

**THE INFLUENCE OF ALTERNATIVE APPROACHES TO SUSTAINABLE FOOD
SECURITY IN KYUSO DISTRICT**

KITUI COUNTY

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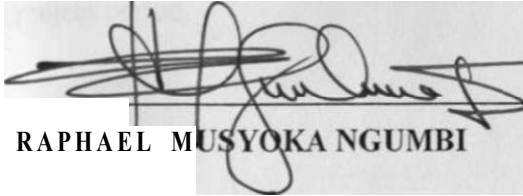
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REQUIREMENT OF THE AWARD OF THE DEGREE OF MASTERS OF ARTS IN
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2012

DECLARATION

This project is my original work and has not been presented for a degree or any other award in any other university or other institutions of higher learning.



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This project has been submitted for examination with my approval as university supervisor(s).

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DEDICATION

This Research Project is dedicated to my wife Sarah, our two daughters- Clarice and Sasha and our son Raphael Junior for their understanding, support and patience throughout the research project period.

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LIST OF ABBREVIATIONS AND ACRONYMS

ASAL	Arid and Semi-Arid Lands
MoA	Ministry of Agriculture
MDG	Millennium Development Goals
FAO	Food and Agriculture Organization
ADB	Asian Development Bank
GMCs	Genetically-modified crops
KFSSG	Kenya Food Security Steering Group
NGO	Non Governmental Organization
USAID	United States Agency for International Development
OFDA	Office of U. S Foreign Disaster Assistance
OCHA	Office for the Coordination of Humanitarian Affairs
SRA	Strategy to Revitalize Agriculture
NFNP	National Food Security and Nutrition Policy
KFSSG	Kenya Food Security Steering Group
IFPRI	International Food Policy Research Institute.
ESA	Eastern and Southern Africa
CRS	Catholic Relief Services
SGR	Strategic Grain Reserve

NCPB National Cereals and Produce Board.

ODI Overseas Development Institute

ABSTRACT

This study is concerned with alternative approaches to sustainable food security in Kyuso District-Kitui County. The objectives of the study includes; to establish how capacity building and increase in grain production can be used as approaches to influence sustainable food security in Kyuso district; to determine whether safe storage of grains and development of food grain tolerant to drought can influence food security; to explore the extent to which Genetically Modified Crops (GMCs) and dietary diversification have been used as approaches to food security in Kyuso District; to find out whether gender sensitive development and good governance can influence food security. The research design which was used was descriptive while several sampling methods such as stratified, cluster, purposive and convenient were used. Data was collected using a questionnaire which contained open as well as closed ended items. An interview schedule was also used to obtain data from the agricultural officers and the NGOs representatives who had been sampled. Descriptive statistical techniques were used to analyze various items of the questionnaire. These included averages, percentages, frequencies and totals. This study used frequencies and percentages because they easily communicate the research findings to majority of readers.

The study found out that the alternative approaches which had been identified had influence on sustainable food security in Kyuso District in that they increased food production, and knowledge of producing the food for instance research and capacity building. It also found out that though the approaches had influence on sustainability of food very few had been used to a great extent in the region. For instance it was established that GMCs had not be implemented in the District, dietary diversification was still poor because majority of the residents depended on maize products for their food. The study also found out that food security in the region could be attained by enhancing gender sensitive development which had not been attained in Kyuso.

The study thus recommends that; focus should be made towards ensuring that more awareness creation concerning GMCs and their influence on food security is done in Kyuso district. There is need for a lot of sensitization to be done on the alternative approaches as well as be implemented in the region. Gender sensitive development should be enhanced by women being educated on agricultural techniques, as well as increasing their literacy levels. Diet should be diversified from over-reliance on maize crop to other food varieties that could do well in the area as well as meat products such as fish products being introduced in the region. More agricultural officers are needed to be deployed to the region which is big and vast hence the few officers available are unable to reach majority of the farmers for capacity building and research work. There was no agricultural research institute in the region and the study strongly recommends that there is need for one to be established in the region. The study also recommends that the NGOs should move from distributing relief food to the residents to focusing on alternative approaches, particularly cash for assets and food for assets, to enhance resilience of the community to shocks and hazards associated with climate change. The government can also start irrigation schemes to increase food in the region since River Tana forms the boundary between the District and neighboring Tharaka Nithi District and therefore water from the river could be accessed easily for irrigation.

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

Food security as a concept originated only in the mid-1970s, in the discussions of international food problems at a time of global food crisis. The initial focus of attention was primarily on food supply problems - of assuring the availability and to some degree the price stability of basic foodstuffs at the international and national level. That supply-side, international and institutional set of concerns reflected the changing organization of the global food economy that had precipitated the crisis. A process of international negotiation followed, leading to the World Food Conference of 1974, and a new set of institutional arrangements covering information, resources for promoting food security and forums for dialogue on policy issues(ODI, 1997).In 1983, FAO expanded its concept to include securing access by vulnerable people to available supplies, implying that attention should be balanced between the demand and supply side of the food security equation:"ensuring that all people at all times have both physical and economic access to the basic food that they need"(FAO, 1983)

By the mid-1990s food security was recognized as a significant concern, spanning a spectrum from the individual to the global level. However, access now involved sufficient food, indicating continuing concern with protein-energy malnutrition. Definition was broadened to incorporate food safety and also nutritional balance, reflecting concerns about food composition and minor nutrient requirements for an active and healthy life. Also food preferences, socially or culturally determined, now became a consideration (FAO, 1983).The definition focused on a wider construct of social security which has many distinct components including, of course, health and

nutrition (Dreze & Sen, 1989). The 1996 World Food Summit adopted a still more complex definition:

Food security, at the individual, household, national, regional and global levels is achieved when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life (FAO, 1996).

This definition was again refined in The State of Food Insecurity 2001: Food security is a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life (FAO, 2002). This new emphasis on consumption, the demand side and the issues of access by vulnerable people to food, is most closely identified with the seminal study by (Sen, 1981). Eschewing the use of the concept of food security, he focuses on the entitlements of individuals and households. Essentially, food security can be described as a phenomenon relating to individuals. It is the nutritional status of the individual household member that is the ultimate focus, and the risk of that adequate status not being achieved or becoming undermined. The latter risk describes the vulnerability of individuals in this context. As the definitions reviewed above imply, 'vulnerability' may occur both as a chronic and transitory phenomenon.

According to Republic of Kenya (2008) and The World Food Summit (1996) food security is understood to exist when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. Food security encompasses food availability through production. Food security therefore is not the physical availability of any single commodity; such as maize in the Kenyan context. Neither does it imply just availability but must be accessible in terms of affordability in

adequate quantities, containing essential nutrients (Kiome, 2009). Food security is not just a supply issue but also a function of income and purchasing power, hence its relationship to poverty. Household food security is the application of this concept to the family level, with individuals within households as the focus of concern while food insecurity exists when people do not have adequate physical, social or economic access to food as defined above.

Food security is built on three pillars:

- Food availability: sufficient quantities of food available on a consistent basis.
- Food access: having sufficient resources to obtain appropriate foods for a nutritious diet.
- Food use (utilization): appropriate use based on knowledge of basic nutrition and care, as well as adequate water and sanitation (i.e., converting access to food into nutritional well-being),
- Stability (The World Food Summit, 1996; Brione, 2011).

Stability can be viewed in terms of the distinction made by Roumasset (1982) between long-term and short-term food security. The former refers to a permanent or persistent state of food security; for instance, high-income households may be able to ensure their continued access to food in the face of the most severe shocks. The latter refers to the period-to-period level of safety of households in ensuring at least a minimum level of food consumption (Briones Corcolon, Sumalde & Villancio, 1999). Hence, a poor household may momentarily enjoy adequate dietary intake, but remain food insecure in the short term as it remains vulnerable to entitlement shocks.

Only about two-thirds of the Kenyan population can be said to be currently food secure (Republic of Kenya, 2008). About a third (10 million) of an estimated 34 million people in Kenya suffers from chronic food insecurity, based on dietary energy supply. Food and nutrition

insecurity is closely linked to poverty. Kenya Food Security Steering Group (KFSSG), 2010) increased the projected number of people requiring emergency food assistance between September 2009 and February 2010 to 3.8 million individuals, representing a 32 percent increase since February 2009. In Kenya, recurrent seasons of failed or poor rains, sustained high food prices, environmental degradation, outbreaks of disease, and flooding have led to deteriorating food security conditions throughout Kenya, straining coping mechanisms, exacerbating existing chronic poverty, and contributing to increased inter-ethnic conflict over access to limited land and water resources United States (USAID), 2010). Due to such grave effects caused by food insecurity the research got interested in establishing alternative approaches which can lead to sustainable food security in Kyuso District of Kitui County in Kenya.

Food security sustainability is defined as ability of future generations to meet their own needs." The concept of sustainability is used in many contexts and with widely different meanings. Sustainable" means to endure, to last, and to keep in being. Sustainable development is about marshalling resources to ensure that some measure of human well-being is sustained over time. According to Pearce and Atkinson (1993) the objective is to take actions which will not impair future generations from living at least as well as the present and hopefully better.

1.1.1 National food security status

About half of the Kenyan population falls below the poverty line. Some of these are resident in relatively well-endowed districts and urban areas. Among these are those living in extreme poverty. Chronically food insecure people suffer from extreme poverty and are largely left to their own devices with no access to some of the safety net provisions available to those suffering from acute food shortages in drought and flood prone areas (Republic of Kenya, 2008). Kiome (2009) indicates that over the years, the Kenya food situation is in such a way that Kenya

Government has strived to achieve national, household and individual food security throughout the country. The success of this effort has been mixed. The economic review of agriculture 2007 indicates that 51 % of the Kenyan population lack access to adequate food. This inaccessibility to food is closely linked to poverty which stands at 46% (National Economic Survey, 2008).

Republic of Kenya (2003) on Kenya Economic Recovery Strategy for Wealth Creation points out that despite tremendous improvements in nutritional status in Kenya since independence, a significant proportion of people, particularly children still live under continuous threats of hunger and starvation. Malnutrition in children in certain areas on certain times of the year due to poverty and disruption in food supply are a common feature. Hence achievement of food security and good nutritional status is critical in enhancing human development and overall productivity in Kenya.

The framework for action to achieve food and nutrition security is outlined in the new National Food Security and Nutrition Policy, which identifies food security as a basic human right.(Republic of Kenya, 2008).This study is framed in the context of basic Human Rights, Child Rights and Women's Rights, including the Universal Right to Food.

Kyuso District (the area of study) is a new district capped out of the larger Mwingi District in the former Eastern Province. According to Arid Lands Resource Management Project (2006-2007) the current Mwingi District has been divided into two. The new Mwingi District now covers Central, Migwani, Nuu, Mui and Nguni divisions with an area of 5,215.4 sq km While Kyuso District has four divisions namely Tseikuru, Mumoni, Kyuso and Ngomeni divisions (Njue, 2009). Kyuso District borders Kitui District to the south, Machakos District to the west, Mbeere and Meru South District to the north and Tana River District to the east. The area is generally plain with a few inselbergs in Mumoni, Nuu and Migwani Divisions. The highest point of the

district is Mumoni Hill, with an altitude of 1,747 meters above sea level. The landscape is generally flat, but slopes gently towards the east and northeast where the altitude is as low as 400m. The district covers an area of 10,030 km² and has a population of 303,828 (1999 population census), with an average population density of 47 persons per km.

The district is occupied by the Akamba people. The Akamba are agro-pastoralists who cultivate a diverse variety of drought tolerant crops such as millet and maize. Climate is generally hot throughout the year with mean annual temperatures ranging from 24° C and 30° C. Rainfall distribution is bimodal, with peaks normally in April and November. Average annual precipitation is less than 350 mm (Sombroek, & Braun and van der Pouw, 1982). Under these conditions, rain-fed agriculture is unsustainable (Opiyo, Mureithi & Ngugi, 2011). Livestock production is the principal economic activity in the area, although crop production is limited to isolated pockets of cultivable land (Opiyo, Mureithi & Ngugi, 2011).

1.2 Statement of the problem

Problems of drought, famine and climate are real and widespread in developing countries begetting hunger and malnutrition. Indeed, millions of people are food insecure due to famine, drought, pests and climate change (Kinyua 2004). Accordingly, these myriad predicaments lead to poor crop harvests placing the country and region in a situation of food insecurity. More precisely, most people, especially in sub-Saharan Africa, depend on food aid to survive. More so, poverty levels are endemic, affecting majority of the population. This further compounds the food crisis situation in the region. Kenya has not been spared either. In the recent years, and especially starting from 2008, the country has been facing severe food insecurity problems. These are depicted by a high proportion of the population having no access to food in the right amounts and quality (Kenya Food Security Steering Group, 2008). The communities in arid and

semi-arid lands of the country where Kyuso District is found are particularly vulnerable to food insecurity (Kinyua 2004). This is because there is over-dependence on rain-fed farming. Sustainability still remains a challenge in attaining food security. More needs to be done if sustained community development is to be attained, which will translate to better lives hence the need for this study to assess the influence of alternative approaches to sustainable food security in Kyuso District-Kitui County.

1.3 Purpose of study

The purpose of this study was to investigate the influence of the alternative approaches which can contribute to food security in Kyuso District.

1.4 Objectives of study

1. To establish how capacity building can be used as approaches to influence sustainable food security in Kyuso district.
2. To ascertain how increase in drought tolerant grain production influence sustainable food security in Kyuso district.
3. To determine whether safe storage through reduction of wastage can influence food security in Kyuso district
4. To explore the extent to food diversification through genetically modified crops (GMCs) have been used as approaches to food security in Kyuso District.
5. To find out whether gender sensitive development can influence food security in Kyuso district
6. To explore how good governance can contribute to sustainable food security in Kyuso district.

1.5 Research Questions

1. How can capacity building influence sustainable food security in Kyuso district?
2. How can increase in the production of drought tolerant grain influence sustainable food security in Kyuso district?
3. To what extent does safe storage of drought tolerant grain through reduction of wastage influence food security in Kyuso district?
4. How can food diversification through genetically modified crops influence sustainable food security in Kyuso district?
5. How can gender sensitive development influence food security in Kyuso district?
6. To what extent has good governance contributed to sustainable food security in Kyuso district?

1.6 Significance of the study

The study will be of great importance to the stakeholders in agriculture especially the farmers who can use the various approaches that will be recommended by this study to increase their household food production/yields on their farms.

It will also help Non Governmental Organizations (NGOs) to address food security and nutrition from the different approaches which can be used to ensure food sustainability instead of relief food distribution to Kyuso community.

The government through the Ministry of Agriculture (MoA) will use the study findings to formulate policies that will address the issues of sustainable food security in rural areas, drought management and the nutrition of the populations.

1.7 Study Delimitation

The study was done in Kyuso District of Kitui County and it limited itself to the alternative approaches that can be employed to ensure food security in Kyuso District. The factors that have led to the food insecurity in the District will also be discussed.

1.8 Limitations of the study

The challenge that the researcher faced included the vastness of the District. The researcher used assistants to assist in especially the follow up of the questionnaires hence the study becoming very expensive financially.

The area covers the former Mwingi North Constituency which has poor road network and as such sampled population was not easily accessible.

1.9 Assumptions of the study

One assumption of the study was that the household heads were best suited to give information concerning food security.

It also assumed that majority of the household head were involved in some farming either of crops or livestock.

1.11 Definition of significant terms

- Alternative approaches-** different ways/methods that can be used to ensure food to all
- Food security-** is understood to exist when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life.
- Capacity building-** is an ongoing process through which individuals, groups, organizations and societies enhance their ability to identify and meet development challenges.
- Sustainable -** growth in which food use aims to meet human needs while preserving the environment so that these foods can be met not only in the present, but also for generations to come.
- Dietary diversification-** the number of unique foods consumed over a given period of time
- Genetically modified foods-** a crop whereby a gene of desired characteristic is transposed from one plant to another,

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter contained reviewed literature related to alternative approaches to food security. The sub-headings include; alternative approaches to food security, strengthening research and capacity building, safe storage of extra food, increase food grain production per unit area, Genetically modified Crops, diversification of eating habits/dietary diversification, reduction of grain losses, development of small / cooperative grain-storage facilities, gender sensitive development and good governance.

2.2 Alternative approaches to sustainable food security

Food security is an essential feature of a country's independence and sustenance hence there is need for alternative approaches to be employed to ensure that the areas affected by food insecurity have access to nutritious food at all times. Literature reviewed has identified several alternatives that can be employed and they include;

2.3 Strengthen research/capacity building

Among the approaches that can be used to ensure sustainable food security is strengthened research. According to Republic of Kenya (2008) strengthen research-extension-farmer linkages enhance flow and utilization of technical information appropriate for intensified and diversified agricultural production systems. Mwaniki (2007) suggests that Africa should focus on education, research and development, access to capital and infrastructure development. Measures to facilitate free primary education throughout Africa are urgently required. Education not only endows one with the power to read and hence be informed, but it also allows one to

communicate. As an intervention to food security, education must go beyond the level of reading and writing to that of transfer of knowledge. To be useful, information transfer should be two-way. The poor have an idea of what would work for them and what they need. Since they are supposed to be the primary beneficiaries of food security related policies, it would be prudent to at least listen to them. In addition, education will open avenues to off-farm employment, thus acting as a safety net. It is time that Africans played an active role in research and development on matters that affect them. This includes food preservation at the village level, alternative medicine to make health more affordable to its people, creating more efficient agricultural extension, options for improving soil fertility, best approach to manage the different agricultural systems, and marketing strategies that would work best for a given group of farmers. Care should be taken to modify available technology to suit community setting and not the other way round. For benefits to be realized in all areas, infrastructure development must be high priority.

2.4 Safe storage of surplus food

According to Republic of Kenya (2003) a short term action that would significantly increase food availability is the improvement of on-the farm storage and food storage management. That translates into at least one month food for a subsistence farmer with no other source of income

Maize is core to food security, rural development and poverty reduction in Eastern and Southern Africa (ESA). Lack of appropriate grain storage technologies results in significant losses due to post harvest pests, undermines food security, forces farmers to sell maize when prices are low and blocks value addition and opportunities to poor households. Grain storage is a crucial component of the post-harvest chain (Musembi, 2010).It is practiced by farmers, traders and governments to facilitate marketing and to ensure food security.

The most storage facilities such as traditional cribs and gunny bags cannot guarantee protection against the larger grain borer that causes over 30% of the losses, sometimes entire harvest are wiped out during severe infestations. They are not even effective against the common weevil that accounts for 10-20% post harvest losses. Apart from causing losses pests in stored grain are also linked to aflatoxin poisoning like the severe ones experienced in 2004 and 2005 in some parts of Kitui District (Farm Africa, 2008). Catholic Relief Services (CRS) (2008) indicates that the traditional method of storage is to leave the maize in the field until the moisture content is reduced to about 18%. Further reduction of the moisture content is achieved by "stocking" in the field or drying the cobs on the ground if harvested directly. Maize is then stored on cobs in granaries with or without husks, depending on traditions. Some hung the cobs on racks inside dwelling or on trees. The granaries or cribs vary in size and configuration from area to area. The most common abundant storage structures are circular woven basket type, sometimes plastered with mud or cow dung, and rectangular cribs made of split wood poles or sisal stems among others.

The system of storage seems to suffer from several kinds of deficiencies. The grains are liable to spoil on account of improper storage conditions. The turnover of old stock by the new one is being overlooked. In this regard, the storage needs to be monitored for quality on a regular basis. Proper record-keeping using modern computational tools and programmes will be helpful in this direction. There is also need for modernization of storage facilities. The Government of Kenya supports purchase and storage of Strategic Grain Reserve (SGR) as well as intervening in stabilizing the price of cereals by participating in the market through NCPB (Kiome, 2009). All maize and wheat that is not to be stored for consumption by farmers and their families has to be sold to the National Cereals and Produce Board (NCBP). NCBP is a parastatal organization

whose main purpose is to buy, store and distribute cereals. It has exclusive permission to handle maize and wheat (CRS, 2008).

2.4.1 Reduction of grain losses

In many African countries, the post-harvest losses of food cereals are estimated at 25% of the total crop harvested. For some crops such as fruits, vegetables and root crops, being less hardy than cereals, post-harvest losses can reach 50% (Voices Newsletter, 2006). In East Africa and the Near East, economic losses in the dairy sector due to spoilage and waste could average as much as US\$90 million/year (FAO, 2004). According to Republic of Kenya (2008) in Kenya, each year around 95 million litres of milk, worth around US\$22.4 million, are lost. During periods of sufficient rainfall, Kenya often realizes surplus harvests of many food commodities, particularly maize, milk and pasture/fodder. However, a significant proportion of Kenya's produce is lost due to inadequate storage facilities, poor storage practices for food and lack of deliberate initiatives to harvest, dry and store surplus pasture/fodder. It has been estimated that post-harvest losses for various products range from 30 - 40% for maize, up to 50% for fruits and about 7% for milk per annum. Although the country generally lacks storage capacity, there are pockets of surplus capacity spread across the country under the management of National Cereals and Produce Board (NCPB). Out of the total NCPB storage capacity of 28 million bags (2.52 million tons), only about 15% of this is currently utilized. Farmers are at times forced to dispose of their produce at very low prices during glut periods due to lack of appropriate storage facilities. Cumulative losses in Tanzania amount to about 59.5 million litres of milk each year, over 16% of total dairy production during the dry season and 25% in the wet season. In Uganda, approximately 27% of all milk produced is lost, equivalent to US\$23 million/year (FAO, 2004).

The impact of food waste is not just financial, environmentally, food waste leads to: wasteful use of chemicals such as fertilizers and pesticides; more fuel used for transportation; and more rotting food, creating more methane - one of the most harmful greenhouse gases that contribute to climate change. Methane is 23 times more potent than carbon dioxide as a greenhouse gas. The vast amount of food going to landfills makes a significant contribution to global warming. WRAP (Waste and Resource Action Program), a UK based group, estimates that if food were not discarded in this way in the UK, the level of greenhouse gas abatement would be equivalent to removing 1 in 5 cars from the road (WRAP, 2007). Reduction of loss of grains which is estimated at about 10% of the total annual produce under various stages of post-harvest processing and short-term storage should be implemented (Kumar, 2002).

In a study done in Kitui district; Musembi (2010) found out that the common post harvest practices used by farmers were sun drying, grain treatment with storage chemicals and bagging. The community had less skills and techniques of value addition to store and make use of perishable food crops such as mangoes.

2.5 Increase food grain production per unit area

Multiplying and distributing seeds of drought tolerant crops is a longer term activity aimed at enhancing household food security. Sorghum, millet and other drought tolerant crops give some protection to the farmer so that he or she could expect a minimum yield each season (Adoyo, 2007)

It must progressively increase food grain production per unit area. Seeds of new high-yielding varieties and optimum use of irrigation water, fertilizers and pesticides are the means to achieve this objective (Kumar, 2002).

2.6 Diversification of eating habits/dietary diversification

Food Agricultural Organization research (2008) shows that maize is central to the diet of over 80 percent of Kenyans. Kenya's staple diet is remarkably complete for the nutrition it offers. Yet even as Kenya battles with food insecurity caused by drought, changes in eating habits are seeing two-thirds of Kenyans suffering malnutrition through their own eating choices, with a majority now suffering from potentially debilitating iron deficiencies and vitamin gaps (Karuga, 2011). Malnutrition has devastating effects on any population. It increases mortality and morbidity rates, diminishes the cognitive abilities of children and lowers their educational attainment, reduces labour productivity and reduces the quality of life of all affected. In addition to investing in short-term interventions, which are vital, African countries should increase their investment in long-term interventions such as dietary diversification, food sufficiency and bio-fortification. These have lower maintenance costs, a higher probability of reaching the poor who are vulnerable to food insecurity, and produce sustainable results. Dietary diversification still remains the best way to provide nutritious diets to the sustainability of any population. It is possible to obtain the right mix of food to alleviate malnutrition from that which is locally produced (Mwaniki, 2003). The probability of so doing is increased with increase in locally produced foods. Africa needs to increase its production of animal products, fruits, pulses and vegetables. Increased production would in part make these foods affordable to the poor and increase their protein, vitamin and mineral intake. One sure way is to revisit the cultivation of traditional fruits and vegetables that are adapted to prevailing environmental conditions. Mwaniki (2007) indicates that in addition, East and Central Africa should increase their roots and tuber production so as to reduce their dependency on cereals. This reduces the risk of crop failure during droughts since tubers like cassava are relatively more drought tolerant. We must

continue to strive for food sufficiency. Food insufficiency creates dependency on the supplier and could be used as a weapon to bend preferences to the master's liking. If Africa is to be food sufficient it must produce more food not only in quantity but also in variety.

The Ministry of Agriculture identified promotion of high value traditional crops as a solution to chronic food insecurity in the ASALS in its Strategy to Revitalize Agriculture (SRA). The National Food Security and Nutrition Policy (NFNP) highlights the nutritional effects on a population primarily fed on maize and advocates diversification of eating habits. This emphasizes the need for increased efforts to produce more of the other food crops in addition to cereals (Kiome, 2009).

2.5.1 Genetically modified Crops

A large number of Genetically Modified Crops (GMCs) and Foods have been developed to address hunger and malnutrition throughout the world. These includes maize and cotton cultivars modified with the *Bacillus thuringiensis* gene for insect resistance (FAO, 2008), herbicide tolerant canola and soybean (FAO, 2008 and Rowe 2004), and "Golden rice" that has increased Vitamin A content (Bonny, 2003 and Hoban 2002).

Genetically-modified (GM) crops, in which a gene of desired characteristic is transposed from one plant to another, are the most extreme and controversial output of the biotechnology companies. Although the technology has so far concentrated on overcoming weeds and pests, it has potential to respond to nutritional needs or drought and salinity brought on by climate change. Claiming higher yields, and lower chemical inputs, GM crops feature prominently in macro-solutions to the global food crisis. However, the technology depends on capital intensive fanning and the intellectual property rights are held by a small nucleus of corporations dominated by Monsanto. However these characteristics have limited appeal in the poorest

countries whose farmers are accustomed to the right to save their own seeds. Very few countries in Africa have adopted GM crops and 2010 saw the landmark rejection of a modified aubergine plant by the Indian government (Food Security Guide, 2011). However, persistent controversy and claims that these products may be wanting and harmful to human life and the environment have created considerable concerns. In this respect, public perception towards Biotechnology/Genetic Engineering/Genetically Modified Organisms is wanting.

(GMOs) has been thoroughly investigated in industrialized countries (Loureiro & Bugbee, 2005, Fischhoff & Fischhoff, 2001; Eurobarometer, 2008). Apparently, not much is known about public perception towards GM technology in developing countries though the few countries, in the developing world such as South Africa, that have chosen to embrace the technology have welcomed the benefits it has offered.

2.7 Development of small / cooperative grain-storage facilities

Non-government organizations (NGOs) could develop small/cooperative grains-storage facilities in remote/tribal areas. A national effort involving individual families and NGOs along the outline given above is bound to give a sound second line of support to the Indian government's centralized system of food grain storage and supply (Kumar, 2002). This has an advantage in that a strong correlation is observed between economic and political strength and food security among various countries. Food security as a national goal, through participation of people in storage of grains and of farmers for higher agricultural yields, with the use of scientific methods, can create conditions for the growth of gross national product and employment in the country (Kumar, 2002).

2.8 Rural Off-farm Opportunities

Rural off- farm opportunities will provide opportunities for both the landless rural poor and the group of non-adopters that fall out of business when the agricultural sector becomes more efficient. In addition, provision of off- farm opportunities will curb rural to urban migration and possibly induce some urban to rural migration. It would reduce the number of non-motivated farmers who took up farming just because they had no other options, thus paving the way for more efficient farming. Some of the opportunities that African countries can look into include cottage industries that process food crops by value addition and/or enhancing shelf life through preservation techniques; production of small scale processing machinery; provision of credit; contract processing facilities; and market facilitation. Specific activities may include the production of items with enhanced shelf life that would allow for marketing in distant markets. These products may range from dairy products such as butter, cheese and ghee, to pre-processed and packaged cut vegetables such as carrots and shelled garden peas for the urban population; to dried fruits and vegetables. More sophisticated, yet relatively technically easy to produce products, such as starch and vegetable oils, may also be produced. For this to be achievable there is need for collaboration amongst the multi- stakeholders (Mwaniki, 2007).

2.9 Gender Sensitive Development and Food Security

There is an intrinsic gender issue where poverty is concerned. One of the ways in which this is manifested is in the shift from woman-led leadership to man- led leadership as one moves from subsistence farming to market driven farming. Women are important as food producers, managers of natural resources, income earners and caretakers of household food security. They also play a crucial role in determining and guaranteeing food security and wellbeing for the entire household. Equitable, effective and sustainable agriculture cannot be pursued without an

explicit recognition of these realities (FAO, 2001). Women constitute the highest percentage of Africa's population and their rate of contribution to food production is higher than that of men. They make up 60-80% of agricultural workers in Africa and Asia and more than 40% in Latin America (Monson and Kalb, 1985). Agricultural productivity has been said to increase by as much as 20 percent when women are given the same inputs as men (International Food Policy Research Institute (IFPRI), 2002).

Women have distinctive roles to play in determining the accessibility of food basically because of their traditional role as wives and mothers who cook for their families (USAID, 2008).

Transforming food from its raw state into processed or cooked food has been the preserve of women (FAO, 1997).

Africa like other continents, is still suffering from sexist approaches (Dey, 1981; Gladwin 1997 & Carr, 1997). There are certain types of crops that are farmed solely by men and others by women. Generally women are expected to grow subsistence crops, gather fuel and rear children. For instance men in Tanzania own and farm palm trees and coconut (Gladwin, 1997) while in Gambia men cultivate sorghum, millet, maize and groundnuts while women are allowed to cultivate rice as staple food (Otieno, 2001). In Kenya, women only own a fraction of titled land (Republic of Kenya, 2002). Due to cultural factors they are often denied the right to inherit property or keep property obtained during marriage after divorce. As a result family members can evict women with impunity.

FAO (2001) confirms that women's empowerment is central to raising levels of nutrition, improving production and distribution of food and agricultural products, and enhancing the living conditions of rural populations. According to Mwaniki (2007) the education of women is known to produce powerful effects on nearly every dimension of development, from lowering

fertility rates to raising productivity, to improving environmental management. If women are to be fully effective in contributing to food and nutrition security, discrimination against them must be eliminated and the value of their role promoted.

However, care should be taken not to aggravate the male gender while we pursue the noble task of empowering women. If we do not have the support in the local communities, public investments in education are less effective. We should, as much as it depends on us, avoid imposing our preferences on society without taking time to understand the existing cultural structure. As and when possible, an inclusive approach where men and women complement each other to achieve set objectives should be used (IFPRI (International Food Policy Research Institute), 2002).

One way to do this is by having open communication and group meetings. Nothing facilitates suspicion more than a breakdown in communication. If both men and women had more equal schooling, incomes, and therefore the economy, would grow faster. When only half of the labour force is able to read and write, obtain credit, develop a work skill and obtain work, it is hardly surprising that there will be losses in output. There is, without question, a need to address issues related to women's low status that is evident in their minimal access to resources like inputs, land, and credit and the fact that they have low income and low literacy. There is a tendency for planners and policymakers to think that rural women do not know their own problems. These women can clearly articulate their problems based on their own experience. We need to use methods like focus group discussions that capture this (Mwaniki, 2007).

2.10 Good Governance and Food Security

While it could be argued that all the above interventions are part of good governance, special emphasis on the need for good governance is prudent. All the above strategies can only work in a

peaceful, corruption free environment. Part of good governance is the provision of safety nets to vulnerable groups. It should also provide for the minority and be totally inclusive in its decision-making. There is need to delink political interests from the basic needs of a nation. More often than not sustainable food security measures are long-term strategies, which need to be protected from volatile political interests of leaders. If this means that departments dealing with such issues need to be stable, then so be it. In addition, it is in everyone's best interest to have only the best handling the issues at hand without political interference from governments and donors alike (Mwaniki, 2007).

Medium term interventions such as increased security against banditry and livestock rustling, would allow farmers to have an extra source of income by keeping animals. In some parts of Eastern Province (where area of the study is found) fertile land is lying idle due to insecurity. Ensuring security in these areas would have the dual effect of attracting farmers back to fertile land and allowing farmers below subsistence level to generate income and become self sustaining (Republic of Kenya, 2004)

2.13 Conceptual framework

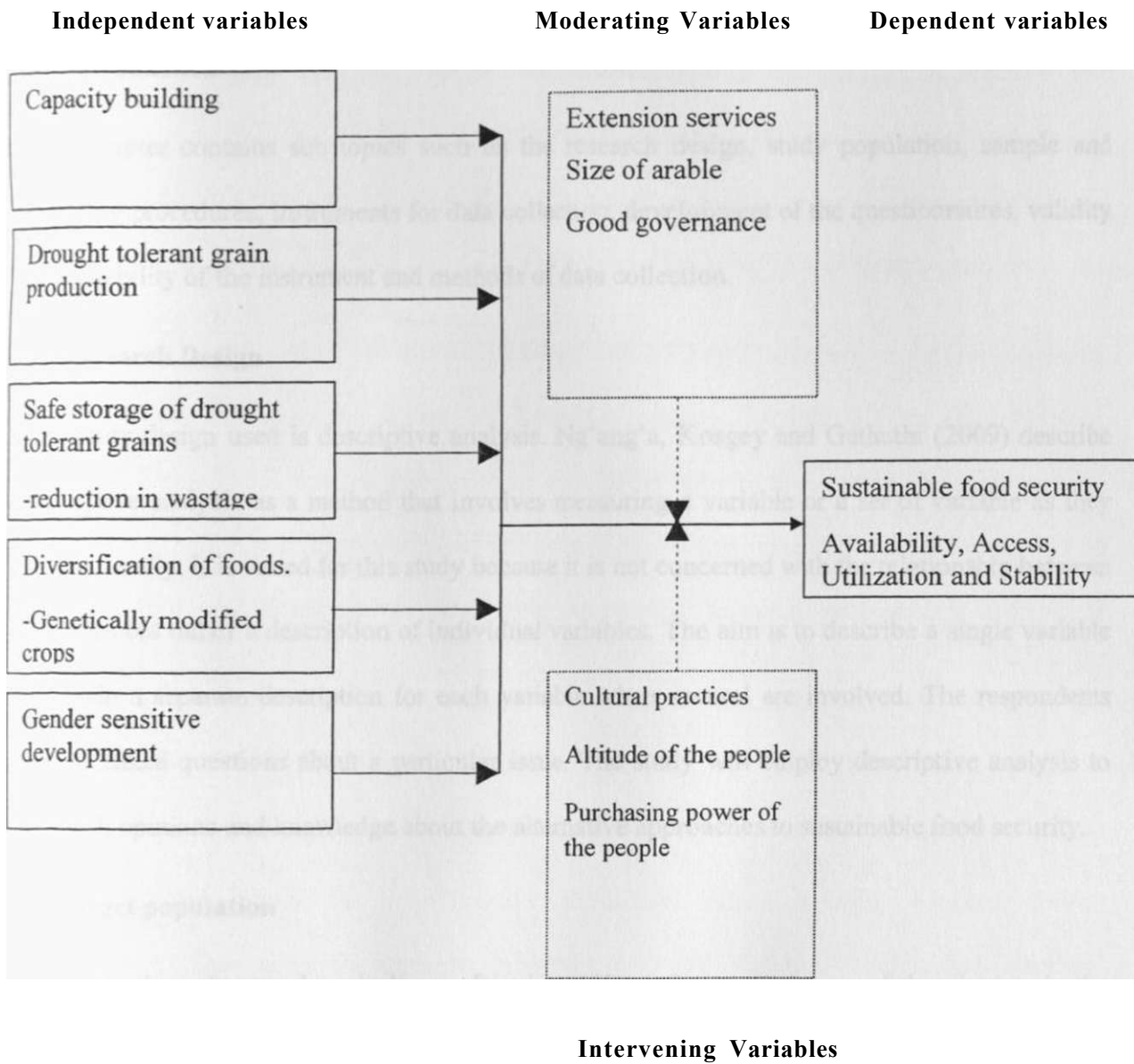


Figure 1: A model of the alternative approaches to sustainable food security

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter contains sub topics such as the research design, study population, sample and sampling procedures, instruments for data collection, development of the questionnaires, validity and reliability of the instrument and methods of data collection.

3.2 Research Design

The study design used is descriptive analysis. Ng'ang'a, Kosgey and Gathuthi (2009) describe descriptive analysis as a method that involves measuring a variable or a set of variable as they exist naturally. It is suited for this study because it is not concerned with the relationship between variables but rather a description of individual variables. The aim is to describe a single variable or obtain a separate description for each variable when several are involved. The respondents will be asked questions about a particular issue. The study will employ descriptive analysis to establish opinions and knowledge about the alternative approaches to sustainable food security.

3.3 Target population

The research study was done in Kyuso District of Kitui County. It is one of the districts in the former Eastern Province. The target population included all the household heads, government officer and NGOs or other agencies involved as stakeholders in food security. The total population of Kyuso district is 303,828 (Kenya National Bureau of Statistics, 2009). The district was purposively selected due to its state of food insecurity.

3.4 Sample and sampling procedures

The sampling procedure used was stratified whereby respondents were selected from each of the stakeholder's group's namely household heads, agricultural officers and other agencies or the NGO representative. Cluster sampling also formed part of the sampling technique because the area was divided into the four divisions namely; Tsekuru, Mumoni, Kyuso and Ngomeni.

Each division was to provide 20 household heads that were picked randomly and conveniently due to the lack of sampling frame for household heads. The others who were selected purposively were the four agricultural officers attached to each division and twelve (three from each division) other respondents selected from the NGOs community hence the total number of the respondents will be; eighty (80) household heads, (4) four agricultural officers and twelve (12) NGOs representatives bringing the total number of respondents to 96

3.5 Data collection instrument

The data was collected using questionnaire for the household respondents (Appendix B) and an interview schedule (Appendix C) for the four agricultural officers and the 12 representatives from the NGO community. Document analysis was also used. The questionnaire and interview were preferred for their suitability to this study. A questionnaire was suitable as methods of data collection because it allows the researcher to reach a larger sample within limited time. It also ensures confidentiality and thus gathers more candid and objective replies.

In the development of the questionnaire two techniques were used; closed ended and open ended technique. The items contained in the questionnaire were based on the alternative approaches to sustainable food security.

- Closed ended items were developed for they allow easier and accurate analysis of the data. They also make numerical comparison relatively easy while allowing a high degree of respondents' objectivity. They also reduce the problem of falsification.
- Open ended questions were considered feasible in order to give the respondents a chance to deliver rich information and not to feel the constraints imposed by a fixed choice question.

3.6 Instrument Validity

Piloting was conducted to assist in determining accuracy, clarity and suitability of the research instrument. According to Borg and Gall (1989), one can carry pilot study on two or three cases. The purpose of the piloting was to assist the researcher to identify the items which may be inappropriate so as to make necessary corrections, examine responses to determine the level of ambiguity of the questions and determine the percentage of responses.

The questionnaires were given to three lecturers from the department of Extra Murals for validation. The responses were also checked to verify whether the questions answered what they were intended to answer in order to ensure instruments validity. Based on the analysis of the lecturers, the researcher was able to make corrections, adjustments and additions to the research instruments.

3.7 Instrument reliability

In the study, reliability was assessed through the results of piloting, which was done using test-retest technique. The research instrument was administered to the same group of subjects twice in the pilot study. A two week lapse between the first and the second test was allowed.

The scores from both tests were correlated to get the coefficient of reliability using Pearson's product moment formulae as follows:

Pearson's coefficient of correlation

$$r_{xy} = \frac{\sum (X_i - \bar{X})(Y_i - \bar{Y})}{\sqrt{\sum (X_i - \bar{X})^2 \sum (Y_i - \bar{Y})^2}}$$

Where

N number of respondents

X scores from the first test

Y scores from the second test

The value of r lies between +_1, the closer the value will be to +1 the stronger the congruence.

3.8 Data collection procedures

After approval of the research by the University supervisor, a research permit which authorizes the researcher to carry out the study was obtained from the National Council of Science and Research at Utalii House, Nairobi. The researcher paid a courtesy call to the District Commissioner Kyuso to inform him of the intended study. The questionnaires were drop and pick type, so the respondents were given one week to fill them. After one week the questionnaires' were collected. Due to the vastness of the study area sampled the researcher was be assisted by research assistants whose duty was mainly to follow up the questionnaires.

3.9 Methods of data analysis

The data collected from questionnaires was analyzed by the use of descriptive statistics (frequencies and percentages) using SPSS (Statistical Package for the Social Sciences). The descriptive analysis was appropriate for this study because it involved the description, analysis and interpretation of circumstances prevailing at the time of study. Descriptive statistical

techniques were used to analyze various items of the questionnaire. These included averages, percentages, frequencies and totals. This study used frequencies and percentages because they easily communicate the research findings to majority of readers (Gay, 1992). Frequencies easily show the number of subjects in a given category.

A number of Tables were used to present data findings. Coding was done where the response were transferred into summary sheets by tabulating. They were tallied to establish frequencies. The frequencies were determined by converting similar responses into percentages to illustrate related levels of opinion. The questionnaires were analysed separately in four categories; from household heads, government officers and from the NGO representatives.

3.10 Ethical consideration

Consent of the participants was sought whereby they agreed to participate in the study through voluntary informed consent without threat or undue inducement. In addition the respondents were assured that the information they gave was to be kept confidential and used only for the purpose of research. For anonymity the respondents were requested not to write their identities in the questionnaire section while the appropriate chain of command was followed before the commencement of the data collection process.

3.11 Operational definition of variables

Table 3.1: Operationalization table

Objective	Variable	Indicators	Measurement scale	Types of analysis
To establish how capacity building and increase in grain production can be used as an approach to ensure sustainable food security in Kyuso district	Capacity building	Modern methods	Nominal	Descriptive
	Food production	Of faming Diversified agriculture Utilization of information No. of bags harvested	Ordinal	
To determine whether safe storage of grains and development of food grain tolerant to drought can be used as an approach to ensure sustainable food security	Safe storage of grain	Modern storage facilities	Nominal	Descriptive
	Grain tolerant to drought	Varieties of food grain tolerant to drought	Ordinal	
To explore public perception towards Genetically Modified Crops and dietary diversification as an approach to sustainable food security	Genetically modified Crops	Change in attitude	Nominal	Descriptive
	Dietary diversification	More foods that are genetically modified	Ordinal	
To find out whether gender sensitive development and good governance can be alternative approaches to sustainable food security	Gender sensitive development	Affirmative action policies More loans for women	Nominal	Descriptive
	Good governance	Peaceful environment	Ordinal	

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.1 Introduction

The study examined the influence of alternative approaches to sustainable food security in Kyuso District, Kitui County. This chapter aims at analyzing, presenting and discussing the results.

4.2 Questionnaire Return Rate

One questionnaire (Appendix B) was used as an instrument for collection of data from household heads and it was administered to 80 household heads. There was an interview schedule (Appendix C) which was administered to four (4) agricultural officers and 12 NGO representatives.

Table 4.1: Distribution of questionnaire return rate

Type respondents	Total	Returned (f)	%
Household head	80	69	86.25
Agricultural officers	4	3	75
NGO representative	12	10	83.3

Out of the 80 questionnaires for the household 11 (13.75%) were not returned. One (25%) agricultural officer and 2 (two) (16.7%) of the NGO representatives sampled requested to be left out of the study due to their busy schedule. So the household heads who participated in the study were 69 (86.25 %), 3 agricultural officers (75%) and 10 NGO representatives (83.3%)

4.3 The demographic characteristics of the respondents

The demographic information in this sub-section was obtained by use of 4 multiple choice questions for household heads, 3 for agricultural officers and 6 for NGO representatives.

The results are shown on Table 4.2, 4.3, 4.4, 4.5, 4.6 and 4.7.

Table 4.2: Distribution of response per gender

Gender	Household heads		Agricultural officer		NGOs representative	
	f	%	f	%	f	%
male	22	31.9	3	100	6	60
female	47	68.1	-	-	4	40
Total	69	100.0	3	100	10	100.0

From Table 4.2 majority of the household heads who responded to this study were women 68.1%. However it should be noted that most of them indicated that they were not the true household heads i.e. they had husbands who were working elsewhere and thus could not be reached to respond to this study. This can be interpreted that agricultural activities had been left to women as had been indicated in the literature reviewed. As for the agricultural officers and the NGOs representative majority were male-100% and 60% respectively.

Table 1.3: Distribution of household response by age

Gender	Household heads		Agricultural officer		NGOs representative	
	f	%	f	%	f	%
21-30	7	10.1	-	-	2	20
31-40	16	23.2	1	33.3	4	40
41-50	22	31.9	2	66.7	2	20
51-60	12	17.4	-	-	1	10
60-70	10	14.5	-	-	1	10
80 and above	2	2.9	-	-	-	-
Total	69	100.0	3	100	10	100.0

According to Table 4.3 most of the respondents 31.9 % who participated in this study were in the age bracket of 41-50. This is the prime age whereby majority of the respondents have children who are in their teen age and need food. Age 21-30 recorded 10.1 % and this is because at that age majority of people are still in colleges and very few have families of their own for them to be referred to as house hold heads. Those above 80 year of age were a mere 2.9% which is an advanced age and if these people did any farming it was for passion and by use of laborers.

The agricultural officers who were interviewed were in the age 41-50 bracket (66.7%) and 31-40 bracket (33.3%). As indicated earlier this is the prime age for working.

As for the NGOs representatives, majority were in age bracket 31-40 (40%) followed by 41-50 and 21-30 bracket (20%). This differs slightly with the respondents in the other two categories.

This difference is occasioned by the fact that Kyuso District is in the ASAL areas where the NGOs advertises for vacancies for non-family candidate hence the likelihood of employing people who are relatively young and are not attached to families or have young families.

Table 4.4: Distribution of responses as per education level

Level of education	Household heads		Agricultural officer		NGOs representative	
	f	%	f	%	f	%
Never went to school	5	7.2	-	-	-	-
Primary	11	15.9	-	-	-	-
Secondary	38	55.1	-	-	-	-
Diploma	6	8.7	3	100.0	-	-
Degree	9	13.1	-	-	10	100.0
TOTAL	69	100.0	3	100.0	10	100.0

From Table 4.4, many of the household head respondents' educational level was secondary education 55.1%. Followed by those who had attained primary 15.9% and degree level 13.1% and there are those who have never been to school at all 7.2%. This means that majority of the respondents can understand the national as well as the official languages of the nation hence introduction of alternative approaches to food security can be rolled out to them in any of the languages. The agricultural officers all had reached diploma level of education (100%) while again 100% of the NGOs representative all had degrees. This may have been the minimum requirement for their employment.

Table 4.5: Distribution of household head responses as per the division of residence

Division	f	%
Muumoni	16	23.2
Kyuso	20	29.0
Tseikuru	20	29.0
Ngomeni	13	18.8
TOTAL	69	100.0

The researcher had cluster sampled the area in such a way that each division was to have 20 household head respondents. Table 4.5 shows that all questionnaires from Kyuso and Tseikuru divisions were received back forming 29.0% for both. Muumoni division returned 23.2% while Ngomeni had the least number of respondents 18.8% due to unavailability of the respondents who had been sampled even after follow ups for the questionnaires.

The NGOs representatives were asked to indicate which organizations they worked for and the responses are shown on Table 4.6.

Table 4.6: Responses of the NGOs representatives

Responses	%
World Vision	30
Catholic Diocese of Kitui	30
Kenya Red Cross	20
German Agro Action	10
Cooperative Housing Foundation	10

Total

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From Table 4.6 the NGOs representatives who responded to this study were working with World Vision and Catholic Diocese of Kitui (30%), Kenya Red Cross had 20% while German and Cooperative Housing had 10% response.

On whether the NGOS represented had programs dealing with food security the responses were as follows in Table 4.7.

Table 4.7: Responses as to the food security related activities the NGOs were involved in

Responses		%
Yes	10	100
No		
Total	10	100

Table 4.7 show that all 100% of the NGOs were involved in food security related activities a further proof that Kyuso District was food insecure.

4.4 Items on food security

In this section the household heads were asked to indicate whether food was available to them at all times and their responses are presented on Table 4.8.

Table 4.8: Distribution of responses as to whether food was accessible throughout the year

Responses	f	%
Yes	10	14.5
No	59	85.5
Total	69	100

As for Table 4.8, majority of the household 85.5% do not have food throughout the year. This means that Kyuso District is food insecure. There is a small percent 14.5 who indicated that they had food throughout the year but not from their farms. They represented the group that has other sources of finances for instance formal employment and remittances.

4.5 Responses on alternative approaches to food security

The household heads were requested to select and indicate how these approaches could influence food security in the region. The options were as follows:

Strongly agree (SA), Agree (A), No Opinion (NO), Disagree (D) and Strongly Disagree (SD)

4.5.1: Items on capacity building and increase in grain.

The first objective of this study was to establish whether capacity building and increase in grain production can be used as approaches that influence/ ensure sustainable food security in Kyuso district .The data was presented in Tables 4.9, 4.10 and 4.11.

The respondents were asked to show how strengthening research and capacity building influenced food security and the responses were as follows on Table 4.9 and 4.10.

Table 4.9: Responses as to whether strengthening research and capacity building could be used as an approach to ensure food security

Strengthening research/capacity building	f	%
Strongly agree (SA),	41	59.4
Agree (A),	25	36.2
No Opinion (NO),	3	4.4
Disagree (D)	-	-
Strongly Disagree (SD)	-	-
Total	69	100

The result of Table 4.9 shows that majority of the household heads 59.4% strongly agreed that strengthening research/capacity building can be used as an approach to ensure food security while 36.2% agreed to the same. A small percentage 4.4 % however did not have any opinion.

Table 2: Responses on how capacity building and research influences food security

Response	SA %	A %	NO %	D %	SD %	Total
Enhances flow and utilization of information	100	0	0	0	0	100
Enables transfer of knowledge of what approaches can work for the area	49.3	46.4	4.4	0	0	100
Acts as safety nets for the farmers	42	53.6	2.9	1.5	0	100

Table 4.10 shows that 100% of the household strongly agreed that research and capacity building enhances flow and utilization of information. None of the respondent disagreed to the statement. On whether the approaches enables transfer of knowledge of what approaches can work for an area, 49.3% of the household strongly agreed, 46.4% agreed and 4.4% had no opinion. 42% of the respondents agreed that research and capacity building acted as safety nets food security followed by a majority 53.6% who agreed, 2.9% had no opinion and 1.5% disagreed with the statement.

4.5.2: Items on storage of grain and development of food grain tolerant to drought

The second objective was meant to determine whether safe storage of grains and development of food grain tolerant to drought can influence food security. The responses are tabled on Table 4.11,4.12 and 4.13.

Table 3: Distribution of the responses on safe storage of grains

Safe storage of grain	f	%
Strongly agree (SA),	69	100
Agree (A),	0	0
No Opinion (NO),	0	0
Disagree (D)	0	0
Strongly Disagree (SD)	0	0
Total	69	100

The results of Table 4.11 show that all 100% of the house hold head strongly agreed that safe grain storage was an approach that could strongly be used to ensure food security. This is because the farmers lose so much grain due to lack of safe storage especially when they had a bumper harvest.

Table 4: Responses to the statements on grain storage

Safe storage of grains	Response	SA	A	NO	D	SD	Total
		%	%	%	%	%	
	There is NCPB storage in the area	14.5	36.2	14.5	20.3	14.5	100
	Improper storage leads to grain spoilage	69.6	26.1	4.3	0	0	100
	Turnover of the old stock is overlooked by the new one	21.8	58.0	4.3	15.9	0	100
	Storage needs to be monitored for quality	85.5	11.6	2.9	0	0	100
	There is need for proper records using modern computational tools and programs	87.0	13	0	0	0	100
	There is need for modern storage facilities	84.1	14.5	1.4	0	0	100

Table 4.12 show that the household heads had differing views on the statement. For instance though there is a NCPB storage facilities in Kyuso only 14.5% strongly agreed to that and 36.2% agreed to the statement. There is a big percentage 14.5% who have no opinion meaning that the respondents were not aware of the facility. 20.3% disagreed while 14.5% strongly disagreed that such a facility exists. This shows that there is need during capacity building for the residents to be informed of the facilities available to them so that when they harvest more than they can store they can take it to NCPB storage facilities.

As concerns improper storage the majority of the household heads 69.6% strongly agree that it leads to grain spoilage. Where turnover of old stock being overtaken by old ones only a small

percentage of 21.8% strongly agreed to it. This is mainly because the residents rarely harvest a lot of grain due to the region being in the ASAL regions. Quite a big percentage, 85 is in agreement that there is need for quality to be monitored. 87% which is also a big percentage strongly agree that the records need to be computerized while 84.1% strongly agree that there is need for modern storage facilities. These high percentages can be interpreted to mean that computerized recording as well as modern storage facilities are not available in Kyuso. These will replace the traditional storage facilities such as traditional cribs and gunny bags which cannot guarantee protection against the larger grain borer that causes over 30% of the losses. Sometimes entire harvest is wiped out during severe infestations. They are not even effective against the common weevil that accounts for 10-20% post harvest losses. .

Table 5: Responses on increased food grain as an alternative measure

Responses	SA %	A %	NO %	D %	SD %	Total
Increased food grain production per unit area	100	0	0	0	0	100
Provide seeds of high quality varieties	88.4	11.6	0	0	0	100
Use irrigation	97.1	2.9	0	0	0	100
Use fertilizers	44.9	52.2	2.9	0	0	100
Use of pesticides	10	0	90	0	0	100

Table 4.13 shows that all the household heads 100% strongly agreed that increased food grain production is a measure that can be used to ensure food security. According to the respondents they strongly agreed that this can be done by providing seeds of high quality varieties 88.4%, use

of irrigation 97.1%, use of fertilizers 44.9% and use of insecticide 100%. The statement on use of **insecticide** had low response because of low usage which can be attributed to low purchasing power of the residents of Kyuso district.

4.5.3: Items on GMCs and dietary diversification

The third objective intended to explore the extent to which Genetically Modified Crops (GMCs) and dietary diversification have been used as approaches to food security. For the GMCs the respondents were given 2 multiple question and a Likert scale item to show the extent to which they agreed or did not agree to the statements. The responses were presented on Tables 4.14, 4.15 and 4.16.

Table 6: Responses as to whether the respondents were aware of GMCs

Response	f	%
Yes	24	34.8
No	45	65.2
Total	69	100

The analysis in Table 4.14 shows that majority of the respondents 65.2% were not aware or the genetically modified food and crops. Only 34.8% of the respondents knew about them.

Table 7: Responses concerning the respondents' awareness about GMC

Response	Yes		No	
	f	%	f	%
They have been introduced in this region	0	0	69	100
I have read about them in the newspapers	24	34.8	45	65.2
I have bought GMCs food in supermarkets	9	13.0	60	87.0

Table 4.15 indicates that all the respondents (100%) agreed that GMCs had not been introduced in Kvus District. A small percentage 34.8% had read about them in the newspapers and only **13.0%** had bought the GMCs from a supermarket. These results are an indication that majority of the people in Kyuso district are not aware of the GMCs as alternative approach to food security.

Table 4.16: Responses as to how GMCs influence food security

Responses	SA	A	NO	D	SD	Total
	%	%	%	%	%	
They increase crop yields	27.5	7.2	50.8	10.2	4.3	100
Lowers chemical inputs	14.5	14.5	65.2	4.3	1.5	100
They are harmful to human health and environment	43.5	28.9	11.6	6.2	5.2	100

The results of Table 4.16 indicate that majority of the respondents had no opinion about the statements given about GMCs and their influence on food security. For instance 50.8% did not know whether GMCs increase crop yield or not. Also another big percentage 65.2% was not

aware that GMCs lowers chemical inputs. Nevertheless, 43.5% strongly agreed that GMCs are harmful to human health and environment which is a misconception. Due to this fact there is need for more education to be done in the region concerning GMCs and their influence on food security

As concerns dietary diversification the respondents were given some statement to respond to and the results were presented on Table 4.17.

Table 8: Responses as to whether there is need to diversify food as an approach to food security

Responses	SA %	A %	NO %	D %	SD %	Total
People in my area over-rely on maize more than other crops.	100	0	0	0	0	100
There is need to diversify foods	87	13	0	0	0	100
There is need to increase animal products	50.7	29	18.8	7.2	0	100
There is need to increase root and tuber plants such as cassava	88.4	7.2	4.4	0	0	100
Traditional food such as millet, sorghum, cassava etc have been neglected	100	0	0	0	0	100

It is clear from Table 4.17 that respondents in Kyuso District 100% strongly agreed that there is over-reliance on maize as a food crop more than the other crops. The respondent, 87% thus strongly agreed that there is need to diversify food in the region. As concerns increasing animal

products, only about half 50.7% of the respondents thought it should be done while majority strongly agreed that there is need to increase root and tuber plants such as cassava 88.4% as well as the traditional foods such as millet and sorghum 100%. This may be due to the fact that these crops do better in semi arid lands like Kyuso, the area of study.

4.5.4 Analysis of items on gender sensitive development as an approach to food security.

The fourth objective was intended to find out whether gender sensitive development and good governance could influence food security in Kyuso District. The respondents were given 2 multiple question, one open ended question and Likert scale items to respond to. The results were analyzed in Tables 4.18, 4.19 and 4.20.

Table 4.18: Responses as to whether there were some crops cultivated exclusively by men

Response	f	%
Yes	39	56.9
No	30	43.1
Total	69	100.0

There were 56.9% of the respondents who agree that there are some food crops in the region which are grown exclusively by men.

Table 9: Response as to which crop is grown by men only

Response	f	%
Tobacco	39	56.9
No response	30	43.1
Total	69	100.0

This Table indicates the crop that is grown by men only in the region is tobacco only (56.9%)

It should however be noted that the 43.1 % non response is from those who had indicated that there is no food crop grown by men only on Table 20. Tobacco is mainly grown by men because **it is** a cash crop.

Table 4.20: Responses as to whether women involvement can be an alternative approach to food security

Response	f	%
Yes	69	100
No	0	0
Total	69	100

From the results of Table 4.20 all the respondent 100% are in agreement that women are important in food production and their involvement can act as an alternative approach to food security.

Table 4.21: Responses as to why women should be involved in food policies formulation

Responses	f	%
They constitute highest percentage of population	40	57.9
They are the ones who cook for families.	69	100
Levels of nutrition will be raised	69	100

All the respondents (100%) agreed that women cook for the families and as such they are important if the levels of nutrition are to be raised. There were some respondents who refuted the statement that women constituted the highest population as indicated in Table 4.21.

Table 4.22: Responses as to ways in which gender sensitivity can be enhanced to ensure food security

Responses	SA %	A %	NO %	D %	SD %	Total
Women should be educated on agricultural techniques	100	0	0	0	0	100
Discrimination of women to be eliminated e.g. in credit provision or land ownership	85.5	14.5	0	0	0	100
Empower women by using an inclusive approach where men and women complement each other	100	0	0	0	0	100
Communication/group discussion between men and women	100	0	0	0	0	100
Increase women literacy	88.8	7.2	0	0	0	100

Majority of the respondents strongly agreed 100% that women need to be educated on agricultural techniques, complement men by using an inclusive approach as well as having dialogue with their male counterparts. There was 85.5% of the respondents who strongly agreed that women need to be empowered through credit provision and land ownership and 88.8% strongly felt that the literacy levels of women was low and should be increased before both gender can contribute to food security issues.

As for good governance the respondents were given two questions to respond to and the findings were presented on Table 4.23.

Table 4.23: Responses as to whether good governance can be used as an alternative approach to food security

Response	f	%
Yes	69	100
No	0	0
Total	69	100

All respondents 100% agree that good governance is an approach that can ensure food security. The reasons they gave for that response included the fact that good governance ensures a peaceful environment as well as a corrupt free environment.

The NGOs representatives and the agricultural officers were asked to show the extent to which the identified had been used in their areas of jurisdiction. The results were analyzed and results were presented on one Table 4.24 for comparison purposes.

Table 4.24: Responses from the NGOs representatives and Agriculture Officers showing the extent to which the alternative approaches had been used in the areas of jurisdiction

Response	To a	To a small	Not at	
Total	great extent	extend	all	
	%	%	%	
Agricultural officer				
Strengthening research	75	25	0	100
Safe storage of grains	25	75	0	100
Increase food grain per unit area	0	100	0	100
Introduction of genetically modified foods	0	0	100	100
Diversification of eating habits	0	100	0	100
Reducing grain losses	75	25	0	100
Gender sensitive development	25	75	0	100
Good governance	75	25	0	100
NGOs Representative				
Strengthening research	60	40	0	100
Safe storage of grains	40	60	0	100
Increase food grain per unit area	70	30	0	100
Introduction of genetically modified foods	0	0	100	100
Diversification of eating habits	20	30	50	100
Reducing grain losses	30	70	0	100
Gender sensitive development	0	80	20	100
Good governance	60	40	0	100

According to Table 4.24 strengthening research in agriculture had been applied to a large extent NGOs representative 75% and agricultural officers 60%. The Table also shows that safe storage of grains had only been used to a small extent, 75% and 60%. As for increased food grain per unit area the score differed with all 100% of the NGOs indicating that it had been used to a small extent but 75% indicating that it had been done to a great extent. All of them (the respondents) 100% however agree that GMCs had not been introduced in the area. Diversification of eating habit as per the NGOs representatives had not been done 50% although; a small percentage 20% agree it had been done to a great extent and 30% show it had only been done to a small extent. Reducing grain losses had been done to a great extent 75% as per agricultural officers and to as small extent 70% as indicated by NGOs representatives. Gender sensitive development had only been done to a small extent 75% response by agricultural officers and 80% from the NGOs representative. Good governance was being employed to a great extent with 75% and 60% respectively.

As a way of concluding all the respondent were asked to give other alternative approaches that could be used to ensure food security and the responses were analyzed together for comparison purposes and were presented on Table 4.25.

Table 4.25: Other approaches suggested by the respondents that could be employed to ensure food security

Response	f	%
Household heads		
Planting drought tolerant crops such as cowpeas and green grams and pigeon peas to be intensified	26	40.6
Government get market for fruits which get rotten during the ripening season especially mangoes.	32	43.4
Improved road network for selling and buying) (outside the district) the available food produce when on season.	28	40.6
NGO representatives		
Construct fish ponds	7	70
Practice Agro forestry	4	40
Introduce green house farming	2	20
Agriculture officer		
Sink borehole	1	25
Introduce green house farming	2	50
Embrace rainwater harvesting technologies	3	75

The results of Table 4.25 show that the household heads suggest that planting of drought tolerant crops such as cowpeas and green grams and pigeon peas to be intensified with 40.6% response.

Marketing for fruits (43.4%) especially during the ripening season was seen as another way of ensuring that there was no wastage and the money could be used to buy other food stuff by the residents. Kyuso district does not have any tarmacked road hence there was need for the authorities to construct some for traders to bring in food stuff from other district to ensure that food was available at all times. The NGO representatives' suggestions included construction of fish ponds as a way of diversifying food 70%, practice Agro forestry, 40% and introducing Green house farming 20% which was supported by Agriculture officials with 50% response. The Agriculture officials 25% also suggested that sinking of borehole as a way to provide water for fanning as well as embracing rainwater harvesting technologies 75% due to the small amounts of rainfall in the region that does not support crop growth.

CHAPTER FIVE

SUMMARY OF THE FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The study was an analysis into alternative approaches to sustainable food security in Kyuso District, Kitui County. This chapter aims at analyzing, presenting and discussing the results.

5.2 Summary of the findings

A majority, 68.1 % of the household heads who responded to this study were women. However it should be noted that most of them indicated that they were not the true household heads i.e. they had husbands who were working elsewhere and thus could not be reached to respond to this study. This can be interpreted to mean that agricultural activities had been left to women as had been indicated in the literature reviewed from Monson and Kalb, (1985) who found out that women constitute the highest percentage of Africa's population and their rate of contribution to food production is higher than that of men. They make up 60-80% of agricultural workers in Africa and Asia and more than 40% in Latin America. For food security to be achieved in Kyuso district then there is need to educate the women on the alternative approaches that can be used to achieve food security including empowering them with financial assistance and land ownership rights.

However, the study had all agricultural officers and a majority of NGOs representatives being men. Most of the respondents who participated in this study were in the age bracket 41-50 and 31-40 brackets. Their educational level was secondary education 55.1% while the agricultural officers all had reached diploma level of education 100%. Again 100% of the NGOs representative all had degrees which could be as a result being the minimum qualifications that

was needed for them to be employed by the NGOs. Kyuso and Tseikuru divisions produced majority of the respondent followed by Muumoni and the least came from Ngomeni division.

The NGOs representatives who responded to this study were working with World Vision and **Catholic** Diocese of Kitui 30%, Kenya Red Cross had 20% while German Agro action and **Cooperative** Housing Foundation had 10%.

The study also found out that majority of the household 85.5% did not have food throughout the **year** meaning Kyuso District was food insecure. As far as the alternative approaches to food security were concerned majority of the household heads strongly agreed that training and **research** on agriculture has an influence on food security or can enhance food security in the region.

Although there is a NCPB storage facility in Kyuso only 14.5% strongly agreed to that and 36.2% agreed to the statement showing that many of the residents did not know about it. This **could** be as a result of majority of the residents not harvesting enough to warrant taking it to the **storage** facility as a study done by Musembi (2011) in the larger Kitui district (which included Kyuso district) showed that at times the harvest lasts for two weeks only. There is a big **percentage** 14.5% of those who have no opinion meaning that the respondents were not aware of **the** facility. This shows that there is need during capacity building for the residents to be **informed** of the facilities available to them so that when they harvest more than they can store **they can take** it to NCPB storage facilities.

The study also found out that improper storage leads to grain spoilage with the majority of the household heads 69.6% strongly agreeing to that. They also thought that quality of the stored grains should be monitored, records need to be computerized and there is need for modern storage facilities as found out by the study.

Increased food grain production is a measure that can be used to ensure food security according to the findings of this study. The findings of this study agree with others that providing seeds of high quality varieties 88.4%, use of irrigation 97.1%, use of fertilizers 44.9% and use of insecticide 100% are some of the methods that can attain that approach. Use of insecticide had Genetically Modified Crops as an alternative to food security was not considered favorable by many of the household heads respondents. This is because majority of them were not aware of the genetically modified food and crops because they had not been introduced in Kyuso District and the few who heard of them, was through reading them in the newspapers or through the media. Due to that reason they did not know whether GMCs increase crop yield or not, nor whether it lowers chemical inputs. There was a big percentage that strongly agreed that GMCs are harmful to human health and environment which according to literature reviewed was a misconception (Food Security Guide, 2011) showed that persistent controversy and claims that these products may be wanting and harmful to human life and the environment have created considerable concerns. Due to that there is need for more education to be done in the region concerning GMCs and their influence on food security. The finding agree with literature reviewed that indicated that very few countries in Africa have adopted GM crops and 2010 saw the landmark rejection of a modified aubergine plant by the Indian government (Food Security Guide, 2011).

There is over-reliance on maize as a food crop more than the other crops a finding that enhances the result of a study done by Food Agricultural Organization research (2008) which showed that maize is central to the diet of over 80 percent of Kenyans.. The respondents 87% thus strongly agreed that there is need to diversify food in the region. As concerns increasing animal products, only about half of the respondents thought it should be done while majority strongly agreed that

there is need to increase root and tuber plants such as cassava as well as the traditional foods **such as** millet and sorghum. This may be due to the fact that these crops do better in semi arid **lands** like Kyuso, the area of study.

Tobacco which is not a food crop was the only crop indicated as being grown by men as a cash **crop** in this region.

Women are important in food production and their involvement can act as an alternative approach to food security as per this study. The reasons given for that was that women cook for the families and as such they are important if the levels of nutrition are to be raised. However there were some respondents who refuted the statement that women constituted the highest population involved in agriculture differing with literature which had been reviewed. As concerns ways in which gender development can be enhanced this study suggested that women need to be educated on agricultural techniques, complement men by using an inclusive approach as well as communicate with their male counterparts. Credit provision, land ownership and the literacy levels of women were found to be low and should be increased before both gender can contribute to food security issues. Good governance is an approach that can ensure food security in Kyuso District. The reasons they gave for that response included the fact that good governance ensures a peaceful environment as well as a corrupt free environment.

As to the approaches that had been employed in Kyuso District, the study found out strengthening research in agriculture and reducing the grain losses had been done to a great extent, while safe storage of grains had only been used to a small extent. As for increased food grain per unit area the respondents differed with all the NGOs indicating that it had been used **to** a small extent but agricultural officers indicated that it had been done to a great extent. Diversification of eating habits had not been done satisfactorily because only a minority of

NGOs representative had indicated it had been done to a great extent. Another finding of the study is that in Kyuso district, the GMCs had not been introduced and gender sensitive development needed to be reinforced. Good governance was found to be in place in the region except for few cases of insecurity which were common phenomena.

There were alternative approaches which could work in Kyuso and were suggested by the respondents included; intensifying planting of drought tolerant crops such as cowpeas, green grams and pigeon peas improving road network and getting market for the perishables especially mangoes when they are on season. Other alternative approaches were constructing of fish pond as a way of diversifying food, practicing agro forestry, and starting of green house farming. Sinking of borehole as well as embracing rainwater harvesting management technologies as methods of providing water for farming, due to the small amounts of rainfall in the region that does not support crop growth were also found out.

5.3 Conclusion of the study

The study concludes that Kyuso District is food insecure and the alternative approaches that have been discussed in this study can go a long way in ensuring that food security has been realized in the district.

For food security to be achieved in Kyuso district then there is need to educate the women on the alternative approaches that can be used to achieve food security including empowering them with financial assistance and land ownership rights. The women's educational levels also need to be raised for them to benefit from the training offered on the various approaches especially for those who had not attained form four certification.

NCPB storage facility in Kyuso was not known by many of the resident that they existed. This shows that there is need during capacity building for the residents to be informed of the facilities available to them so that when they harvest more than they could store themselves, then they can take it to NCPB storage facilities.

From the finding, it is agreed that improper storage leads to grain spoilage. Thus the quality of the stored grains should be monitored, records need to be computerized and there is need for modern storage facilities.

The study also concludes that increased food grain production is a measure that can be used to ensure food security. This can be done by providing seeds of high quality varieties, use of irrigation, use of fertilizer and use of insecticides. Although use of insecticide had low response indicative of low usage which could be attributed to low purchasing power and as well as the availability of cheap manure from the livestock kept by the farmers.

It also concludes that majority of the people in Kyuso were not aware of the genetically modified food and crops because they had not been introduced in Kyuso District. Due to that reason they did not know whether GMCs increase crop yield or not, nor whether it lowers chemical inputs. They also thought that GMCs are harmful to human health and environment which according to literature reviewed was a misconception. Due to that there is need for more education to be done in the region concerning GMCs and their influence on food security.

Another conclusion of the study was that gender sensitive development needed to be reinforced in Kyuso District. It also concludes that there is need for modern approaches to be introduced into the region while retaining the traditional drought tolerant food crops such as green grams popularly known as *Ndengu* by the residents in Kyuso District.

5.4 Recommendations and suggestions of the study

This study makes several recommendations which include that;

There is need for more education to be done in Kyuso District concerning GMCs and their influence on food security. There is also need for a lot of awareness on the alternative approaches to be done as well as be implemented in the region.

Gender mainstreaming on food security interventions should be enhanced by women being educated on agricultural techniques, as well as increasing their literacy levels. The government could also think of introducing affirmative action policies in agriculture as it has already so in **other** areas of development.

There is need to diversify diet from over-reliance on maize crop to other food varieties that are appropriate for this area. Root and tuber plants such as cassava as well as the traditional foods such as millet and sorghum which do well in Semi Arid regions should be encouraged. Fish fanning should be enhanced in this region to diversify grains with animal foods. For this to be achieved the farmers need incentives from the government such as supply of the fish lets, provision of markets, water for the fish ponds and even the technological knowhow on how to start fish farming.

More agricultural officers are needed to be deployed to the region which is big and vast hence the few officers available are unable to reach majority of the farmers for capacity building and research work. From probing done to the residents it was established that there was no Agricultural research institute in the region and the study strongly recommends establishment of one in the region.

The study also recommends that the NGOs should move from distributing relief food to the **residents**. Although there were indications that they are gradually shifting from relief food to **productive** safety net programmes namely cash for assets and food for assets, there is need to **facilitate** intensification and replication of these approaches through-out the entire district.

The government can also prioritize irrigation schemes to increase food production in the region for River Tana forms the boundary between the District and Tharaka Nithi District so water from the river could be accessed easily for irrigation.

The farmers need incentives in order to embrace the alternative approaches discussed in this study. This is especially on the technological knowledge on how to adopt such approaches for instance how to start fish farming or even how and where to obtain the seeds for GMOs.

5.5 Recommendations for further study

There is need to conduct further study on;

The challenges that prevent the uptake of the alternative approaches in Kyuso District.

The causes of food insecurity in Kyuso District should also be studied because in spite of the climatic conditions there are areas in the world with the same climatic conditions but are food secure.

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APPENDICES

Appendix A: Letter to Respondents

Dear Respondent,

I am a post-graduate student of the University of Nairobi. I am conducting a study on alternative approaches to sustainable food security. This is in fulfillment of the degree in Masters of Arts in Project Planning and Management. You have been selected to participate in this study. I would very much appreciate if you would kindly assist me by responding to all the items attached in the questionnaire. Your name and that of your organization need not to appear anywhere in the questionnaire unless you wish. The information you provide is anonymous and will be used for academic research purposes only.

Your cooperation will be greatly appreciated.

The completed questionnaire will be picked from you two weeks after delivery.

Thank you in advance.

Yours faithfully,

Raphael Musyoka Ngumbi

Post graduate student

APPENDIX B: Questionnaire for Household Heads

Section A: Demographics

1. Indicate your Gender.

Male Female

2. Indicate your age (in years) in the appropriately box

(a) 21-30 (b) 31 - 40

(c) 41 - 50 (d) 51 - 60

3. What is your highest Academic qualification?

(a) Primary (b) Diploma

(c) Degree (d) others (specify)

4. Respondents area of residence

Division

a) Muumoni

b) Kyuso

c) Tseikuru

d) Ngomeni

Section B: Item on food security

7. Is food available to you at all times?

Yes ()

No ()

Section C: Items on alternative approaches to food security

8. Below are some of the alternative approaches that can be used to increase food security

Using the scale in given:

Strongly Agree (SA)

Disagree (A)

No Response (NO)

Disagree (D)

Strongly Disagree (SD)

Please indicate by ticking the statements that you agree or disagree are applicable in your area

Alternative approaches to food security	SA	A	NO	D	SD
1.Strengthen research/Capacity building					
-Enhances flow and utilization of information					
-Education enables transfer of knowledge of what can work for the area					
-Acts as safety nets for the farmers (off-the farm)					
2 Safe storage of grains					
-There is NCPB storage in the area					
-Improper storage leads to grain spoilage					
-Turnover of the old stock is overlooked by the new one					
- Storage needs to be monitored for quality					
-Need for proper records using modern computational tools and programmes					
-There is need for modern storage facilities					
3.Increased food grain production per unit area					
-Provide seeds of high quality varieties					
-Use irrigation					
-use fertilizers					

9. Do you know about genetically modified crops or food?

Yes () No ()

10. If Yes in question 9 what do you know about them?

a) They have been introduced in this region ()

b) I only read about them in the newspapers ()

c) I have bought GMOs food in supermarkets ()

11. Below are some statements about GMCs and their influence on food security. Please tick in the appropriate box using the scale as given in question 8.

Genetically modified crops	SA	A	NO	D	SD
-They increase yields					
-Lowers chemical inputs					
-They are harmful to human health and environment					

12. Are there foods crops that are cultivated by men only?

Yes () No ()

13. If yes, which types of crops are grown by men and for what purpose?

14. Are women important in food production in your area?

Yes () No ()

15. Give reasons for your answer

Below are statements concerned with ways in which gender parity can be reduced. Please tick in the appropriate box using the scale as given in question 8.

16.Gender sensitive development	SA	A	NO	D	SD
Increase literacy levels of women					
Enhanced communication between men and women					
Discrimination of women to be eliminated for instance in credit provision or land ownership					
Empower women by using an inclusive approach where men and women complement each other					

17. In your opinion, kindly give the alternative approaches that you think can be employed to ensure food security in your area

APPENDIX C: Interview Schedule for Agriculture Officers and NGO Representatives

Section A: Demographics

1. What is the gender, age and academic qualification of the respondent?

Section B: Items on food security

2. The NGO the respondent is working for a type of interventions related to food security.

Section C. Items on alternative approaches to food security

3. Discuss how the following approaches influence food security in the study area.
 - i. Strengthening research
 - ii. Safe storage of grains
 - iii. Reducing grain losses
 - iv. Diversification of crops
 - v. Genetically modified crops
 - vi. Gender sensitive development
4. Invite suggestions from the respondent in regard to appropriate alternative approaches that can be employed to ensure food security in the study

