a well	23	38%
Small scale irrigation (drip irrigation) using the generator	11	19%
Total	**60**	**100%**

(Source: Field Data, 2021)

From the findings, 26(43%) of the irrigation on the farms was on a small scale from earth dams, 23(38%) was irrigation using water drawn from wells and 11(19%) was small scale irrigation (drip irrigation) through the use of generators. The findings therefore reveal that the irrigation carried out in the farms was small scale in nature. This nature of irrigation was that it served small land sizes and the use of generators required large amounts of fuel to power. Boosting irrigation in this region will enhance the food security situation in the region.

Some respondents had diversified their system of livelihood with activities such as supplying produce to the few manufacturing industries and this helped to reduce the problem of food insecurity in their households. This is because the income acquired from the sales was used purchase food. According to the findings, there were a few industries in the area, 31% of the factories were fruit processing factories, 16% were sisal factories, 16% were dairy processing plants, 14% were ginnery factories and 13% were coffee factories. Increase of capacity of production of these industries and

establishment of others can go a long way in enhancing food security at the household level in the county.

Despite the above, most (97%) of the respondents revealed that the alternative strategies/best practices applied were not successful in enhancing food security. They attributed this mainly to lack of adequate water sources in the area that can be tapped for irrigation to improve farming. Other hindrances to the application of best agricultural practices include lack of training, inadequate capital and low levels of awareness on weather and climate patterns of the area. However, a few farmers (3%) of those who applied alternative strategies indicated the best practices had improved their family's living standards and reduced food insecurity.

4.8 Usefulness of Alternative strategies/best practices in addressing household food insecurity.

To further address objective four, the respondents were also asked to identify and rank the usefulness of the alternative strategies/best practices that can be applied in addressing the household food insecurity situation within Makueni County. Using Likert scale, the ranks were: Strongly Agree (SA), Agree (A), Don't Know (DK), Disagree (D), and Strongly Disagree (SD) were used. The findings are shown in Table 4.29.

Table 4.29: Statements on Usefulness of Alternative strategies/best practices in addressing household food insecurity

Statements	SA	A	DK	D	SD	N	Mean	Std. Dev
Support through irrigation can boost food production at family level.	337	63	0	0	0	400	1.16	0.365
Adoption of agricultural technology at household level can address food insecurity.	296	104	0	0	0	400	1.26	0.439
Establishment of agro-based industries for processing produce in the area can boost food availability.	226	174	0	0	0	400	1.44	0.496
Regular provision of communication to farmers on weather and climate dynamics can support food production activities.	42	358	0	0	0	400	1.90	0.307
Minimization of postharvest losses.	43	357	0	0	0	400	1.89	0.310
Ensuring proper food storage.	103	297	0	0	0	400	1.74	0.438

(Source: Field Data, 2021)

Based on Table 4.29, many respondents were of the opinion that support through irrigation can boost food production at family level, adoption of agricultural technology at household level can address food insecurity, and establishment of agro-based industries for processing produce in the area can lift food availability with mean scores of 1.16, 1.26 and 1.44 respectively. Also, majority of the respondents agreed that regular provision of communication to farmers on weather and climate dynamics can support food production activities, minimization of postharvest losses and ensuring of proper food storage are useful best practices in addressing household food insecurity with 1.90, 1.89 and 1.74 mean scores respectively.

The above findings are also buttressed by the respondents' suggestions on what should be done to enhance household food security in the region. Their suggestions are as indicated in Table 4.30.

Table 4.30: Measures to Enhance the Household Food Security

Measures	Frequency	Percentage
Irrigation	381	95%
Proper and effective agricultural practices	311	78%
Encouraging hard work and putting clear strategies that aim at improving food production	308	77%
Adopt new agricultural technology at household level and minimize post-harvest losses	324	81%

(Source: Field Data, 2021)

Most respondents (381, 95%) reported that irrigation was one of the measures of enhancing household food security. The other measures that were suggested by the respondents as measures of enhancing food security were: 329(82%), proper and effective agricultural practices, 311(78%), encouraging hard work and putting clear strategies that aim at improving food production, 308(77%) and 324(81%) indicated that the adoption of new agricultural technology at household level and minimizing of post-harvest losses as some of the measures that can be put in place to enhance household food security.

A few studies have also been done which appear to confirm this study's findings on some of the strategies that can be applied to improve food security. For instance, Ogutu (2011) observes that many African countries have responded to food shocks predominantly by use of social safety nets. He criticizes these responses and instead argues that African agricultural sectors should be given the right investments and incentives to produce sufficient food. To increase food productivity, Africa must enhance use of chemical fertilizer from an average of 8.8 kg per hectare to an average

of 50 Kg per hectare, a level that has been reached by many middle income countries. Ogutu (2011) further states that the use of fertilizer must be done alongside enhancement of irrigation. The continent is also supposed to embrace plant breeding and application of biotechnology in order to increase agricultural productivity. Rukuni (2002) acknowledges that Africa continues to suffer from food insecurity and states that the continent has not invested adequately in policy environment, institutions serving farmers, technology to transform traditional agriculture and infrastructure and hence poor agricultural productivity. Rukuni (2002) asserts that for sustainable development in agriculture, the continent will require to invest in new technology in agriculture, human capital in professional managerial and technical skills, growth in biological capital, favorable economic environment and improvement in the performance of institutions such as credit, marketing and research among others. Rose (2008) points out that to enhance agricultural production in Latin America, agricultural research and extension will play a crucial role. She also recommends the need for developing local capacity via community-based participation and also suggests the need to focus on over-consumption when tackling food security issues.

Other studies include Amede (2008) who undertook a study on modelling crop-livestock systems for achieving food security and increasing production efficiencies in the Ethiopian Highlands. Their study revealed that the production systems used in the region does not enhance food security due to decreasing farm size and increasing resource degradation. The study suggested the need to enhance food security through reallocation of land and minimizing resource degradation. The study also calls for the need for better understanding of farmers' attitudes to risk, vulnerability and access to resources. Kimiywe (2015) examined post-harvest challenges in relation to food and

nutritional security in Kenya. The study revealed that some of the causes of food insecurity include minimal value addition, poor transportation, high post-harvest wastages and losses, and absence of quality seeds among others. Kimiywe (2015) recommends organization of small scale farmers by food processing firms to increase the farmers' output through building of processing plants closer to the farms, centralization of marketing, cooling, and storage facilities, and providing means of transport. Other recommendations include providing farmers with suitable technology and establishing field schools for enhancing agricultural skills of the farmers. On their part, Smith and Gregory (2012) states that the greatest challenge of the 21st century is how the world will be able to feed her enormous population which is likely to hit ten billion by 2050 without relenting on the effort to reduce environmental impact such as the biodiversity loss and greenhouse gas emission among others. They suggest that strategies that escalate production of food nonetheless increasing emission of greenhouse gases. For instance, Nitrogen (N) fertilizer that fueled green revolution is unlikely to be sustainable. They call for measures that will boost efficiency of agriculture like reducing demand for food products by reduction of food wastage and changing dietary patterns, or maximize food output in compared to the agricultural inputs.

The above literature is indicative of the fact that food insecurity remains a global challenge amid the rising population. Although the studies have given some general recommendations of some of the ways required to address food insecurity, the current study revealed specific household strategies that can help to mitigate the problems of household food insecurity within Makueni County.

CHAPTER FIVE

5.0 SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter summaries findings of the study in addition to concluding and making relevant recommendations according to the findings. Among the recommendations are the suggestions of suitable areas for additionally inquiries.

5.2 Summary of the Findings

This study focused on four main objectives namely: to examine the socioeconomic determinants of household food insecurity within Makueni County; to examine coping and adaptive strategies undertaken by households to enhance food security; to assess the effectiveness of institutional frameworks used in addressing household food insecurity; and to evaluate alternative strategies that can be used to enhance household food security within Makueni County.

Before addressing the study's specific objectives, the general characteristics of the study area were examined and also confirmed whether the households are food insecure or not. Based on the observation schedule, the study found out that the households' environment was 40% clear cut grass, 35% had trees and crops while 22% was bushy. The area is relatively poor as reflected by semi-permanent nature of houses and pit latrines. As an indicator of shortage of water, about 67% of the respondents had roof catchment gutters for water harvesting. However, 73% of the households did not have outside water storage facilities. Generally, the households are food insecure most of the times as confirmed by 75% of the respondents.

With regard to the first objective which sought to ascertain how socioeconomic factors influence food insecurity, the findings reveal that apart from the known fact of the bio-physical factors, different socioeconomic variables also affect household food insecurity. They include number and age of dependents, education level, gender, marital status and occupation. Other social factors include unavailability of extension services and inaccessibility of information on climatic and weather conditions. The economic factors that were found to influence food security in the region include but not limited to access to markets, land size, land tenure, substitute economic activities, access to credit facilities and income levels. Other economic variables found to have an influence on food insecurity include cost of inputs, technology and expenditure patterns among others.

The findings indicated that majority (78%) of the respondents who engaged in farming activities were aged between 21 and 60 years. This age category, if well trained on good farming practices is able to provide the much-needed labor force for food production in the region. 62% of the respondents were female suggesting that women, who were the majority, actively participate in activities relating to solving the household food insecurity within Makueni County. The study further found that majority (87%) of the respondents had basic literacy skills (had attained primary and secondary level) and therefore can be well trained on the effective household food insecurity interventions in the County. The study revealed that greater number (78%) of the respondents had 3-6 regular dependents in their household units. Most (75%) of the regular dependents were aged 0-20 years. Family size and age of the dependents tends to influence food insecurity situation and this in turn impacts on the efficacy of household food insecurity interventions. Dependents below 20 years and those over

60 years depend on the respondents for their daily provisions which can be a challenge in ensuring there is food security.

The study also found out that about 61% of the household heads were involved in farming activities. The main livelihood activities together constituting 89% were mixed farming and crop farming. Other economic activities carried out by the respondents include charcoal burning (72%), sale of sand (42%), and brick farming (26%). This implies that the respondents are highly vulnerable to food insecurity because they do not have reliable alternative sources of income to help them to mitigate food shortages. The findings also show that the income level of nearly all (95%) of the respondents was less than KSh 10,000 every month and this seriously impacts on their purchasing power of the basic needs and affecting the food security situation in Makueni County. In addition, the findings of the study indicated that much of the household income was spent on food items implying that food production was not in sufficient quantities so they had to use a big part of their incomes in purchasing food. Household expenditure of KSh 10,000 and below accounted for about 93% of the respondents with most (63%) spending between KSh 5,000 to 10,000 per month.

Land is an important factor of food production. According to the study findings, about 71% of the respondents owned between 1 and 2.5 acres of land with most 48% owning 1.5 acres and below. Although, over 80% of the respondents owned their land, the land size for most of them is a limiting factor for adequate food production especially given that most of them have not adopted the best agricultural practices such as irrigation and use of technology. The findings equally indicated that cash crop

cultivation had been given very minimal land. Therefore, cash crops farming was generated limited income for the respondents.

The study results further revealed that most of the farmers agreed and strongly agreed that they face food insecurity because they lacked access to credit facilities; large family size; lack of extension services; high cost of inputs; lack of adequate land; destruction by pests; and premature sale of harvested food to meet non-food needs of the family like payment of school fees and medication among others. Other factors that contribute to food insecurity include lack of adequate capital, lack of good agricultural technology and lack of adequate communication on weather and climate which can help them to be equipped with information on planting period, harvesting and other activities. The results of the hypothesis (household food insecurity in Makueni County is significantly influenced by socioeconomic factors) showed that the two variables had significant statistical relationships. Therefore, the alternative hypothesis that; socioeconomic factors have significant influence on household food insecurity was accepted.

The study's second objective was to examine how coping and adaptive strategies affect enhancement of household food security. On coping strategies, majority (79%) of the respondents agreed that they engaged in small scale businesses to support their families with food, (91%) indicated they kept livestock which they sold to provide food for their families, 61% engaged in casual labour to provide food for their families. Other coping strategies which respondents used to cope with food insecurity include food rationing (76%), purchase of cheap food items (79%), eating wild fruits and animals (39%), 78%) trade-offs (buying food at the expense of other family needs like payment of fees and medication). Receiving of remittances from relatives

and friends, food aid from the government and private sector as well as eating a lot of food when it is in plenty were also mentioned as coping strategies though by smaller number of respondents. The adaptive strategies which were limited in use include small scale irrigation, engagement in formal employment and keeping of livestock as a way of diversifying systems of livelihood.

On this objective, it was hypothesized that there is a significant effect of coping and adaptive strategies on enhancement of household food security within Makueni County. The results showed that coping and adaptive strategies significantly predict household food insecurity. Therefore, the hypothesis that; there is a significant effect of coping and adaptive strategies on enhancement of household food security within Makueni County was accepted. Although the coping and adaptation strategies were mechanisms of addressing household food insecurity, they only served to cushion the farmers from severe vulnerability to food shortage. The strategies that were applied were therefore not successful in addressing food insecurity challenge. The reasons given by the households for the non-success of coping and adaptation strategies in eliminating food insecurity include the death of cattle due to drought, poor climatic conditions and expensive food commodities. The respondents also indicated that the strategies were not successful due to lack of government support, lack of knowledge on how to curb food insecurity, absence of dams for irrigation, business giving very little income and lack of irrigation schemes in the area.

In order to improve coping and adaptive strategies, the respondents suggested provision of loans for businesses, need for capacity building, the government to support the households with dams for irrigation, need to use modern technology for diverse activities such as poultry keeping and support for drilling of boreholes and

water harvesting. Nearly all (91%) of the respondents indicated that abandoning farming all together would not be a solution to food insecurity problem in the area.

The study's next objective was to examine how food insecurity relates with application of institutional frameworks. Approximately 74% of the respondents indicated that there were no institutions intervening on matters of food insecurity in the region. The respondents who indicated that they were aware of institutions providing intervention measures on food insecurity mainly cited NGOs, CBOs and churches. The local administration, Government ministries and politicians were not seen to be giving much support to households on food insecurity. Over 85% of the respondents did not support the statement that the institutions provided adequate and regular food aid to households with a mean score of 1.74. Over 80% of the respondents also disagreed with the statements that the institutions support households with relief seeds, training of farmers on good agricultural practices and technology and provision of extension services. Most (86%) of them also indicated that they did not get assistance in form of water for irrigation, information on weather and climate and credit facilities. The respondents also indicated that they were not provided with support in the areas of marketing, quality assurance, information communication technology and inputs with mean scores of 1.95, 1.82, 1.98 and 2.38 respectively. The hypothesis for this objective was that the institutional frameworks applied have significantly enhanced household food insecurity within the County. The analysis established lack of significant link between institutional frameworks and food insecurity. The findings therefore indicate that the institutional interventions of addressing household food insecurity within Makueni County were not effective. The implication is that the institutional frameworks applied have not significantly enhanced household food insecurity within Makueni County.

The fourth objective sought to evaluate the alternative strategies that can be used to enhance household food security within Makueni County. The study established a general absence of alternative strategies with only few being available to address the food insecurity situation in the County. The findings reveal that 81% of the respondents indicated that there were no alternative or best agricultural strategies that were applied at the household level to enhance food security. However, the study found out that there were few alternative strategies available such as the construction of water dams to act as a reservoir of water. The water harvested in these dams was used for domestic and farming activities during the dry seasons. Secondly, there was establishment of some irrigation schemes which assisted the farmers to irrigate their crops when there is little or no rainfall at all. Thirdly, another alternative strategy that had been applied is the training of farmers on good agricultural practices which when applied will assist the farmers to improve their agricultural yield. Fourth, the provision of adequate and timely information concerning the weather patterns in the area enabled the farmers to know when to plant their crops so that they can have maximum yield.

With regard to farmers' perceptions on the alternative or best strategies that can be applied to boost food production in the area, majority (over 80%) of the respondents indicated that the best strategies that when applied will be useful to address food insecurity include: adequate supply of irrigation facilities, adoption of agricultural technology, establishment of agro-based industries. Other best strategies that can be used to boost food security as reported by the respondents include; timely provision of communication on weather and climate, minimizing post-harvest losses,

diversification of systems of livelihood and ensuring proper food storage. The alternative strategies can assist in addressing food security in Makueni County.

5.3 Conclusion

The study evaluated the socioeconomic determinants of household food insecurity, coping and adaptation strategies to eliminate food insecurity, institutional interventions to food insecurity and possible alternative or best strategies of enhancing food security in Makueni. The study established that over 80 % of the respondents did not have sufficient food for their families in most times. Food insecurity in the region is as a result of the interplay between bio-physical and socio-economic factors. This study however focused on the social-economic determinants of food insecurity. The study established that the social factors that influenced food insecurity include the number and age of dependents, education level, gender, marital status, occupation, availability of extension services, and accessibility of information on climatic and weather conditions. The study also concludes that the economic factors like access to markets, land size, land tenure, access to credit facilities, income levels, cost of inputs, technology and expenditure patterns among others are directly linked to food insecurity within the sampled region. Thus, solutions towards addressing food insecurity should therefore be aimed at not only addressing the bio-physical factors but also the socio-economic variables as they have significant influence to food insufficiency in the region.

With regard to the coping and adaptive strategies to food insecurity, this study concludes that over 80 % of the respondents are resilient to the challenges of food insecurity. They engaged in several coping strategies such as starting small scale businesses sale of livestock, looking for casual labour jobs, food rationing, food aid,

purchase of cheap food items, eating wild fruits and animals and trade-offs (buying food at the expense of other family requirements such as paying fees and medication) among others. The adaptive strategies used include small scale irrigation, formal employment and keeping of livestock. Although the study concluded that coping and adaptive strategies significantly predict food insecurity, most respondents indicated that the strategies were not successful in addressing household food insecurity within the sampled county. The study concludes that the coping and adaptive strategies are merely firefighting mechanisms and therefore the need to look out for ways of enhancing these strategies and also explore effective and sustainable food production systems.

On the issue of institutional interventions on food insecurity in the region, the results have indicated that institutional frameworks applied have not significantly enhanced household food security within Makueni County. The study concludes that the role of the Government and the private sectors has not been adequately felt at the household level as far as redress of the problem of food insecurity is concerned. This therefore raises the question of policy formulation and implementation of the same so that the households can feel the impact of the interventions by these sectors.

As far as the alternative /best strategies for addressing food insecurity are concerned, the study established minimal application of the strategies that can bolster food production at the household level. This study concludes that the households continue to be in cyclic food insecurity because they have not adopted best practices such as irrigation, agricultural technology, awareness of weather and climate patterns and changes, agricultural extension services, engagement in agro-based firms for value addition and capacity building on diverse systems of livelihood among others.

5.4 Recommendations

Based on study findings, this study observed that efforts to improve food security situation at the household level in Makueni County be focused not only on the bio-physical determinants but also on the socio-economic factors that influence food insufficiency in the area. The study recommends the following specific issues:

1. With regard to the objective on socio-economic determinants that influence food insecurity in Makueni County, this study recommended as follows:
    (a) That the socio-economic variables influencing food insecurity be addressed alongside the bio-physical variables by among other things ensuring that farmers are supported to access credit which they can use to boost their food production and in diversifying their systems of livelihood.
    (b) That there is need to prioritize on extension and agricultural research in order to promote and implement efficient use of the available land by the farmers.
    (c) That the study found out that there are a large number of young people who are dependent on the little that is harvested from the farms. It will be appropriate to also come up with youth related income generating programmes that can offer some income that can be used to purchase food.
2. The study also examined the coping and adaptive strategies used by households in addressing food insecurity. In this regard, the study recommends that these strategies be strengthened by ensuring that:

(a) Concerted effort by both the national and County Government of Makueni is made to enhance capacity building in areas such the new agricultural technology, weather and climate patterns, irrigation, diversification of livelihood/alternative strategies, marketing and inputs among others.

(b) The private sector such as the insurance companies to consider to come up with an insurance programme that can cover farmers against losses during times of crop failure.

3. On the issue of the role of institutional interventions and the use of best practices in enhancing food security in Makueni County, this study recommends:

(a) Need for increased level of involvement of public and private institutions at the household level to support farmers who bear the brunt of food insecurity in Makueni County.

(b) Need for participatory based and workable National and County Government policies and programmes that are able to support food security at the household level in a sustainable manner.

(c) That the area was found to have abundance of mangoes and so there is need for enhancement of agro-based industries such as fruits processing factories as a way of ensuring prolonged preservation of the fruits beyond the harvesting season when they are in plenty.

(d) Need to explore ways of using technological interventions like the use of Short Text Messages (SMSs) for constantly updating farmers with issues such as market prices for food crops and weather and climate updates. This will enable farmers to be well equipped with information regarding food production, harvesting, distribution and marketing without incurring losses.

(e) Need to enhance support of the already existing best agricultural practices such as small scale irrigation and explore a wide range of best agricultural strategies that can enhance food production in the region.

Thus, to make the households in Makueni county food secure, all the above-mentioned recommendations should be implemented taking the form of an integrated approach/model which is shown in figure 5.1 below. Effective interventions on food insecurity will involve households, county and national government and the private sector. Broad based agricultural and industrial programmes will require to be implemented in the area to enable the farmers to produce adequate food and also have income to purchase food. Since food insecurity is a multifaceted issue, it requires an integrated approach involving improvement of all the sectors including agriculture, education, health, infrastructure, and information and technology for sustainable food production. This model if implemented can offer long-term oriented solution to the recurrent food insecurity at the household level in Makueni County.

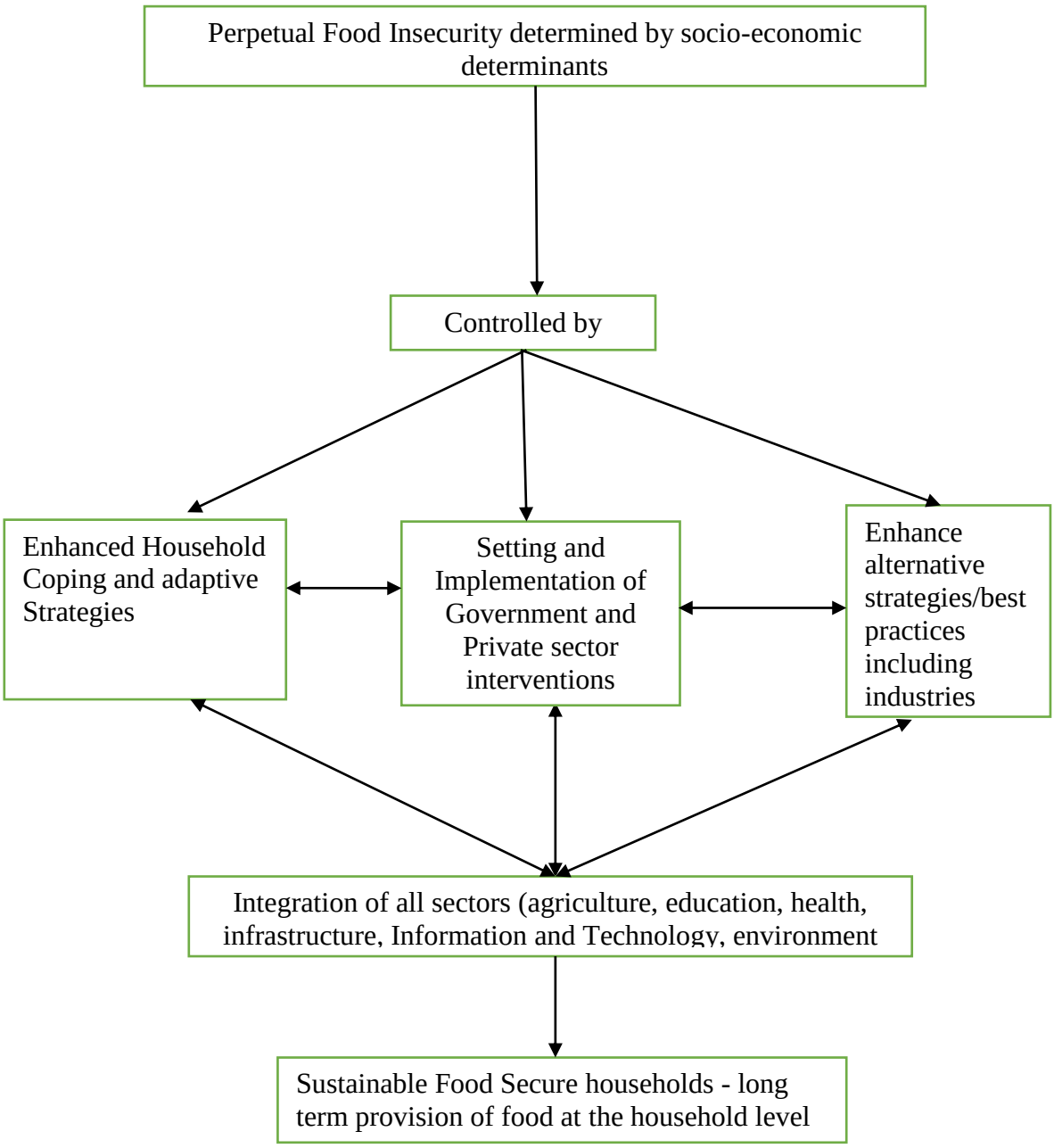

Figure 5.1: An Integrated model of ensuring sustainable food security in Makueni County

(Source: Author, 2021)

5.5 Suggestions for Further Studies

This study focused mainly on socio-economic determinants of food insecurity, coping and adaptive strategies, effectiveness of interventions to food insecurity and the alternative strategies that can be applied to enhance food security at the household level in Makueni County in Kenya. Further research is required to:

1. Study the impact of climate change on household's systems of livelihood particularly on food shortages and various income shocks.
2. There is a need for additional longitudinal data to understand causality in relationships and the impact of food insecurity at the household level in Makueni County.
3. More comprehensive research studies, with adequate time allocation and adequate considerations of both crop and livestock based food sources are required for a better understanding of household security.
4. It will also be crucial to undertake a baseline survey to assess on the potential for diverse economic activities such as manufacturing industries, tourism and others that can enhance job creation for the youth.
5. During the study, a number of people, especially women were found travelling long distances to fetch water. Further research is required on how these impacts on their ability to provide for their families.

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7.0 APPENDICES

Appendix 7.1: The Seventeen Sustainable Development Goals

1. Ending all forms of poverty
2. Ending hunger, attain food security and enhance nutrition and stimulate sustainable agriculture".
3. To ensure people have healthy lives and support wellbeing for all persons of all ages.
4. Ensuring that there will be all-encompassing and fair quality education and uphold lifelong learning for everybody.
5. Realise gender equality and empowerment of all women and girls
6. Ensure water and sanitation are available for all and be sustainably managed.
7. Ensure modern energy is accessible and affordable, reliable, sustainable and for all.
8. Promote continual all-encompassing and sustainable economic growth, full and productive employment, and descent work for everybody.
9. Develop robust infrastructure, support wide-ranging and sustainable industrialization and raise innovation.
10. Reduction of inequality among and within nations.
11. Cities and human settlements be made inclusive, safe, resilient and sustainable.
12. Ensure consumption and production patterns are sustainable.
13. An urgent action be taken to combat climate change and its effect.
14. Oceans, seas and marine resources be conserved and well used for sustainable development.

15. Terrestrial ecosystems be protected, restored and stimulate sustainable use and management of forests, fight desertification and stop and reverse land deprivation.
16. Ensure promotion of peaceful and all-encompassing societies for sustainable development, offer access to justice for everybody and build effective, accountable and inclusive institutions for all.
17. The means of implementation be strengthened and rejuvenate the global corporation for sustainable development.

Source: FAO (2016)

Appendix 7.2: History of Major Droughts in Ukambani

Year	Name of famine	Drought Index		Impact	Cause	Intervention by Govt. & Others
		LR	**SR**			
1840-1843	Famine of hides and skins					
1845-1850	*Kiasa*					
1870	*Ngeetele*					
1878-1882	*Ndeta* (Famine of star)					
1895	*Yua ya Ngali* (Uganda railway famine)		-1.51(S)		-Drought, war	None
1896		-1.47(s)				
1897-1901	*Muvunga* (Famine of rice) and Y*ua ya Munyil*i (Famine of livestock Dysentry)	-0.94(s)	-0.78(m) -0.69(s)	Human deaths estimated up to 50-75% of the population		
1903			-0.93(s)	No record		
1904		-0.81(s)				None
1907			0.74(m)	'A minor famine' (Lindblom)	-Drought	
1908		-0.89(s)				
1909		-1.68(s)				
1910		-0.80(s)	-0.49(l)			
1913	*Yua ya Malakwe (*Famine of beans)		-0.63(m)	Food shortages	- Coincided with Sahelian famine	
1914-1918	*Kau wa Muthyaka* (Famine of First	-0.67(m)	-0.44(m)			

	World war fought with bows and arrows)					
1928	*Kakuti*	0.49(l)	-0.47(l)		-Drought, locusts, Quelea birds	-Appeal for famine relief dismissed by governor
1929-1930	*Yua ya nzalukangye* (Famine full of blinks due to looking everywhere for food)	-1.47(s)		-Food shortage -Denudation of grassland -Cattle deaths		
1933		-1.90(s)		-Food shortages, cattle deaths	-Drought, locusts	-Maize and pigeon peas distributed -Cattle tax suspended
1939	*Kau wa Italia(*Famine of world war II with Italians in Ethiopia)		-1.11(s)	-Food shortage	-Drought Conscription (Italian/Somali/Ethiopia war)	-Maize imports -Crops exports banned
1942	*Mbuluga* (Beans bought from Kikuyu during famine)					
1943	*Munyoloko upesi* (Famine of cassava) -*Yua ya wimbi* (famine of millet)		-0.73(m)			-Maize imports
1944		-040(l)			Drought, Locusts	-Food Relief
1945		-1.58(s)	-0.30(l)	-Human mortality low	-Military demands	-Famine Relief -Intensified soil conservation.
1946		-0.83(s)	-0.37(l)			

1949	*Yua ya makonge* (Famine of sisal)	-0.70(m)	-0.61(m)	-Sisal sold to buy food		
1960	*Yua ya mafuriko na Ndeke* (Famine of aeroplane/helicopter)		-0.74(m)	-Food shortages -Cattle deaths (70%-80% among maasai) -Flood destroyed crops	-Drought followed by Floods.	-1 million pounds spent on food aid and air drops.
1965	Yua ya Atta (Famine of Atta-i.e reddish wheat flour)	-1.00(s)	-0.36(l)	-Food and fodder shortages	-Drought	-Large food imports -Cattle movements
1969		-0.61(m)	-0.34(m)			
1971			-0.62(m)			
1972		-1.21(s)		-Food and fodder shortages -Cattle deaths (up to 80% among Maasai)	-Drought	-Government food aid -Drought resistant crops -Stock improvement schemes
1973		-1.24(s)	-0.82(s)			
1974			-0.67(m)			
1975		-1.00(s)	-0.96(s)			
1976		-0.88(s)	-0.41(l)			

1980			0.47(l)	-Food shortage	-Drought -Depletion of maize stocks by early exports	-NGO food for work programmes.
1981			0.80(s)			
1983/ 84	-*Nikwa Ngwete* (I am dying with cash in my hands but no food to buy)	-0.92(s)	0.54(m)	-Food shortage -Cattle deaths	-Drought -High prices	-MIDP and other terracing programmes, -International aid -Yellow maize imports.
1987		-0.82(m)	-0.75(m)			

Key: L= Light Drought; M= Moderate Drought; S= Severe Drought; LR= Long Rain; SR= Short Rain

Source: Tiffen, M. et. al (1994)

Appendix 7.3: Questionnaire for Farmers

Introduction

This questionnaire is aimed at gathering information from farmers concerning food insecurity. The study is based in Makueni County in Kenya. The information sought is to enable the Researcher complete Doctor of Philosophy Degree (PHD) of Kenyatta University. The information acquired was used for academic purposes only. Consequently, all information supplied was treated confidentially. The findings and recommendations of the study was significant because the data can help to improve the livelihoods of farmers in the region not only by ensuring increased agricultural productivity but also in seeking long term engagements in other sectors such as industry and service.

Section A. Demographic Data

Q1. Please indicate Age (in Years) ----------

Q2. Please tick (√) Gender

(01) Male (02) Female

Q3. Please tick (√) marital status

(01) Married (02) unmarried (03) Divorced/Separated

Q4. Please indicate highest level of education

(a) None (b) Primary (c) secondary (d) Middle level college (d) university

Q5. Indicate the number of your regular dependents……..

Q6. Please indicate the age of each of regular dependents.....

Q7. Please indicate current occupation of head of the household.....

Q8. What are the main sources of income?

(a) Business (b) formal employment (c) farming (c) Others (specify)

Q9.What is your main livelihood activity?

(a) Crop farming (b) Livestock grazing (c) Business (d) mixed farming (e) Others (specify)

Q10. Please indicate income levels in KSh per month

(a) Less than 5,000 (b) 5,000-10,000 (c) 10,000 and above.

Q11. Please indicate your household food expenditure in KSh per month

(a) Less than 5,000 (b) 5,000-10,000 (c) 10,000 and above

Q12. Please indicate your approximate percentage of household

Expenditure food to your total monthly income.....

Section B: Socioeconomic factors contributing to household food insecurity within Makueni County

Q1. Please indicate the size of your farm in acres.....

Q2. Please indicate land tenure (a) family owned (b) lease (c) rented (d) communal (e) Others (specify).....

Q3. What are the main activities that take place in your land (please rank them in order of priority - where 5 is the main activity and 1 is the least activity)?

Sno.	**Activity on land**	**Rank**
1	Cash crop	
2	Food crops	
3	Grazing	
4	Wood lot	
5	Other (specify)	

Q4.What size of your land is reserved for food crops (in acres)?.....

Q5.What size of your land is reserved for cash crops (in acres)?.....

Q6.Do you have sufficient food for your family most of the

time?.....

a) Yes

b) No

If yes/no, please explain.....

Q7. (i) What kinds of food are consumed in this household?

a) …….

b) ……....

c) ……....

d) ……....

(ii) How many meals do you eat in a day?

a) One

b) Two

c) Three

d) Other

(iii) How many meals you take per day during dry/wet season do?

a) One

b) Two

c) Three

d) Other

Q8. What kind of foods does your household often eat during rainy/dry season?

(i)

(ii)

(iii)

Q9. Has the type of foods eaten by your household changed over the last 10 years?

(i) Yes

(ii) No

If Yes or No, please explain…….....

Q10. How often does your household go without a meal during rainy/dry season?

a) Very often

b) Often

c) Not often

d) Not at all

Q11. Please explain your answer in Q11 above…….....

Q12. Please indicate and rank what you consider to be household food insecurity using the ranks Strongly Disagree (DS), Disagree (D), Don't Know (DK), Agree (A), and Strongly Agree (SA).

Measure of household Food insecurity	**Rank**				
	S.A	A	D.K	D	S.D
I do not get adequate harvest to cater for my family food requirement most of the time					
I cannot afford enough food for my family most of the time					

Q13. Please indicate your level of agreement with following statements on socioeconomic factors and your household food security.

Use Strongly Disagree (DS), Disagree (D), Don't Know (DK), Agree (A), and Strongly Agree (SA).

Socio-economic factors contributing to food insecurity	**Agreement Level**				
	SA	A	DK	D	SD
There is inadequate land for producing enough food for my family					
My food production is limited because farm inputs are very expensive					
Non-food needs of my family such as medical care and school fees make me sell my harvests immediately					
Pests destroy most of my food crops					
My ability to produce adequate food for the family is hindered by the extreme costs of farm inputs					
My ability to produce food that adequate for my family is hindered by the absence of extension services					
The large size of my family makes it impossible for me to produce adequate food for it.					
My spouse wastes a lot of our income in the consumption of tobacco and/or alcohol					
In ability to access credit facilities hinders me from doing good farming					
Old age prevents me from engaging in good farming					
I lack good market to sell my agricultural products					
I hardly access adequate information on climate and weather patterns					
Others (specify)					

Section C: Coping and adaptive strategies of enhancing household food security within Makueni County

Q1. What is your average harvest in Kgs for your main food utilities (maize, beans and cow peas) during:

a) Long rain season? (Indicate the quantity of each separately)

b) Short rain season? (Indicate the quantity of each separately)

Q2. Approximately how many Kgs of your main food utilities do use in your household per annum?

Q3. In the face of food insecurity which assets do you choose to invest in or choose to run down

Assets invested on	**Reasons for investment**	**Assets run down**	**Reasons for running assets down**

Q4. Please list down and rank the coping strategies that you use to enhance household food security. Indicate as: Strongly Disagree (DS), Disagree (D), Don't Know (DK), Agree (A), or Strongly Agree (SA).

Coping strategies undertaken by households to enhance food security	**Rank**				
	S.A	A	D.K	D	S.D

Q5. Please indicate what has made the above coping strategies successful or not successful in enhancing food security at the household level?

……...

……...

Q6. Please indicate what action should be taken to improve on the coping strategies that you have identified in Q 3 above.

Coping strategy	**Action of improving the coping strategy**

Q7. Please list down and rank the adaptive strategies that you use to enhance food security at household level. Indicate as: Strongly Disagree (DS), Disagree (D), Don't Know (DK), Agree (A), or Strongly Agree (SA).

Adaptive strategies undertaken by households to enhance food security	**Rank**				
	S.A	A	D.K	D	S.D

Q8. Please indicate what has made the above adaptive strategies successful or not successful in enhancing food security at the household level?

Q9. Please indicate what action should be taken to improve on the adaptive strategies that you have identified in Q 6 above.

Adaptive strategy	**Action of improving the adaptive strategy**

Section d: Institutional interventions used in addressing food insecurity in Makueni County.

Q1. Are there any institutions that often comes to your aid because of food insecurity?

a) Yes

b) No

Explain your answer----------

Q2. If Yes in Q1 above, please list down those institutions and indicate their role

Sno.	Institution	Roles
1		
2		
3		
4		

Q3. Among the listed institutions below, kindly rank them on the basis of support that they give to the community during food insecurity (Rank each as: Most supportive (M.S); Supportive (S); Less Supportive (L.S), Don't Know (DK); Not supportive (NS)

Institution	**Level of support to community**
Local administration (County Commissioners, Sub-County commissioners, chiefs	
Government Ministries	
Political representatives - Mps,	

Ward Representatives	
NGOs	
CBOs	
Churches	
Other (Specify)	

Q4.Do you belong to any group (Women group, youth group, self-help group, faith-based group etc) If Yes Specify…….

Q4. (b) Please indicate the main functions of the group.....

Q5.Explain how the group assists you to deal with food related challenges ---------

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Q6. Please indicate and rank the effectiveness of institutional interventions used in addressing household food insecurity. Indicate as: Strongly Disagree (DS), Disagree (D), Don't Know (DK), Agree (A), or Strongly Agree (SA).

Institutional interventions used in addressing food insecurity	**Rank**				
	SA	A	DK	D	SD
The institutions provide adequate and regular food aid to households					
The institutions support households with relief seeds to enhance food production					
The institutions have trained farmers on good agricultural practices and technology to be able to produce adequate food for the family - Extension services					

Farmers have been assisted through provision of water for irrigation to boost food production					
Farmers are given adequate and timely information on weather and climate					
The institutions support households with credit for boosting food production					
Provide marketing support					
Provide quality assurance					
Provide Information communication technology support					
Provide inputs support					
Others (specify)					

Section e: Alternative strategies applied and how they can be in addressing the cyclic food shortage in Makueni County?

Q1. Are there any alternative strategies used in your region to address food insecurity?

(01) Yes (02) No

If No in Q1 above, explain…….

Q2. If Yes in Q1 above, please indicate the alternative strategies applied to address food security in your region.

(01)

(02)

(03)

Q3. Please indicate and rank the usefulness of the following best practices in addressing household food insecurity. Indicate as: Strongly Disagree (DS), Disagree (D), Don't Know (DK), Agree (A), or Strongly Agree (SA).

Best strategies of addressing household food insecurity	**Rank**				
	S.A	A	D.K	D	S.D
Support through irrigation can boost food production at family level					
Adoption of agricultural technology at household level can address food insecurity					
Establishment of agro-based industries for processing produce in the area can boost food availability					
Regular provision of communication to farmers on weather and climate dynamics can support food production activities					
Minimization of postharvest losses					
Ensuring proper food storage					
Others (specify)					

Q4. What is your view/opinion about the strategies in addressing food insecurity.....

Q5. Why do you think they have worked (or not worked)? .....

Q6. If yes or no in Question 4 above, please explain.....

Q7. What do you think should be done to enhance the household food security.....

Q8. Do you have any other comment/suggestion you wish to make regarding the issue of food security? .....

Thank you for your cooperation

Appendix 7.4: Observation Schedule

Please provide a tick (√) appropriately

Q1. Availability of pit latrine: (a) Yes..... (b) No..... If No, determine and describe the alternative to pit latrine.

Q2. If Yes in Question 1 above, describe the nature of pit latrine.....

Q3. Type of roof of the house (a) Iron sheet (b) Grass (c) Concrete (d) Other (specify).....

Q4. Type of Wall of the house (a) Mud (b) Concrete (c) Iron sheet (d) Other (specify).....

Q5. Type of floor of the house (a) Earth (b) Concrete (c) Other (specify).....

Q6. Roof catchment gutters (a) Yes..... (b) No.....

Q7. Water storage facility outside (a) Yes..... (b) No.....

Q8. If Yes in question 7 above, describe size and nature of the water storage facility.....

Q9. Describe nature of homestead environment (bushy, clear cut grass, with trees and crops etc).....

Q10. List down food crops in the farm.....

Q11. List down Cash crops in the farm.....

Q12. Indicate Condition of crops in the farm.....

Q13. Are there livestock (a) Yes..... (b) No.....

Q14. List down main crops sold in the nearby market.....

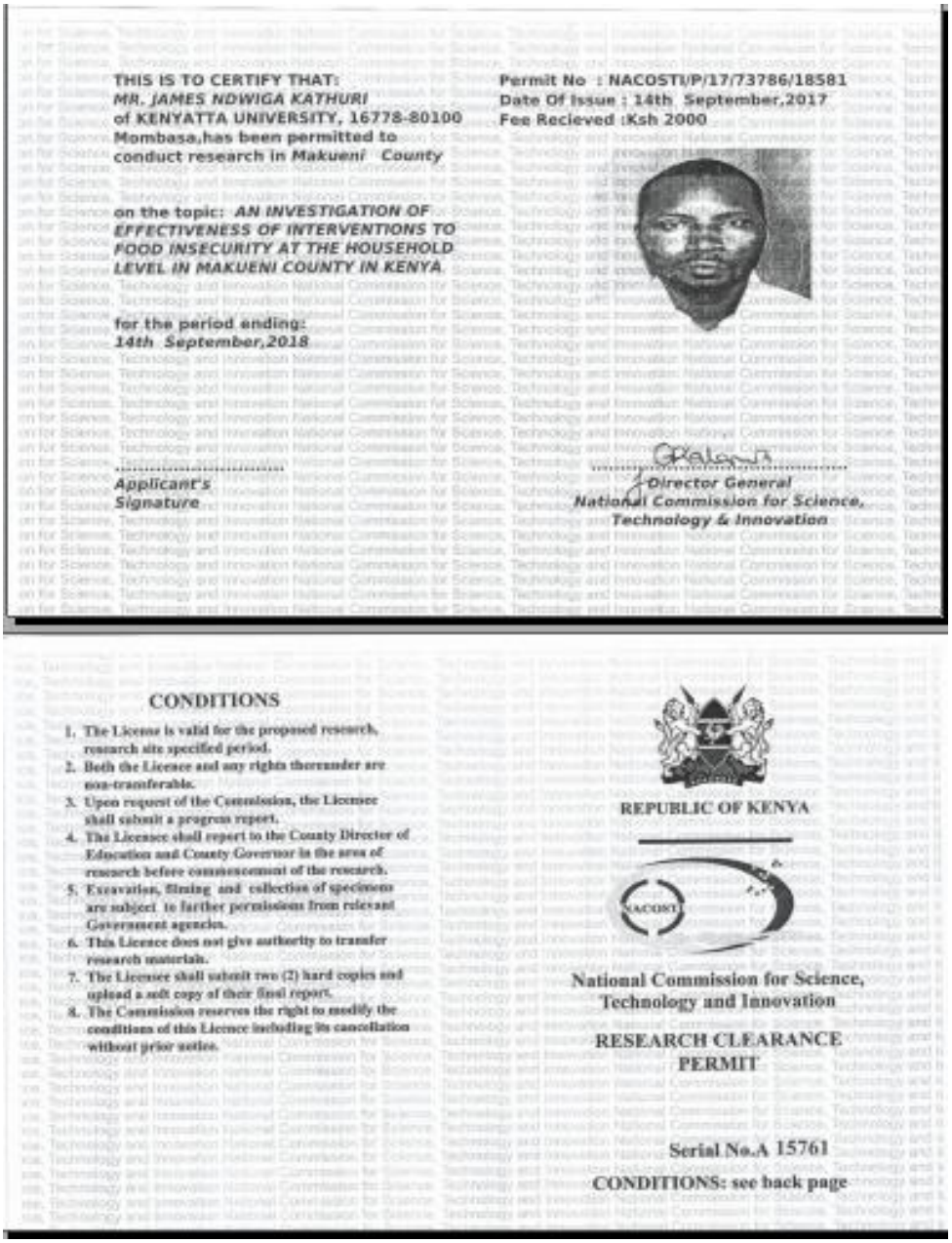
Q15. List down other activities engaged in other than farming.....

Q16. Is irrigation being carried out in the farm (a) Yes (b) No

Q17. If Yes in question 16 above, describe the size and nature of irrigation…….

Q18. List down industries available in the study area .....

Appendix 7.5: Research Permit



THIS IS TO CERTIFY THAT:
MR. JAMES NDWIGA KATHURI
of KENYATTA UNIVERSITY, 16778-80100
Mombasa,has been permitted to
conduct research in *Makueni County*

on the topic: *AN INVESTIGATION OF EFFECTIVENESS OF INTERVENTIONS TO FOOD INSECURITY AT THE HOUSEHOLD LEVEL IN MAKUENI COUNTY IN KENYA*

for the period ending:
14th September,2018

Permit No : NACOSTI/P/17/73786/18581
Date Of Issue : 14th September,2017
Fee Recieved :Ksh 2000

Director General
National Commission for Science,
Technology & Innovation

CONDITIONS

1. The License is valid for the proposed research, research site specified period.
2. Both the Licence and any rights thereunder are non-transferable.
3. Upon request of the Commission, the Licensee shall submit a progress report.
4. The Licensee shall report to the County Director of Education and County Governor in the area of research before commencement of the research.
5. Excavation, filming and collection of specimens are subject to further permissions from relevant Government agencies.
6. This Licence does not give authority to transfer research materials.
7. The Licensee shall submit two (2) hard copies and upload a soft copy of their final report.
8. The Commission reserves the right to modify the conditions of this Licence including its cancellation without prior notice.

REPUBLIC OF KENYA

National Commission for Science,
Technology and Innovation

RESEARCH CLEARANCE
PERMIT

Serial No.A 15761

CONDITIONS: see back page

Appendix 7.6 : Research Authorization Letter

NATIONAL COMMISSION FORSCIENCE, TECHNOLOGY ANDINNOVATION

Telephone: +254-20-2213471,
2241349,3310571,2219420
Fax: +254-20-318245,318249
Email: dg@nacosti.go.ke
Website: www.nacosti.go.ke
When replying please quote

9th Floor, Utalii House
Uhuru Highway
P.O. Box 30623-00100
NAIROBI-KENYA

Ref No. **NACOSTI/P/17/73786/18581** Date: **14th September, 2017**

James Ndwiga Kathuri
Kenyatta University
P.O Box 43844-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"An investigation of effectiveness of interventions to food insecurity at the household level in Makueni County in Kenya"*** I am pleased to inform you that you have been authorized to undertake research in **Makueni County** for the period ending **14th September, 2018.**

You are advised to report to **the County Commissioner and the County Director of Education, Makueni County** before embarking on the research project.

Kindly note that, as an applicant who has been licensed under the Science, Technology and Innovation Act, 2013 to conduct research in Kenya, you shall deposit **a copy** of the final research report to the Commission within **one year** of completion. The soft copy of the same should be submitted through the Online Research Information System.

GODFREY P. KALERWA MSc., MBA, MKIM
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Makueni County.

The County Director of Education
Makueni County.