HOUSEHOLD FOOD-RESOURCE HANDLING PROCEDURES AND FOOD SECURITY IN GUCHA SUB-COUNTY, KISII COUNTY, KENYA

BY

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DECLARATION AND RECOMMENDATIONS

DECLARATION BY THE STUDENT Q

This thesis is my original work and to the best of my knowledge has not been presented for examination of any degree in any Institution or University.

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DEDICATION

I dedicate this thesis to my dear wife Eunice Ndunge, my daughter Jeniffer Bosibori and Son James Mutunga for their emotional and professional support. Lastly I dedicate this thesis to my parents for their unconditional support and encouragement.

ABSTRACT

This study was about household food-resource handling procedures and food security in Gucha sub-county, Kisii County, Kenya. Globally, 32% of all the food produced is lost or wasted, which amounts to approximately 24% of all food produced. In Kenya, approximately 40%-50% of food-resources are lost along the food production chain, which is twice the global average. In Gucha Sub-county, smallholder farming households face chronic food shortage associated with food-resource handling procedures. Despite concerted efforts to reduce food loss and waste, important data gaps remain as a major challenge with most of the previous studies focusing on determining food security status rather than mitigating food loss and waste. Little focus has been invested towards understanding how household food-resource handling procedures contribute to incidences of food loss and waste. Household social cultural behaviour aspects play important role in explaining food-resources handling procedures. However, this social cultural dimension is least studied. This study sought to assess how household food-resource handling procedures affect availability of food in the study area. The specific objectives of the study were to analyze the influence of household organization of agronomic procedures on food availability among rural households in Gucha Sub-County; to examine how household harvesting procedures affect food security among rural households in Gucha Sub-County; to assess the effect of household food storage procedures' on food availability among rural households in Gucha Sub-County; to examine how household food consumption patterns and exchange procedures affect food security among rural households in Gucha Sub-County. The study employed Real Life Situation and Personal Construct theories to understand farmers' social behavior in food-resource handling procedures. The study employed a descriptive survey research design in giving descriptive accounts of the various situations observed on household food-resource handling in Gucha Sub-county. The researcher employed interview schedule, key informant interview, focus group discussions and direct observation as the main methods of data collection. Simple random sampling and purposive sampling were used to select 377 respondents. Data was analyzed using qualitative technique as well as quantitative technique. The study found that food loss and waste occur along the food production chain starting from agronomic, pre-harvesting, harvesting, processing, storage, consumption and to exchange procedures. The study findings manifested an agricultural production system characteristic of smallholder rural farmers, employing simple farming techniques where both traditional and modern technologies are employed. However, the majority preferred traditional farming techniques. Consequently, respondents experienced low maize harvest. Food availability, affordability and taste and preference influenced their consumption and exchange behavior, resulting to significant food losses and waste. The study concluded that food-resource handling procedures from agronomic, pre-harvest, harvest to post-harvesting stages contributed a significant loss of all the household food harvested in a season. The study recommended for a shift towards understanding household social cultural behavior in relation to food-resource handling procedures, and its influence on household food availability.

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LIST OF ABBREVIATIONS

AGRA	:	Alliance for a Green Revolution in Africa
ASDSP	:	Agricultural Sector Development Support Programme
APHILIS	:	Africa Post Harvest Losses Information System
ART	:	Antiretroviral therapy
AFFA	:	Agriculture, Fisheries and Food Authority Act
CAADP	:	Comprehensive Africa Agricultural Development Programme
CEAFDAW	:	Convention on the Elimination of All Forms of Discrimination Against Women
CIGs	:	Common Interest Groups
CSA	:	Climate Smart Agriculture
EACFSAP	:	East Africa Community Food Security Action Plan
ERS	:	Economic Recovery Strategy
EPA	:	Environmental Protection Agency
EU	:	European Union
FADC	:	Focal Area Development Committee
FSC	:	Food Supply Chain
FSNP	:	Food Security and Nutrition Policy
FSNS	:	National Food Security and Nutrition Strategy
FAO	:	Food Agriculture Organization
G20	:	Group of Twenty
GHG	:	Green House Gases
IS	:	Interview Schedule
IICA	:	Inter-American Institute for Cooperation on Agriculture
KARI	:	Kenya Agricultural Research Institute
KCIDP	:	Kisii County Government Developed County Integrated Development Plan
KMDP	:	Kenya Maize Development Programme
KNFU	:	Kenya National Farmers' Union
KNBS	:	Kenya National Bureau of Statistics
KALRO	:	Kenya Agricultural Research and Livestock Organization

KMDP	:	Kenya Maize Development Programme
KI	:	Key Informant
NFSNP	:	National Food and Nutrition Security Policy
NEPAD	:	New Partnership for African Development
UNCRC	:	United Nations Convention for the Rights of the Child
UN	:	United Nations
UDHR	:	Universal Declaration on Human Rights,
USDA	:	U.S. Department of Agriculture
MDGs	:	Millennium Development Goals.
NALEP	:	National Agriculture Livestock and Extension Programme
NEPAD	:	New Partnership for African Development
SDGs	:	Sustainable Development Goals
SSA	:	Sub-Saharan Africa
SRA	:	Strategy for Revitalizing Agriculture
WFC	:	World Food Conference
WHO	:	World Health Organization

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I express my sincere gratitude to the research assistants and households that participated in this study for their valuable knowledge and experience. I thank the lecturers who taught me in different courses and offered guidance for me to earn the knowledge that has helped me to produce this work. I am grateful to all institutions and individuals in Kisii County whose names I will not mention, but in one way or another supported me to complete this task, successfully as well, NACOSTI for awarding me fieldwork research grant.

My deepest gratitude goes to my family, siblings and parents for their moral support during the study. To encapsulate all once again, thanks be to God for giving me good health and making this work possible.

OPERATIONAL DEFINITION OF TERMS

Adaptive capacity:

Is the ability of a smallholder farmer to develop skills and technical know-how that may enable him/her to cope up with current demands on household food security, while minimizing food loss and waste.

Agronomic activities:

Refer to the creation, management and optimization of agricultural production through land preparation, choice of crops suited for planting, and weeding.

Crop management:

In this study, it refers to cultural practices which commence from land preparation to consumption and exchange.

Food-resource:

Refer to material items that affect food patterns, food choices and sharing.

Food Consumption:

Refers to the amount of maize available for human consumption.

Food exchange:

This is the process of intra and inter-household food sharing and exchange of maize products among household members.

Food Loss:

Refers to both qualitative and quantitative waste, damage, reduction or disappearance of food and/or food-resources at any level during the production process.

Food wastage:

Refers to any food lost by deterioration or not used the right way

Food Insecurity:

Refers to individuals' and household's limited or inadequate access to sufficient, safe, nutritious, socially and personally acceptable food to meet dietary requirements for a healthy and productive life.

Food supply chain:

Refers to the connected series of activities or processes that describe how food from the farm ends up on a table. These processes include production, processing, distribution and consumption.

Food system:

Refers to all essentials including social, environment, people, inputs, processes, infrastructures, political and social institutions, and operation that relate to the production, processing, distribution, preparation and consumption of food and the outputs of the actions, including socio-economic and environmental outcomes.

Harvesting:

This is the process of removing maize cobs from the stalk and transporting to the homestead for drying and storage

Hastening harvest:

Is the process of removing maize from the fields before it is ready for harvesting.

Household food-resource handling procedures:

Refer to a series of activities that are involved in food production to utilization, which include household's harvesting and processing activities, storage, food consumption patterns and exchange processes.

Household:

A household is a group of individuals living together, typically sharing meals or a food budget.

Household food security:

It refers to household ability to acquire food. A household is food secure when it has access to the food-resources needed for a healthy life for all its members in adequate quality, quantity, safety, and culturally acceptable.

Pos-harvesting:

Refer to all procedures involved in maize handling after harvest. These include; processing, storage, consumption, and food exchange.

Social cultural behaviour:

Is the interaction process among smallholder farmers that influence their beliefs, norms, values, attitudes and perceptions in food-resource handling.

Storage:

This is the process of preparing and placing maize cobs and grain in a secure and well ventilated place or facility to avoid damage before use.

Sustainable food system:

Is the process of ensuring existence of food security and proper nutrition for all, now and for future generations without any compromise.

Smallholder farmer:

This is a farmer whose agricultural course is principally subsistence and farms on land not exceeding ten acres.

Quantitative loss:

Refer to decrease in edible maize mass available for human consumption throughout different divisions of the supply chain.

Qualitative Loss:

Refer to the loss of nutrients value/or through contamination of food and unwanted changes to taste, color, texture, or cosmetic features of food.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Globally, 32% of all food produced in the world is lost or wasted, which amounts to approximately 24% of all food produced. Approximately one out of every four calories grown to feed people is not ultimately consumed by humans and yet over 842 million people globally do not eat enough to be healthy implying that others go to bed hungry each night (FAO, 2014). Food is lost and wasted to a varying extent across the globe, along the food production chain. As a result, overall global food availability is lower than it would be otherwise, negatively affecting food security and requiring countries' agriculture system to produce additional food to compensate for the food that is not ultimately consumed by humans (HLPE, 2014).

In most rural areas of the world, little focus has been invested towards understanding how household food-resource handling procedures contribute to massive incidences of food insecurity due to losses and waste. This study conceptualizes food-resource handling procedure as the series of activities that are involved in food production chain, which include: household's agronomic, pre-harvesting, harvesting, storage, food consumption patterns and exchange processes. Whereas, food loss and waste is the casting off of descent edible food by practicing ineffective food-resource handling procedures along the production chain, thus, negatively affecting food security status of households. In this study, food loss and waste are applied interchangeably and generally relates to household behavioral issues in food-resource handling processes.

Food loss and waste is a major concern for most countries of the world. It has been a major cause of food insecurity in many households, and it is blamed on household food-resource handling practices on the farm and household, which is influenced by social factors. In many studies such as Aschemann-Witzel et al. (2015), food-resource handling procedures and in particular, social cultural influences on food loss and waste have been given little attention. In this study, social cultural behaviour is the interaction process among smallholder farmers that influence their beliefs, norms, values, attitudes and perceptions in food-resource handling. This study holds that food loss and waste cannot be addressed well without understanding underlying micro-context environments (that is households) where major food-resource handling activities take place. This is because in the micro-environments, it is the cultural knowledge that informs people's norms, customs, values and habits in relation to food-resource handling processes.

The population of the world is projected to increase to almost ten billion people by 2050 and the world produces 17% more food per person at present than before (IFPRI, 2016). Paradoxically, going by the most recent estimates from FAO, 842 million people globally do not eat enough to be healthy implying that others go to bed hungry each night (FAO, 2013). Existing data, indicate that one third (30–50%) of world's food produced by developed and developing countries never reaches human stomach (Kader, 2005), but it is either lost or wasted (Gustavsson et al. 2011; IFPRI, 2016). This is partly why reduction of food loss and waste ranks high on the agenda of Sustainable Development Goals in particular SDG 12.3 on reduction of food loss and waste.

Since the 1990s, there has been an increase in anthropological writings about food security and its relation to policy (MacRae, 2016). In the year 2000, the Millennium

Development Goals aimed to reduce hunger in the world. In September 2015 the United Nations member states made a commitment to end hunger, achieve food security, improve nutrition and promote sustainable agriculture by 2030 (FAO, 2016). In 2015, the G20 Agriculture ministers noted with great concern the significant extent of food loss and waste throughout food supply chain. The ministers described it as a global problem of enormous economic, environmental and societal significance (IFPRI, 2016). It is on this basis that countries throughout the world are making progress towards achieving SDG target 12.3. For example, in the United States of America, Department of Agriculture (USDA) and U.S. Environmental Protection Agency (EPA) jointly announced the "U.S. 2030 Food Loss and Waste Reduction Goal", which is consistent with SDG Target 12.3.

Europe Union launched "the New European Circular Economy Package" which commits EU member states to meet SDG Target 12.3. In Africa, the African Union through its member states had earlier in 2014 issued the Malabo Declaration, a set of agriculture goals aimed at achieving shared prosperity and improved livelihoods. This declaration includes a commitment to half the current levels of post-harvest losses by 2025 five years early than SDG. A critical review of the above studies shows that they focus on national food security with less concentration on the household where food handling processes occur.

In this study, the researcher holds that although household food security is the basis for national food security, many governments focus their agricultural interventions on national level, while ignoring the micro-environments (households) where the actual production and food handling takes place. Food loss is not just at the end of the crop life, but it starts from the initial stages of selecting the seed, farming techniques, storage

techniques and consumption habits. Despite food loss and waste being massive at the agronomic and pre-harvest stages, many studies have not focused on household food-resource handling procedures at micro-environments that can reduce it. Apparently, a recent upsurge of interest has been on post-harvest loss of cereals that have led to the development of the institutions such as African Postharvest Losses Information System (APHLIS)-2010, which incorporates a network of local experts, a loss calculator and a free access database of key information to help understand the extent of food loss and waste (Hodges et al. 2010).

According to AGRA (2016), many smallholder farmers in rural areas continue to lack access to current knowledge on pre- and post-harvest best practices which can influence their social cultural behavior towards reducing food loss and waste. Barriers to extension on a large scale continue to pose a great challenge. For instance, Kitinoja (2013) noted that extension agents are very few and farmers grow many varieties of crops using their indigenous or local knowledge in the food production processes in developing countries. Comparatively, in developed countries, the amount of food loss is minimal at later stages in the production process due to the behavior of consumers and effective coordination between actors in the production process (Kipinski, 2016).

In developing countries, 90% of food loss is within the production process (FAO, 2014), and mainly occur at early stages of the food production chain due to poor household food resource handling procedures. Recent studies on global food loss and waste show that the primary source of food loss and waste is on food crops, ranging from 27% to 32% food loss and waste of all food produced in the world (IFPRI, 2016). Similarly, in communities that grow maize as cash crop, they maintain commitment and have minimal

losses, and that is partly why they are called ‘food baskets’. The concern of this study is the missing link that creates the variance in various societies. The answer to this, seem to lie in their social and cultural arrangements at the household level, where food loss is a net outcome of the household behaviour patterns and responses when dealing with food-resources within the social context. Despite this, significant resources have been leveraged in reducing food loss and waste in the production process leaving out investigation of people’s social cultural behavior in the household towards food-resource handling, which is contrary to the conception of this study.

Ellison and Lusk, (2016) recognize that despite macro efforts to reduce for loss and waste in developed and developing countries, there has been less attention on food loss and waste at the household level. For instance, fewer efforts have been made to understand how households in reality make food loss and waste decisions. The academic research to date has primarily been descriptive in nature, gauging consumers’ knowledge of and attitudes towards food waste, as well as their performance of waste-promoting or waste-reducing behaviors (Neff, Spiker, and Truant, 2015; Stancu, Haugaard, and Lahteenmaki, 2016; Parizeau, von Massow, and Martin, 2015; Graham-Rowe, Jessop, and Sparks, 2014), rather than understanding why consumers may discard food in the first place, Thus, the need for this study.

The social cultural behavior of individuals in food-resource handling processes, coupled with environmental factors such as peer pressure and political values, greatly contribute to food loss and waste and eventually, food shortage. This implies that even if these factors contribute to food loss and waste and food insecurity, they have not been given

much prominence in research and agricultural interventions. This warrants new ground breaking research to inform policy makers and interventionists on this area to intercede.

Although food loss and waste varies from nation to nation, the causes and origins of food loss and waste are blamed on poor household food-resource handling procedures. This include: poor agronomic procedures, meager infrastructure (transportation and storage) (FAO, 2016). In China for example, losses and waste of agricultural products especially maize grains occur during agronomic activities, due to poor food-resource handling processes, which are not usually given much consideration by the government (Liu, 2013; Liu et al. 2014).

In South Africa, agronomic factors influence farmers' production processes. For instance, smallholder farmers in rural areas access only 10% of their seeds from the formal markets (Smale et al. 2009). This implies that 90% of smallholder farmers rely on informal means/networks or/and village markets to access the seeds for planting. These channels need to be improved or developed in order to improve smallholder farmers' access to inputs. However, this has never been of priority to researchers and interventionists of food security. Still in South Africa, Thandi et al. (2006) found out that culture affects handling of food resources.

In their study on Anthropology of eating, Mintz and Du Bois (2002) noted that culture is the pervasive foundation that underlies the food value chain. In socio-cultural sense, people use culture to frame what they consider to be acceptable and preferable means for production, consumption and exchange. This study holds that socio-cultural factors are major determinants on how food-resources are handled and used within and outside the household. The study further observes that although these factors are important in

addressing food loss and waste and eventual food security, most studies on food security have given them less focus.

In Nigeria, Kumar and Kalita (2017) observe that during crop transition from farm to consumer, it has to undergo several procedures like harvesting, transportation, threshing, drying, sorting, storage, consumption and distribution (exchange). During this movement, farmers' social behavior before and after harvest, during storage, then consumption patterns and habits, determine the quality and quantity of food loss or wastage. From an Anthropological understanding, this study holds that people construct their perceptions, beliefs, and attitudes about food on the basis of culture while psychosocial factors shape their food production processes, exchange and consumption behavior.

Although APHLIS (2014) found that the total food loss waste for cereals during pre-harvest and harvesting oscillate between 14% and 16% of the production, not much has been done to reduce food losses and waste. Studies such as Stuart (2009); Foresight (2011), FAO (2011), Lipinski et al. (2013), HELP (2014), WRI (2014), FAO (2016) and IFPRI (2017) have all underlined the significance of food losses and waste (FLW) and the need to reduce them to improve household food security and sustainability of food systems. Apparently, one of the major weaknesses of these studies is that they do not indicate the need for studying socio-cultural behavior of people in food-resource handling procedures and how this behavior can lead to food loss and waste.

In Kenya, food loss and waste particularly in cereals such as maize is one of the most perceptible dimensions of poverty and a significant indicator of the country's impoverishment that is further aggravated by improper household food-resource handling procedures. Notwithstanding, the numerous benefits that can be derived from maize

production, pre-harvest and post-harvest losses make its production unprofitable (Rosegrant, 2014; Arah et al. 2015). It is severe in grain growing regions particularly those using it for subsistence, due to the nature of household food-resource handling procedures practiced along the food production chain. Around one in four people in the country remain undernourished (Sorre, 2013).

About a third of Kenya's population is estimated to be food and nutrition insecure (GoK, 2010*)*, while over 10 million people suffer from chronic food insecurity and poor nutrition; and between two and four million people require emergency food assistance at any given time (Barasa, 2010; Sorre, 2012). Nearly 30% of Kenya's children are classified as undernourished, and micronutrient deficiencies are widespread (GoK, 2010*)*. Agronomic factors for example, influence food production processes. Smale et al. (2009) noted that smallholder farmers rely heavily on informal channels to access inputs. Some of these channels for seed access include on-farm seed saving, farmer to farmer exchange and unregulated sales. Storage, consumption, and exchange among farming households in rural areas are influenced by social norms and attitudes, which vary according to age group, personal experience and shape dietary behavior in family meal time schedules and table manners (Guyomrd et al. 2010).

This study focused on maize as a staples cereal in the study area. Maize is by far the most important cereal crop in Kenya today as it has established itself as the main staple food among the various ethnic communities throughout the country (Sorre, 2013). Maize was first introduced in Kenya and East Africa in the 16^{th} and 17^{th} century by the Portuguese traders who brought in some varieties originating from the Caribbean countries. Earlier maize varieties were more suited to the coastal regions than to the medium and high

altitude hinterlands. The spread of the crop to the hinterlands and its subsequent adoption and popularity over the indigenous cereals such as sorghum and millet is a comparatively more recent phenomenon brought about by the European settlers in the early part of the last century.

In Kisii County, maize is a staple crop, however, food insecurity remains pervasive despite other abundant agricultural endowments. This is a paradox of suffering amidst plenty and yet the County and in particular, Gucha sub-County has the knowledge, technology, and the means to end food insecurity. Many households are vulnerable to food insecurity at certain times of the year. Besides, most of the food is lost or wasted along the food production chain. The main research question for the study was what causes the paradox of food insecurity in a high potential rural environment? The researcher assumes that the answer lies on social behavior within and between households, which was one of the main concerns of the study.

One of the issues of the study is that, although Gucha Sub-County produces sufficient food-resources, most of these are drained almost immediately, making households vulnerable to food shortages round the year. For instance, food consumption depends on a large and complex set of social factors related to food availability, accessibility and choice (Kearney 2010). Furthermore, Guyamord et al. (2010) observes that food production behaviour is under the complex influence of a large range of short, medium and long-term regulatory policies that involve food-resource handling processes.

As Voster (2001) notes, effective interventions in prevention of food loss and waste within the household should focus on what happens in the micro-environment and; how this relates with food-resource handling among farming households (Garnett, 2013). Food

loss and waste reduction is a key matter for Kenya as accentuated in various key Government and County Government policy documents including: Vision 2030, Agriculture Sector Development Support Programme (ASDSP), Food Security and Nutrition policy (2011), Climate Smart Agriculture (CSA) and the Global Sustainable Development Goals (SDGs).

Evidently, a review of various international, regional, national, sectoral policies and strategy papers such as the Malabo Declaration on Accelerated Agricultural Growth and Transformation for Shared Prosperity and Improved Livelihoods (2014), Food Security and Nutrition Policy (2011); and East Africa Community Food Security Action Plan (2011–2015) on the significant role of agriculture on food security, have shown that there has been a strong emphasis on ensuring food security in the household, community and the country as a whole. However, very little has been done on the household food-resource handling procedures along the production process and their effects on food loss and waste.

The above studies and frameworks propose that reducing food loss and waste is an effective strategy for improving food security among farming households. This is the reason why reducing food loss and waste has become a major theme at national and county agenda. In February 2017, drought affected over 3 million Kenyans and this incidence raised many pertinent questions on the country's ability to feed all citizens. The challenge however, is lack of mitigation measures on food losses and waste before consumption (Daily Nation, 2017). In a study by Wakibi et al. (2016), 39% of households in Turkana County experience chronic food insecurity; followed by 24% in Kisii and 20% in Migori. Only 23% of the households in Turkana County are food secure; 34% in

Kisii and 42% in Migori. Moreover, Gucha Sub-county is one of the administrative areas in Kisii County that is assumed to produce adequate food for its residents.

Kenya was the first country in Africa to host the first (1st) All Africa Conference on Food Loss and Waste held in March 2017. The conference provided a platform for researchers, academics, farmers, industry, development agencies, civil society and policy makers to learn, share information, build networks and partnerships with the overall objective of identifying effective interventions to reduce food loss and waste in the continent. Regrettably, the analysis of these frameworks have indicated high concentration on food production processes, resulting to paucity of data on food loss and waste in all stages of the food production chain.

The researcher's observation of the themes presented in the conference indicated that they mainly focused on agricultural innovation in production and marketing. This means that researchers and interventionists in the conference ignored food-resource handling processes within the household and how they influence food loss and waste. Moreover, Alexander et al. (2017) observes that most of these studies are conducted at national level, and are based on one sided literature review and statistical data focusing on improving food production processes and lacking social dimension, which this study assumes plays a significant role in food loss and waste. There is a knowledge gap on whether the impact of food loss and waste solutions are socially feasible.

Anthropologists argue that food security should be enhanced right from the household to ensure continual, reliable access to safe, nutritious and culturally appropriate food that provides a foundation for the pursuit of human potential. Pottier (1999) posits that food

security may not be achieved if researchers do not consider qualitative research to have an in-depth understanding about households' social behaviour in food-resource handling processes. This study holds that for such studies to be comprehensive and informative, they need to integrate qualitative data into quantitative data, which is a missing link in many studies conducted.

FAO (2016) emphasizes the need to improve data collection and knowledge sharing on food loss and waste through participatory research. Further there is need for development of effective strategies and improve coordination of international and national policies in order to reduce food loss and waste. Therefore, this study argues that it is intricate to develop mechanisms for preventing food loss and waste with inadequate local knowledge into how much, why, and where the food is lost or wasted along the production chain. It is against this backdrop that the researcher sought to assess how household household food-resource handling procedures affect smallholder farmers in Gucha Sub-county, Kenya.

1.2 Statement of the Problem

Despite food loss adversely affecting most rural areas of the world, little focus has been invested towards understanding how household food-resource handling procedures contribute to massive incidences of food loss and waste as illustrated in this study. According to this study, household social and economic behaviour aspects play important role in explaining food-resources handling procedures. However, this social cultural dimension in achieving household food security is least studied and emphasized by development agents, researchers and the data in the literature is either outdated or

fragmented. Notwithstanding, Kisii County being perceived as one of the food basket counties in Kenya, there is evidence of increasing food insecurity incidences among households in the county, making them more vulnerable to poverty due to chronic food shortages.

As shared in the background, 34% of households in Kisii County are food insecure. Moreover, Gucha Sub-county is one of the administrative areas in the County that is assumed to produce adequate food for its residents. Paradoxically, most of the residents experience chronic food shortages, which seem to be attributed to the household organization, food production processes, consumption behavior, food exchange or marketing, which were of critical concern to this study. Practical observation reveals that, although Kisii County produces sufficient food-resources, most of these resources are depleted almost immediately after harvest leaving the household vulnerable to food shortages. This study holds that food loss and waste along the production chain often result from interrelated causes including: technology, environmental, political and social with the latter being given less consideration by interventions. The argument here is that if household social and cultural arrangements are understood, then it would improve household's management of food-resources. Studies such as Kader (2005), Kader and Roller (2004), and WFLO (2010) noted that 95% of the research investments have focused on increasing on food productivity and only 5% directed towards reducing losses.

Food loss and waste for cereals during pre-harvest and harvesting oscillate between 14% and 16% of the production, but not much has been done to reduce food losses and waste. Studies such as Stuart (2009); Foresight (2011), FAO (2011), Lipinski et al. (2013),

HELP (2014), WRI (2014), FAO (2016) and IFPRI (2017) have all underlined the significance of food losses and waste (FLW) and the need to reduce them to improve household food security and sustainability of food systems, however, they do not indicate the need for studying socio-cultural behavior of people in food-resource handling procedures and how this contributes to food loss and waste.

This study therefore, sought to assess how household food resource-handling procedures affect food security among smallholder farmers in Gucha Sub-County. The study specifically interrogated household organization of agronomic procedures on food availability; effect of household harvesting beliefs and practices on food security; the effect of household food storage beliefs and practices on food availability; and how household food consumption patterns and exchange practices affect food security among smallholder farming households in Gucha Sub-County.

1.3 Objectives of the Study

1.3.1 Overall Objective

To assess how household food resource-handling procedures influence food security among smallholder farming households in the study area.

1.3.2 Specific Objectives

i. To analyze the influence of household organization of agronomic practices on food availability among smallholder farming households in Gucha Sub-County.
ii. To examine how household harvesting beliefs and practices affect food security among smallholder farming households in Gucha Sub-County.

iii. To assess the effect of household food storage beliefs and practices on food availability among smallholder farming households in Gucha Sub-County.

iv. To examine how household food consumption patterns and exchange practices affect food security among smallholder farming households in Gucha Sub-County.

1.4 Research Questions

i. How does household organization of agronomic practices influence household food security among smallholder farming households in Gucha Sub-County?

ii. Do household food harvesting beliefs and practices affect food availability among smallholder farming households in Gucha Sub-County?

iii. How do household food storage beliefs and practices influence food availability among smallholder households in Gucha Sub-County?

iv. Do food consumption habits and exchange practices affect food security status among smallholder farming households in Gucha Sub-County?

1.5 Study Assumptions

i. There between household organization of agronomic practices and food availability among rural smallholder farming households in Gucha Sub-County.

ii. Household harvesting beliefs and practices affect food security among smallholder farming households in Gucha Sub-County.

iii. Household food storage beliefs and practices determine food availability among smallholder farming households in Gucha Sub-County.

iv. Household food consumption habits and exchange practices affect food security among smallholder farming households in Gucha Sub-County.

1.6 Significance of the Study

The intention of carrying out this study was three pronged. First, the study aimed to raise awareness on food losses and waste through data and information sharing, it also targeted to document the impact of food loss and waste in the entire food production chain, guide in the dissemination of effective and appropriate technologies and practices for food loss and waste reduction in the Kenya and African context and to identify effective multi-stakeholder strategies and provide a platform for rural farmers to build networks and partnerships for resource mobilization and other activities geared towards food loss and waste reduction.

Secondly, the study sought to fill an intellectual gap. As noted earlier, food loss and waste is the main cause of food insecurity worldwide, and touches all spheres of human life such as education, health, survival and development and social wellbeing of people. Most of the studies on food security have delved on various issues influencing food loss and waste and consciously and/or unconsciously undervaluing household food-resource handling procedures, which are fundamental in enhancing either food security or insecurity status in households. The existing knowledge gap on food-resource handling procedures left has also been proposed by (Gustavsson et al. 2011; FAO, WFP and IFAD, 2012). In this study, the researcher interrogated agronomic procedures, pre-harvesting and harvesting, storage, consumption patterns and exchange as the main variables and indicators of food resource-handling procedures in the study area.

Thirdly, at policy level, the findings of this study directly informed the National Food and Nutrition Security Policy (NFNSP). Reducing food loss and waste requires action by a wide range of stakeholders such as smallholder farming households, companies, and the government. It also requires changes in technology, practices, behavior and policy. These factors suggest that no single individual or group can sufficiently tackle food loss and waste alone, hence, the need for collaboration. Therefore, the study was vital for policy level intervention since the employed interventions and strategies have failed and have inadequate information that can help to offer practical solutions to the underlying problem.

Fourthly, social cultural dimension of food loss and waste is a critical issue in food loss and waste. The culture of people and how it influences food-resource handling procedures is critical in reducing food loss and wastage among smallholder farmers. Smallholder farmers are acculturated into the local behaviour of individuals, which impact on food-resource handling procedures in different ways. The study therefore, provides information through its recommendations that may lead to implementation of appropriate strategies and interventions. The study also interrogated critical components of household food-resource handling processes that promote influence food losses and waste in the study area. The above facts will be important in advancing guidelines and strategies of ameliorating the problem of food insecurity from a social cultural perspective among rural farming households.

1.7 Scope and Limitations of the Study

This study only focused on nutritional and economic anthropology. On nutritional anthropology, cultural notions of personhood, kinship, sharing, and morality are all expressed in the way food is acquired, prepared and consumed. Therefore, from a nutritional anthropology perspective, this can inform interventions addressing dietary issues among populations. On economic anthropology, the study is vital in understanding what sorts of people make, give, take or consume which sorts of food items, and in what sorts of situations do they do so? From a cultural context it is significant to understand how different sorts of people understand their economic activities, the objects involved and the people with whom they carry out those activities? Unlike economists who usually restrict themselves to monetary transactions and try to develop formal, abstract models of economic systems, economic anthropologists, usually are concerned with all forms of production, circulation and consumption whether monetary or not. Further, they are less concerned with developing formal models and more with trying to describe and understand economic actions in their social and cultural context.

The study only targeted smallholder farming households in Gucha Sub-county and sought to assess how household food-resource handling procedures affect household food security status among smallholder farmers in the study area. The study investigated variables such as agronomic procedures, pre-harvesting, harvesting, storage, consumption, exchange practices. The study used quantitative and qualitative methods data to understand food-resource handling procedures focusing on maize as the staple cereal.

In the pursuit of this study, several limitations were experienced. The first was the cost in terms of time to carry out an extensive and exhaustive research, since it mainly relied on qualitative data, which consumes a lot of time. However, through financial support from NACOSTI, the researcher was able to recruit more research assistants for data collection. The second was to obtain accurate information because of fear of especially in household where women were the respondents. This was addressed by seeking consent from them and explaining in detail the purpose of the study. Lastly, the study was largely qualitative in nature, therefore, it relied on the perceptions and views of respondents and the quality of data depended on them. However, triangulation was utilized to clarify issues that mattered in the study.

CHAPTER TWO

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 Introduction

This chapter covers some of the works by other researchers on food security and in particular on household food-resource handling procedures such as agronomic procedures, food pre-harvesting, harvesting, storage and food exchange procedures. Besides, the chapter highlights food security from a socio-cultural point of view. The chapter provides a conceptual framework and both theoretical and practical understanding of food security. Before embarking on issues of food security, the study provides a brief background on the concept of food security, the development of agriculture and trends of food security in Kenyan communities.

2.2 The Concept of Food Security

Achieving food security at both household and national level is anchored in the Sustainable Development Goals. SDG 1: End poverty in all its forms; SDG 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture; and SDG 12: Ensure sustainable consumption and production patterns. However, sustainable food security especially at household level remains the greatest challenge facing most developing countries. Various factors such as climate change, poor household organization of agronomic activities and poor on and out of farm management practices influenced by households' social behavior are cited to exacerbate food insecurity.

Food security has been one of the top most priorities and challenges for human societies, particularly for developing countries like Kenya (Liu et al. 2014). This is why in 1948 the United Nations (UN) recognized the right to food in its Declaration on Human Rights (FAO, 2006). According to FAO (2006) food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meet their dietary needs and food preferences for an active and healthy life. FAO (2009) identified four pillars of food security as availability, access, utilization and stability. Food insecurity, on the other hand, is a situation of limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways (Bickel et al. 2006).

Household food security exists when all members, at all times, have access to enough food for an active healthy life (USDA, 2008), though this has not been the case in many households which are faced by famine and hunger. Progress by both developed and developing countries has been made in achieving food security, yet an acceptably large number of people still access inadequate food they need for an active and healthy life (FAO, WFP & IFAD, 2013). For example, current estimates indicate that about 845 million people in the world were undernourished in 2014–2016. Undernourishment is experienced because most of the food produced is lost and/or wasted (FAO, 2016).

Globally, quantitative food loss and waste has been a major problem. Each year, there have been losses in food and waste on various crops. For instance, 30% of food loss and waste has been on cereals, 40-50% for root crops and fruit and vegetables, 20% for oil seeds, meat and dairy and 30% for fish (Tatlidil et al. 2013). Despite emphasis by various studies on achieving food security, African food production, supply and consumption

systems are not yet functioning to optimal efficiency to reduce food loss and waste along the food production chain (Negatu & Musahara, 2016). Most countries in particular Sub-Saharan Africa are faced with limited land, inadequate inputs, scarce water and increased weather variability, pre-harvest and post-harvest food losses, impeding the achievement of sustainable food security for the growing population (FAO, 2011). Food losses in sub-Saharan Africa alone exceed 30% of total crop production and representing more than US$4 billion in value every year (World Bank, 2011).

Fighting food deficiency in a rapidly changing world has been the goal of both developed and developing countries, especially through reducing food loss and waste. The Global Hunger Index Report (2012) observes that among the world's regions, South Asia and Sub-Saharan Africa continue to have the highest reported levels of hunger, resulting from poor household food resource handling procedures (Dietz, 2013). This represents acute suffering for millions of poor populations in the two sub-continents (Beckel et al. 2000). However, the developed and developing countries have remained heedful in the way they obtain and share information that is paramount for designing and implementing food security strategies (Mabwabo, 2015), and the focus being on agronomic practices, with little attention on other phases of food production and people's socio-cultural behavior, which according to this study may partly influence household food security.

Sub-Saharan Africa in particular, is the only region of the world that is experiencing extreme chronic food insecurity (Devereux & Maxwell, 2001; Rukuni, 2002). Most of poor rural population (86%) in the region depend on agriculture for their livelihoods in one way or another and most of them are small scale farmers (World Bank, 2007). In light of this there are similarities in the densely populated countries such as Rwanda and

Ethiopia (Jayne et al. 2003). Among the majority of people residing in rural areas, land scarcity continues to be a problem which has negatively affected subsistence farming (FAO, 2010). While secure access to productive land is critical for the livelihoods of millions of poor people living in rural areas, current trends and patterns suggest that access to this key resource in these countries including Kenya, has been declining due to growing demographic pressure, worsening land degradation and land alienation (Cotula et al. 2004; Jayne et al. 2010).

In their historical and contemporary studies of famine and hunger, Sen (1981) and Dreze and Sen (1989) argue that resourceful households rarely go hungry despite aggregate food shortages and that the poor are often hungry even when food supply is plentiful. Economic growth may improve aggregate food supply, but because of unequal control of economic resources and improper household food-resource handling procedures, households continue experiencing food security problems, resulting from food loss and waste (WHO, 2013). This study understands that food security implies the fulfillment of essential food needs of the population of a country throughout the year. This requires an increase in food production relative to the country's population, improvement in per capita food supplies as well as controlled and stable food prices with reduction of food losses and waste. In the next section, the researcher reviews various literature materials to ascertain food security situation in Kenya.

2.3 Agricultural Production and Food Security in Kenya

Over the past three decades, Kenya has brought back agriculture to the top of the development agenda (AGRA, 2016), by investing an increased proportion of its budget from a growing national revenue base. Kenya has an ample continuum of Climate Smart

Agriculture (CSA) policies, strategies and plans that can help secure food security. The Vision 2030 for instance, has linked well with Sustainable Development Goals such as Goal 1: End poverty in all its forms; Goal 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture; and Goal 12: ensure sustainable consumption and production patterns. All these recognize the significance of agriculture to its goal of achieving an average GDP growth rate of 10% per year up to the year 2030.

Kenya's Agricultural Sector Development Strategy operationalizes the Vision 2030 by focusing on transforming smallholder agriculture from low-productivity subsistence activities to more innovative, agri-business oriented agriculture (ASDS, 2010-2020). Regarding adaptation to climate change, ASDS prioritizes investments in weather information systems, research on drought tolerant crop varieties, soil and water conservation, water harvesting, and strengthening integrated pest management systems. However, despite this focus, there has been a glimpse of success, as the agricultural sector is largely a fragile success dependent on decisive government support and consistency of investment (Odhiambo, 2012). Due to this, a third of Kenya's population is estimated to be food and nutrition insecure, while over 10 million people suffer from chronic food insecurity and poor nutrition; with between two and four million people require emergency food assistance at any given time (MoA, 2015). Nearly 30% of the country's children are classified as undernourished, with micronutrient deficiencies widespread (GoK, 2010*).*

In Kenya, the poor have per capita income of less than a US$ 1 a day. For an average household with five persons, the household income is Kshs. 12,245 (US$ 177.5) or less per month, and low income household earns Ksh.14000 (US$ 202.5) and below per

month. While the middle income is Ksh. 14001 to 56000 (US$ 203 to 812) and high income is above Kshs. 56,000 (US$ 812) per month (Olielo, 2013). The high number of cases with undernourishment and micronutrient deficiency are blamed on food loss and waste in the household, leading to insufficiency of food in the households. According to Rosgrant et al. (2013), food loss and waste is a result of improper postharvest handling, lack of appropriate infrastructure and poor food-resource household management techniques. The study focused on this case.

From the 1960s, the production of most basic food crops did not keep pace with population growth and the basic crops, which such as potatoes, sweet potatoes, rice and beans, performed well in the increase area than increase in yield (DRA, 2014). In 1961, Kenya could feed her population of 8.4 million at more than 10% world health organization requirements based on the fact below food contributed 75% of the dietary energy.

After 1970, the situation began to deteriorate, partly as a result of diminishing government support for agriculture and rural development (Fernando, 2013) and partly by deepening socio-economic divides (Nyanjom, 2013). Crop production areas expanded somewhat in the 1970s but yields dropped, partly due to severe droughts. During the 1980s the harvested area of cereals, roots and tubers stabilized with that of pulses more than doubled and yields for roots and tubers reaching their highest levels ever. In the 1990s yield levels deteriorated for all basic food crops and the harvested area of pulses declined again. The last decade started to show impressive improvements, until 2006, when harvested areas for the most important basic food crops (mainly maize) reached an

all-time high (2.4m ha) while average cereal yield levels improved from 1370 kg/ha in 2000 to 1650 kg/ha in 2006.

Although the harvested area of crops improved though not to 2006 levels, Kenya's basic food production in 2009 reached alarmingly low levels with the country is potential to feed only 72% of its population of 39 million at WHO food requirement levels. After 2009, the agricultural situation started to normalize and in 2011 Kenya could feed 88% of its population based on its own agricultural production, again assuming that basic food would cover 65% of all dietary requirements. The agricultural sector continues to play a crucial role for food security. However, it is faced by a myriad of challenges compounded by improper household food-resource handling procedures (Wema, 2010).

In Kenya, for instance, drought affects food production, floods disrupt road networks and transportation and poor storage facilities lead to enormous food loss and waste. During food shortages, local people rely on social networks, casual labour, trade, food aid and cash programmes to survive (IFPRI, 2017). Non-farm activities, however, do not generate sufficient incomes. Lack of employment opportunities means pursuing activities such as charcoal production that deplete natural resources and damage the already fragile environments rather than building resilience (IIED, 2016).

Despite the importance of the agriculture sector in its contribution to employment, government revenue, GDP and raw materials for the industrial sector, its performance has been dwindling. This is attributed to misallocation and under-investment in the sector, disengagement of government support to agriculture, poor infrastructure, limited access to credit and the high cost of farm inputs. The promulgation of Kenya's Constitution in 2010 enunciated a plethora of reforms key amongst them being devolution of agriculture.

Devolution aims to bring services closer to the people and enhance public participation in defining and charting out the development agenda at the grassroots level (KICIDP, 2013)

Devolved framework for agriculture for instance, is anchored in Part 2 of the Fourth Schedule of counties, which provides that the national government shall have *exclusive responsibility* of agricultural policy formulation whilst the county government shall *facilitate, implement and oversee all other agricultural related matters* including the implementation of national policies on agriculture. One of the core constitutional requirements is that both levels of government must observe and be guided by the principles of distinctiveness and interdependence stated under Article 6(2). Collectively, these principles echo the fact that even though both governments are autonomous institutions, they are interrelated and need to work together; especially when discharging their devolved functions including agriculture. Due to this interrelation, the Constitution mandates co-operation and consultation between the two levels of Government. It is expected that these principles serve to ensure that devolved agriculture benefits the people of Kenya.

Noticeably, Kenya's Constitution largely lacks specific provisions to reinforce a robust regime for the implementation of the devolved agriculture. Consequently, the National Government enacted the Agriculture, Fisheries and Food Authority Act, 2013 ('the Act') as the blueprint for devolved agriculture. A perfunctory glance of the AFFA Act, reveals legislative impediments to the implementation of devolved agriculture. Expressly, AFFA Act has fallaciously 'devolved' agriculture by creating a national state corporation; Agriculture, Fisheries and Food Authority (AFFA). In turn, the AFFA Authority is inherent with sweeping powers that arguably encroach on and remain aloof of the

functional and institutional distinctiveness of counties. For instance, under Section 4 of the AFFA act, the Authority is mandated to promote best practices in Agriculture, Monitor agriculture, be responsible for determining the research priorities in agriculture, and advise the national government and the county governments on Agriculture.

This immediate provision creates confusion and conflict in relation to devolution of agricultural functions at the county level. It is neither apparent nor implied what would be the role of counties in agriculture since the AFFA Authority is seemingly bestowed with overarching roles on all matters of agriculture. Notably, the agricultural functions of the national government are exclusively related to agricultural policy formulation while the roles of counties include the implementation of national agricultural policies, facilitation and the provision of agricultural services. The foresaid provisions imply that the AFFA Authority will overstep and undermine the functional and institutional integrity of counties. This therefore, connotes that the Constitutional principle of distinctiveness, the call for equality and autonomy amongst the two levels of government will remain ambiguous.

Ironically, Section 29 of the Act echoes Constitutional provisions for devolved agriculture; providing that both governments shall discharge their devolved agricultural functions as per the Fourth Schedule. Section 4 therefore appears to be misplaced and somewhat abhorrent given the AFFA Authority's mandate (clarify the section 29 and 4). Certainly, in the absence of clarity of roles of the AFFA Authority, it is deducible that the devolved agriculture in Kenya will remain a myth and indeed untenable. Accordingly, there should be shift or decentralization of power and control of agriculture from performance management models built around traditional hierarchical authorities within

state corporations, to the recognition of the distinctive role of counties in devolved agriculture.

In 2014, Kisii County Government developed County Integrated Development Plan (KCIDP), which provides for the baseline information to guide the implementation of all County devolved functions between 2013-2017 in all the nine sub-counties. Agriculture is one of the main focus of KCIDP, in its Integrated Plan, agriculture and rural development has been given a priority. Investment in agriculture at the County level aims to address, low crop productivity and food insecurity, high cost of farm inputs such as fertilizer, seeds, inadequate extension services, poor storage facilities leading to post harvest losses, poor crop farming methods, use of uncertified seeds, small farm sizes, limited access to credit facilities, lack of market and inadequate market channels for farm produce.

Despite the efforts to promote productivity by enhancing technologies, output has declined against ever-increasing consumer demand. This has transformed the country into net grain importer (WEMA, 2013)**.** One of the main factors leading to food security problems is food loss and waste. Food loss and waste have many negative social, economic and environmental impacts. Socially, food loss and waste is as a result of household composition including size, education, age, sex, occupation and inadequate experience in planning or preparing meals; uncertainty of the number of meals in the household per day; inadequacy of information and knowledge; family life style; gender roles and low perception of the impact of food loss and waste among rural farming households (FAO, 2014). Economically, they represent a wasted investment that can reduce farmers' incomes and increase consumers' expenses. Environmentally, food loss

and waste wreak a host of impacts, including unnecessary greenhouse gas emissions and inefficient use of water and land, which in turn can lead to diminished natural ecosystems and their services (Lipinski, 2013).

Moreover, weather uncertainties; natural disasters; climate change; seasonality; slow and inadequate governmental interventions to climate change; lack of farmer responses to climate change; lack of innovation and climate smart agricultural practices results to food loss and waste (FAO, 2014). A rudimentary question on household food loss and waste is on socio-economic and market conditions. For instance, why do these losses and waste occur given the rational behavior expected of farmers, consumers and other stakeholders along the food supply chains? This study therefore, is an attempt to give an account on this question.

Although technological innovation is recognized as a pathway for increasing yields for key staples, fertilizer application and improved use of seed among smallholder farmers are still below the recommended threshold, thereby slowing down crop yield growth (IFPR, 2017). There has been a policy thinking that agricultural and land reforms accompanied by increased government budget support have the potential to underpin a revitalized system of smallholder production especially in areas where land sizes have become too small. Thus, the Kenya's Vision 2030 and the National Land Policy, 2009 propose a range of agricultural and land reforms aimed at revitalizing smallholder agriculture in Kenya. However, not much has been done in improving household food security (Alila & Atieno, 2006).

Maize production for example, is practiced more by smallholder farmers who constitute the bulk of agricultural producers and majority of them are poor rendering them to poor

food-resource handling. Based on African's land endowment, an agricultural led growth strategy has been touted as a solution for achieving food security in the country (Muyanga, 2013). However, recent studies cast doubts on the land abundance, and argue that food security is dependent on household food-resource handling procedures employed along the food value chain to prevent food loss and waste (Ellis, 2005).

With global food supply struggling to keep up with demand since the 2007-2008 world food crisis (World Bank, 2011), all supply and demand components have come under scrutiny once again. Some studies such as World Bank (2011), FAO (2015), and Kange (2014) also argue that the majority of the Kenyan smallholder farmers do not practice proper agronomic, pre-harvesting, harvesting and storage and exchange procedures. This study is an attempt to interrogate the dynamic of the food chain losses using the case of Gucha Sub-county. The study also holds for food loss and waste occurring along the food supply chain from farm-to-fork (Lipinski et al., 2013). As APHLIS (2014) found, the total post-harvest losses for cereals during pre-harvest and harvesting, drying, farm storage, transport and market storage oscillate between 14% and 16% of the production.

Documentary analysis by the researcher has shown that since 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. Households are also incurring huge food bills due to the high food prices. Maize grains for instance, being staple food due to the food preferences is in short supply and most households have limited choices of other food stuffs. The current food insecurity problems are attributed to several factors, such as food loss and waste, which is a result ineffective farmers' adaptive capacity on household food-resource handling procedures.

Additionally, despite the unprecedented impressive development on prevention of food loss and waste across the country, much more remains to be done to sustain the gains so far made. This is aimed at driving the agricultural transformation needed for Kenya's development for a better life for all as articulated in the Malabo Declaration and the Sustainable Development Goals (2015). According to Lipton, (2009), despite the mounting population related challenges, Kenya still has the potential to revitalize smallholder agricultural productivity for reduced poverty and hunger if appropriate policies are pursued. While there has been general consensus on the need to improve smallholder agricultural production in the country, little attention has been devoted to understanding food loss and waste along the food supply chain from the perspective of household food-resource handling procedures (Muyanga, 2013). This study therefore, interrogates the potential for improving smallholder farmers' household food-resource handling procedures for inclusive agricultural growth and food security using Gucha Sub-county as a case study. The study specifically focuses on maize production.

2.3.1 Maize Production in Kenya

In this study, the main focus is maize cereal, which is the main staple (36%) food for most Sub-Saharan countries including Kenya. Inter-American Institute for Cooperation on Agriculture (IICA) conducted a survey to estimate the postharvest losses in Latin America and Caribbean countries and found that in almost all regions, most of the losses observed occurred at the small and medium-scale farms due to a lack of adequate harvesting, drying, and storage technologies, along with a lack of information about the good agricultural practices.

Maize (*Zea mays)* has its origin in Southern and Central America and introduced into Kenya at the Coast by Portuguese traders in the 16th and 17th centuries, but only started becoming an important crop with the European settlement from early 1900s (Odhiambo, 2016). However, any analysis of the maize sub-sector in Kenya in terms of its production and marketing must be done within the context of agriculture, which can be traced back to 1895 when the colonial government agricultural policy was prescribed for the Kenyan territory (Nelson et al. 2008).

The maize sub-sector has had a checkered and at times controversial development history starting with biased colonial policy (1895-1963) favoring the European and discriminating against indigenous Africans. Large tracts of land were alienated from African areas and distributed to European settlers to develop commercial agriculture that would use the then newly Uganda Railways to transport imported farm inputs and farm exports passing via the Mombasa port thereby making the railway viable. Many cash crops like coffee, tea, pyrethrum and sisal were therefore introduced and grown on large plantations. By 1906 the Colonial government had divided the country into 'white highlands' for the whites and the 'native reserves' where the bulk of African population was confined by legislation.

At the beginning of European Settlement, it was soon realized that coffee, sisal and pyrethrum required heavy initial financial outlay to establish and maintain before they could start giving back returns to farmers. Most of these crops also required high levels of input for their establishment and subsequent management. Maize farming on the other hand, became more popular among the settlers as it required less skills and limited financial outlay to produce. It also offered quick returns, just within one season. So, by

1929 about half of all the estates were growing maize as their main crop (Zwanenberg, 1972).

In the late 1920s, the European settlers started to form cooperatives to help market their farm produce and also act as a means for having bargaining power and fronting their course as pressure group. One such organization was the Kenya Farmers' Association (KFA) which was setup to market European crops and to lobby for their interest with the colonial government. By 1920s African farmers had taken to growing maize for subsistence and with some substantial surplus which they sold to the domestic market while European maize all went for export as the world market prices were higher than the domestic prices. However, as the depression of the 1930s depressed world prices, the white settlers through KFA lobbied for their maize to be given preference in the local market where prices remained higher than the world market price. They in turn pushed for the African maize to be exported to face the low world prices and thereby leave room for their maize in the domestic market.

The colonial government encouraged European maize farmers by heavily subsidizing railway transport rebates to enable them export their maize cheaply through Mombasa port. During the Great Depression in the 1930s, the maize farmers were given further subsidy on export maize that was sold in the depressed world market at prices below the local prices level. The colonial government reckoned that European maize growers were so important to the maintenance of white settlement farming structure in the country that they had to be helped to thrive. As such, they could not be left to depend directly on the low prevailing world prices over which they had no control.

In 1936, a marketing law was passed forcing African farmers to sell their maize to government and KFA agents at set prices and with specified grading system that would ensure that the export market was maintained even at the low world prices. This marked the beginning of maize price control in Kenya which later took various forms even after independence and only getting repealed in1993. Throughout colonial history, European farmers pushed for maintaining discriminatory policies against Africans not only in maize, but also in the other cash crop sectors in terms of production and marketing (Van Zwanenberg, 1972).

In the mid-1950s, it became apparent that Kenya would soon gain independence and the colonial agricultural policies were reformed under the Sywnnerton (1955) plan to embrace strategies for bringing African smallholders into commercial farming of cash crops like tea and coffee. When Kenya gained independence in 1963, the new government maintained the dual agricultural production system of the large scale and the smallholder systems. However, with the help of the new government, the large European farms were acquired by elite African farmers who were encouraged and supported to keep up the production systems in such farms to help develop the new economy. Other large farms were bought by the government and subdivided and then sold as small-scale farms to the poor and the, landless Africans who were also encouraged to step up production for their food requirements and with surplus for sale. Maize production has risen to be a large scale and smallholder farmer's crop even in the former white settler farming areas.

In Kisii County, despite the importance of maize and its widespread production and consumption, recent reports indicate dramatic reductions of expected maize yields (GoK,

2010). This has impacted negatively on livelihood, market prices, and overall food security (Oscar, 2009). The decline in maize yields is attributed to various production constraints which include: use of poor quality seeds, population pressure, land constraints, limitations to market access, poor state of infrastructure, high costs of farm inputs, soil fertility, and low soil pH with associated nutrient deficiencies and toxicities (De Groote et al. 2004).

2.4 Agronomic organization Procedures

As conceptualized in this study, agronomy is the creation, management and optimization of agricultural production through land preparation, choice of crops suited for planting and weeding. It is one of the household food-resource handling procedures, which is involved in food production processes. Food loss and waste are determined by the practices in all the stages along the food production chain. In developing countries, most pre-harvest losses and waste of cereal crops occur in rice, wheat, and maize, but they are not well document as most studies focus on post-harvest losses and waste.

In countries such as Bangladesh, they experience food deficiency and imports more than one million tons of rice every year accounting for more than 90% of food produced and about 70% of calories intake (Abedin et al. 2012). In West Africa for example, Nigeria is currently the largest producer of rice with an annual production of about 3.3 million tones (Kumar & Kutali, 2016). In spite of the large production and huge rice imports every year, a large number of people are undernourished in Nigeria.

Agronomic practices among farming households are characterized by land ownership, labour organization and arrangements, land preparation, planting, weeding and management of farms. Globally, the cereal groups accounted for the largest (20%) share

of agricultural production value (Tatlidil et al. 2013). In most African countries including Kenya, maize has been a major staple food. In Nigeria, smallholder farmers have depended mainly on small scale maize farming to improve their livelihoods. However, most of them are lowly skilled and poorly educated families engaged in maize production, which eventually compromises the quality of maize production process (Ogunsanya, 2009). For instance, labour uses rudimentary tools such as hoes and cutlasses and ox-drawn ploughs. Farming methods are basic, since, mechanization of agricultural practices is rare (Ogunsanya, 2009). Availability of good quality affordable inputs is clearly a major constraint for smallholder Nigerian farmers (Abubakar, 2006).

In Uganda, agronomic activities and food-resource handling processes are greatly influenced by cultural factors that influence people's behavior at the end in the production chain. For instance, rules of land inheritance and access to land are culturally determined through lineage or gender (Ojo, 2005**)**. This has an impact on food production processes. Communally, household and individually-owned land, all determine what is produced and how it is distributed. A large variety of studies in different regions of the world have identified the scarcity and high cost of inputs such as labour, agrochemicals and fertilizer as major impediments to raising the productivity of smallholder farmers (Egwuda, 2001). Other related problems include the difficulty in maintaining seed quality due to susceptibility to disease, perishability and the low multiplication rate of seeds (Adejoh, 2009).

In Kenya, there has been an expansion of land used for maize production as evidenced by 1.7 million hectares in 2008 and 1.8 million hectares in 2009. This was actually less than the 2009 targeted by Ministry of Agriculture which aimed at 2.2 million hectares

producing 36 million bags. The available figures showed that 2009 production reached 2.4 million tonnes (MoA, 2009). Farmers especially those in rural areas are faced with high rainfall variability, both within and between seasons and their farming systems have not been static (Cooper and Coe, 2011). They have tested and adopted new agricultural practices over many years. Clearly, coping better with climatic variability is critical to adapting to future climate change (Cooper et al. 2008). These changes in agricultural practices include improved crop, soil, land, water and livestock management systems, such as introducing crop cover, micro-catchments, ridges, rotations, improved pastures, planting trees, and new technologies such as improved seeds, shorter cycle varieties and drought tolerant varieties.

In the country, land ownership, access to land, access to other productive resources and the organization of agricultural production are influenced by cultural practices and traditions of the various ethnic groups and directly affect agronomic practices. Many interventions such ASDSP have significantly focused on resource allocation on food production increase among rural farmers (Kader, 2005). They believe that increasing agricultural productivity is critical for ensuring global food security, but this may not be sufficient. This is because, food production is currently affected by limited land, water shortage and increased weather variability due to climate change and improper household food-resource handling practices. The end result is food losses and waste. Studies have shown that 95% of the research investments in the past three decades had focused on increasing productivity and only 5% directed towards reducing losses (Kader & Roller, 2004; WFLO, 2010). This study is an attempt to add to the knowledge of this neglected aspect of food security research.

HLPE (2014) observed that pre-harvest conditions and actions in the field can indirectly lead to losses at later stages in the chain. Furthermore, agronomic practices influence quality at harvest, suitability for transport and shipping, storage stability and shelf-life after harvest. Florkowski et al. (2009) have found that agronomic factors precipitating post-harvest food losses in terms of quality and quantity can be divided into four groups. These include choice of crop varieties for production, practices such as fertilization and/or nutrient management, water management, pest and disease management, drainage system, staking, transport preparations and bagging.

Biological factors and environmental factors in pre-harvest period can lead to failure to attain desirable quality attributes during crop production, which may lead to a high percentage of food losses (Oerke, 2006). However, accurate estimates of agricultural losses caused by insects during agronomic activities are difficult to obtain because the damage caused depends on a number of factors related to environmental conditions, the plant species being cultivated, the socioeconomic conditions of farmers, and the level of technology used (Oliveira, 2014). Apparently, food losses and waste owing to these attributes vary according to the different types of cultivation, seasons and different production strategies, availability and extent of agricultural extension services for farmers.

This study noted that few governments have substantive programs to monitor and systematically evaluate the losses at agronomic and pre-harvest stage. However, Kenya has done little, as there exist inadequate interventions on types of cultivation, unavailability of agricultural extension services and pests damage. This is the reason why

data on agricultural losses experienced during agronomic stage is extremely scarce and scattered in the scientific literature.

Although there have been some studies on post-harvest, none estimate total food loss and waste on-farm or during pre-harvest. Additionally, there are few peer-reviewed food loss and waste studies (Muth et al. 2007). According to AGRA (2016) smallholder farmers mostly in rural areas continue to lack access to knowledge about current agronomic best practices in an effort to reducing food loss and waste. The barriers to extension on a large scale continue to pose a great challenge. For instance, Gandhi (2016) notes that extension agents are too few, with farmers growing many varieties of crops and speaking too many languages for service providers to develop and apply a standard mechanism and transportation infrastructure is inadequate, making it difficult for extension agents to reach rural communities.

Ousmane et al. (2016) on the other hand quips that agro-input companies, have the input products needed, but face challenges in reaching smallholder farmers who live mainly in remote and hard to reach places. From the above review, agronomists and extension agents, quite often lack a platform on which to record farm and crop data that could help other value chain actors and the end result is a vicious cycle of misinformation, misuse of resources, low productivity and crop loss despite high input costs, and a disconnected and under-performing value chain system. To sustainably achieve the goals of reduced food loss and waste, more research is required on food-resource handling procedures along the whole food production chain and especially from a social cultural dimension, to help fill this knowledge gap. Therefore, the objective of this study is to interrogate household

food-resource handling practices and unravel the extent of influence food security status of smallholder farming households.

2.5 Food Harvesting and Storage Beliefs and Practices

Food harvesting is the process of removing maize cobs from the stalk and transporting to the homestead for drying and storage, whereas storage is the process of preparing and placing maize cobs and grain in a secure and well ventilated place or facility to avoid damage before use. Harvesting and storage variables are a chain of interconnected procedures from the time of harvest to the delivery of the food to the consumers (Abass et al. 2014). In smallholder farming households, harvesting is an important practices, which determines future availability of food and consumption behaviour (FAO, 2016). Agricultural commodities produced on the farm have to undergo several procedures like harvesting, drying, threshing, winnowing, processing, bagging, storage, transportation, and exchange before reaching the final consumer (Abass et al. 2014). The primary role of an effective post-harvest system is to ensure that the harvested food reaches the consumer, while fulfilling customer satisfaction in terms of quality, volume and safety. However, this may not be the case due to a number of reasons.

World Bank estimated 7%–10% of grain loss in postharvest operations at field level, and 4%–5% loss at the market and distribution stage in India. Estimates also suggest that the approximately 12 to 16 million metric tons of grains wasted each year, could meet the food demand of about one-third of India’s poor population. However, despite the criticality of the issue, availability of consistent and reliable postharvest loss data is still a challenge (World Bank, 2011).

Very few assessment studies on food losses have been conducted in developing countries such as India, China, Brazil and Kenya. After the FAO report in 2010, various institutes are making efforts to conduct comprehensive household surveys, interviews, and field measurements to determine the actual status of food loss and waste along the food supply chain in various countries (FAO, 2011). This study adds to this endeavor through a focus on the social cultural dynamics of food loss and waste from Gucha Sub-county.

In Guatemala, due to a lack of storage structures along with the region's high humidity, storage losses were estimated between 40% and 45% (IICA, 2013). Insect infestation was found as the major reason of storage losses in most of the cases. According to Alavi et al. (2012), an average of 23% losses in the maize value chain in Southeast Asian countries, with maximum losses happening during field drying (9%). In Togo, Pantenius (1988) estimated 0.2%–11.8% weight loss due to insect infestation in maize after 6 months of storage in traditional granaries.

Kaminski & Christiaensen (2014) conducted a study to estimate the postharvest losses in maize crop in Uganda, Tanzania, and Malawi through comprehensive household surveys. The losses from the farm level activities were estimated in the range of 1.4% to 5.9%.

Premature harvesting is also one of the main reasons for high food losses and waste along the entire Food Supply Chain (FSC) (Kipng'eno, 2012). In terms of food processing, traditionally, maize is processed by de-hulling or pounding using either a stone quern or mortar and pestle (Kangethe, 2011). The aim is to remove the outer covering to soften the maize for cooking. Dry milling was also traditionally carried out using water mills. The processed maize is used to make a variety of traditional products such as ugali (thick slurry) and porridge (thin slurries) which is the main staple for most households in

Kenya. Traditional processing methods such as de-hulling, soaking and cooking maize have been reported to reduce the levels of aflatoxins by 46.6%, 28-72% and 80-93% in maize containing 10.7-270 ng/g of aflatoxin levels in Kenya (Mutungi et al. 2008).

As noted by Calverley (1996), food losses and waste during crop processing could be significant. For example, there is loss and waste between 6-10% for maize in some African in countries, about 7% for rice in Madagascar, (and 4.3%). Harvesting, drying and threshing losses reported for sorghum and millet were 11.3% and 12.2% respectively, while losses of 3.5% and 4.5% were recorded in Zambia and Zimbabwe respectively, for maize dried on raised platforms. Threshing and shelling losses in smallholder manual methods for Zimbabwe is 1–2.5%, while it is 3.5%, where mechanized shelling is done. Losses for rice during threshing were 6.5% and 6% in Madagascar and Ethiopia respectively, and 2.5% and 5% respectively during winnowing in the same countries (Hodges, 2012). The researcher further estimated quantitative grain losses (prior to processing) to be in the range of 10–20%, but losses of over 50% in cereals and up to 100% in pulses have been reported by other investigators (Obeng-Ofori, 2011).

In Tanzania, the maize weevil (*Sitophilus zeamais)* causes significant damage, although new studies showed that some maize varieties are more resistant to attack (Rugumamu, 2012). Crop storage plays a paramount role in ensuring effective household food supply (Bonti-Ankomah, 2001). Differences in the quality of household food-resource handling procedures towards storage may yield to either food loss or waste. Despite strong emphasis on improved storage facilities as a way of proper household food-resources handling, many studies on food security such as Bala et al. (2010), Aulakh et al. (2013), Majumder et al. (2016), and Kumar & Kutali, (2017) have noted that maximum losses

happen during this procedure. Many developing countries including Kenya still rely on traditional storage techniques for cereals.

In West Africa for instance, farmers store their crops in homes, on the field, in the open, jute or polypropylene bags, conical structures, raised platforms, clay structures and baskets (Addo et al., 2002; Hell et al., 2000). In India, between 50–60% of the grains are stored in the traditional structures such as Kanaja, Kothi, Sanduka, earthen pots, Gummi and Kacheri, at the household and farm level for self-consumption and seed for planting in the next season. In South Africa, inadequate post-harvest storage contributes significantly to food insecurity and more so in areas with high humidity as is experienced in KwaZulu-Natal (Ntlokwana, 1999). Additionally, the widespread and continued use of traditional storage practices by small scale and subsistence farmers despite considerable losses is evident (Abass et al. 2013).

Studies by Oliveira (2014); HLPE (2014); and FAO (2016) have shown that generally, most rural household storage facilities are woefully inadequate. This has led to substantial food loss and waste, both in quality and quantity (HLPE (2014). Although traditional storage facilities are relatively simple and inexpensive to construct and maintain, traditional storage systems are not adequately prepared to safely store food, hence, lead to substantial post-harvest losses and waste (Kareith et al. 2013). In addition to this, farmers and crop handlers, especially women have inadequate information on proper household food handling procedures such as storage. This has resulted in significant food damage by insect pests during storage and marketing (Rugumamu, 2009).

In Tanzania, farmers store crops in small bags with cowdung ash, in wood and wire cribs, pits, metal bins, wooden open-air or roofed cribs, and in raised platforms and roofed iron drums enclosed with mud (Wambugu et al. 2009; Kankolongo et al. 2009). The larger grain borer *Prostephanus truncatus* (Horn), grain weevil *Sitophilus granarius* (L.) and the lesser grain borer *Rhyzopertha dominica* (F.) are some of the predominant food grain storage pests affecting cereal storage (Holst et al. 2000; Hodges, 2012).

Crop storage efficiency depends on storage length, losses during storage such as quality deterioration and storage volume. Losses are largely due to disease, pests and oxidative damage (Salunke & Desai, 1986). Most farmers store agricultural products for at least some time before consuming at home or selling at market. Suboptimal pre-storage drying practices are common preconditions for the accumulation of mycotoxins during storage (Hodges et al. 2011). Traditional storage shelters made out of natural materials often harbor or fail to keep out produce-eating pests and/or are unable to protect food from humidity and temperature variability that result in the vitamin or protein breakdown or food spoilage.

Traditional storage methods, including botanicals and ash, in addition to the use of insecticides and fumigants are often used in storage to keep infestations to a minimum. Even where storage structures are modern, loss at this juncture may be stochastic or unavoidable for a host of other reasons, including electricity interruptions, and storm damage (Sheahana & Barrett, 2016). Food losses can be quantitative as measured by decreased weight or volume, or can be qualitative, such as reduced nutrient value and unwanted changes to taste, color, texture, or cosmetic features of food (Buzby and Hyman, 2012). Food losses in the developed countries are generally low in the middle

stages of the supply chain. This can be attributed to more-efficient farming systems, better transport, better management, storage, and processing facilities which ensure that a larger proportion of harvested output is delivered to the markets (Hodges, Buzby and Bennett, 2011).

In Kenya, Kangethe (2011) noted that during harvesting of maize, the farmers cut the stakes in the field. The maize is left to dry and then remove the cobs later. During harvesting and removing husk, the maize cobs are thrown on the ground and later picked up for storage before shelling. This procedure exposes the maize cobs to fungal spores in the soil and this increases the risk of aflatoxin contamination in later steps in the processing of maize. Timing of the harvesting when the maize is mature and dry is critical in determining the amount of food loss and waste, yet some of the smallholder farmers do not have adequate knowledge on when it is best to harvest.

Kang'ethe further asserts that poor post-harvest handling procedures especially storage at household level in developing countries should be blamed for aflatoxin outbreak. While this may have been the case, no tangible progress has been achieved in improving storage facilities at household level. Smallholder farmers construct cribs and whether these have had impact in reducing aflatoxin accumulation in maize at household level has yet to be evaluated (Mahuku, 2011). Affognon et al. (2015) now call for further research to establish methodologies aimed at accurately measuring losses at levels of the value chain beyond the farm, since most of the existing studies of losses in value chains rely exclusively on case study approaches that are not statistically representative.

Despite a widespread and systematic search of published and unpublished literature, Affognon et al. (2015) found no conclusive evidence on the magnitude of quality losses

stemming from diminished nutritional value or food safety concerns. The only studies available point to the percent of sampled crops over acceptable mycotoxin levels and in very narrow geographic regions like Kenya. For instance, while most research has focused on mycotoxin contamination in high outbreak areas Sheahana & Barret (2016), Mutiga et al. (2015) find aflatoxin contamination above the regulated limit even in areas with no reports of human fatalities such as western Kenya. This study therefore, investigates food loss and waste in storage and finding appropriate, efficient and inexpensive post-harvest technologies for smallholder farmers.

2.6 Household Food Consumption

Food Consumption is the amount of maize available for human consumption. Household food consumption is one of the major components in the food supply chain. It is also one of the stages, which is significantly affected by food loss and waste (Aulakh et al. 2013). Worldwide maize consumption accounts for 31% of the total food production and constitutes more than 75% of the cereal consumption. In 2013/14 maize consumption was around 950 million metric tons (FAOSTAT, 2014), with Africa consuming over 30% and SSA around 21%. Eastern and Southern Africa use larger portions approximately 85% of its production as food (IITA, 2009). Unlike other cereal crops that are consumed mainly by human as food (wheat and rice), maize is a multi-purpose crop used as food, feed, fuel, and as raw materials for industry (Morris and López-Pereira, 1999). The crop has faced the greatest loss and waste during handling procedures. The food loss and waste is categorized as weight loss due to spoilage, quality loss, nutritional loss, seed viability loss, and commercial loss (Boxall, 2001). The magnitude of food losses and waste at

consumption stage vary greatly among different regions and economies (Kumar & Kalita, 2017).

Over the past few years, there has been renewed emphasis on efficiency and food safety at the consumption stage. This has stimulated a major paradigm shift in the way postharvest food losses and waste is conceived from a series of individual components to an integrated value chain linking producers and consumers (Hodge et al. 2010). Most consumers in developed countries have weak financial incentives to minimize food loss and food waste because they have access to an abundance of inexpensive, readily available food. In the USA, over a period of about 80 years (1929–2008), food expenditure by families and individuals as a share of disposable personal income decreased from 23·4 to 9·6% (USDA/ ERS, 2010).

In Europe, research exploring the households' food and food waste behavior or practices in the UK has shown a more in-depth picture of consumer perceptions and thoughts, both with regard to motives governing this as well as social cultural behaviour. Ethnographic studies in Europe indicate that consumers do not carelessly loss or waste food (Evans, 2012; 2011) rather, it is the socially or culturally determined practices in food consumption and the contextual factors in which food habits are embedded that crucially impact consumer's loss and wastage of food.

Watson and Meah (2013) observed that consumers seem to explicitly articulate rare environmental concerns, but are strongly driven by an innate ethical motivation to do the "right thing" yet consumers also express motives that counteract food waste avoidance behaviors. For example, consumers experience the inconvenience connected to avoiding food waste and have the wish to be a "good" food provider for the family ensuring all

member's wishes and tastes are satisfied, potentially at the expense of cooking too much, allowing pickiness or throwing undesired leftovers out (Graham-Rowe et al. 2014).

Studies conducted in Indonesia on household food consumption behavior during shortage of food, found out that 80% of rural women took a smaller number of meals during periods of food shortage, while the percentages of husbands, other family members and children were 6%, 11% and 3% respectively. The 87% of the studied women mentioned that the daily meal is first served to the husband or senior male member of the family and that they have the best share of the food. After that, the children and other family members get the second priority in meal distribution, while rural women take the meal at the end and usually eat a smaller amount of food in case of shortage (Zhou, 2013).

Intra-household food distribution may change in the face of shocks to entitlements. There is evidence from rural South India that food price rises will result in a greater fall in calorie intake for female members of the household. However, they also benefit more from a fall in food prices. Evidence from both Orissa in India and Sub-Saharan Africa indicate that in times of food scarcity such as famine, children get first priority, before adult men and women (Peter et al. 2013). In South Africa, food consumption patterns are determined by food eating habits and food preferences by citizens (Viljoen, 1996).

In Kenya, adult male's consumption of food is greater relative to needs where the household faces chronic food insecurity. This can be interpreted in two ways. The decision to distribute in food distribution in favor of the adult male may be a conscious survival strategy, adopted by the family as a whole to enhance the income he brings in as principal bread-winner. The unequal distribution may be a result of intra-familial conflict, where the adult male has greater power, based on his individual entitlements. Increasing

household entitlements would not necessarily improve food security for other household members, unless this could be effectively targeted away from the adult male. Nyoro et al. (2004) and Peter et al. (2013) reported that nearly 400 grams of maize are consumed per day per person. Given these conditions, and the geographic isolation of rural communities, income seasonality and its implications are important policy issues in the country.

Maize as a staple food in Kenyan is consumed in virtually all parts of the country with the per capita utilization put by various sources at between 1-1.5 bags or 100-150kg per year (World Bank, 2010). As far as the country is concerned maize remains basically a food crop which features more in domestic market than in the international trade. According to Kenya Maize Development Programme (KMDP) maize is the primary staple food crop in the Kenyan diet with an annual per capita consumption rate of 98 kilograms contributing about 35% of the daily dietary energy consumption (FAOSTAT, 2014).

An important challenge in the quest for food security among poor rural agricultural households is sustaining food consumption during the lean season. This is especially true for farm households that rely on rain fed agriculture, and who have poor post-season storage capacity, or limited market opportunities to monetize post harvest surpluses (Oliveira, 2014). A number of studies have documented the extent of consumption seasonality in developing countries, as well as the behavioral responses that agricultural households display in the face of extreme fluctuations in income due to the agricultural cycle (FAO, 2014; IFPRI, 2016). According to Ministry of Agriculture (MoA (2011), Kisii County has experienced decline in maize production, caused by decline in soil

fertility, decreased agricultural extension worker to farmer ratio, persistent sub-division of land, infestation of pests and diseases and low funding to agricultural extension by the government.

Considering the above, an individual's concern for food security is anchored on his or her ability to acquire or access food, be it free or at a given cost. However, from the point of view of nutrition, accessibility, availability and affordability need not be the only concern but should also cover food quality. Food availability is a major function of the producers and the distribution channels, accessibility and affordability are a function of the buying power of the consumers (Briones et al. 1999). Purchasing power also affects the quality of food bought by consumers with the premise that the poor households or individuals can only afford low quality or less nutritious foods. This is the reason why when food security is the main concern, the calorie adequacy of households must also be considered (FNRI, 2005).

Melgar-Quinonez et al. (2006) examined the relationship between household food insecurity and food expenditure using sample households taken from rural areas with small central urban district in Bolivia, Burkina Faso and the Philippines. Households which are food insecure, even at moderate levels, might have a very poor dietary quality (low intake of micro-nutrient-rich foods) and that severely food-insecure households might have limited access even to staple foods.

According to Fine et al (1996), food consumption is seen as representing a passive sphere of re-production, the development of which is mainly a reflection of changes going on in the productive sphere. The household is often taken as the unit of analysis on issues of household food security, yet the need is identified at the individual level. Different

physiological needs of different members of the family mean that it is neither fair nor efficient to divide the food available equally amongst the different family members. It is difficult to observe how intra-familial food distribution actually takes place. When families have a communal kitchen, it is difficult to identify the food intake of individual members accurately.

In many studies improving consumer household food management social cultural behaviour in terms of acquiring and actually enacting food skills and handling know-how to the end of avoiding food waste is a central issue. However, it is clear that it is not easy to change, especially in light of the many other goals and associated trade-offs involved in food and eating. Avoiding food loss and waste might likely continue as a relatively low priority for consumers. Therefore, what appears to be a promising direction, especially as collaborations between multiple actors, is the combination of actions: on the one hand, providing actionable tips and tools, while on the other hand, slightly raising motivation and involvement by emphasizing the multiple ethical reasons alongside the win-win situations.

2.6.1 Socio-cultural Factors Underlying the Acquisition and Consumption of Food

Food anxiety has been traced to the fact that humans, as omnivores with cognition, must consider their choices when selecting what to eat (Pollan, 2006). Because they are omnivores, humans require a diverse diet from a range of plant and animal sources. Each new food that they sample, however, presents the potential for life-sustaining nutrients or sickness or death. Their cognitive power means that humans are aware of options and their ramifications and can make conscious choices about what to consume. The issue is compounded by the special nature of food, as something that we take ourselves and

becomes part of us. Humans have evolved food cultures or diets as a way of passing on accumulated food knowledge and reducing the anxiety associated with the omnivore's dilemma.

Social influences on food intake refer to the impact that one or more persons has on the eating behavior of others, either direct or indirect, either conscious or subconscious. Even when eating alone, food choice is influenced by social factors because attitudes and habits developed through the interaction with others (Feunekes, 1998). Research has shown that we eat more with our friends and family than when we eat alone and the quantity of food increases as the number of fellow diners grows (De Castro, 1997).

The meaning of food is closely related to traditional practices and customs and values associated with the sacredness of the body, while physical and spiritual perspectives being significant in relation to cultural values, attitudes and beliefs that are still considered relevant today. Food is not only considered as a source of physical nourishment but also an important source of medicine and spiritual nourishment. People whose diets consisted of traditionally sourced food were not considered to be fat or obese and all sources of traditional food were considered to be healthy with the social meaning of food inextricably linked to cultural values, beliefs and practices.

Although differences in ethnic food habits exist, they have changed over time as people migrate, intermarry and interact. This has resulted in adoption of new cultures and the modification of existing ones. For example, with the advent of the early traders and colonialists to African countries, new foods such as spices, non-indigenous fruits, wheat, rice and maize were introduced. According to Rutishauser (2008), by the 1960, leavened bread had become popular because its ingredients were familiar and readily available.

Maize and rice are other examples of introduced foods, which in various forms have increasingly contributed a major proportion of peoples' diets. Such foods have therefore, been adopted and acculturated within various cultural settings to the extent that they are likewise subjected to indigenous traditional cultural food preparation practices such as malting, fermentation and brewing.

2.6.2 Food Exchange Practices

Food exchange is the process of intra and inter-household food sharing and exchange of maize products among household members. Food exchange is an important attribute in the food production chain system. Kangethe, (2011) highlights six categories of food exchange agents in the maize grain marketing chain. These are assemblers, wholesalers, retailers, disassemblers, posho millers and large-scale millers. In addition, a smaller category of traders using bicycles purchase and bulk maize at the farm level and deliver to the assemblers, retailers, or posho millers. Since trading in maize and maize products is fully liberalized in Kenya, producers are allowed to sell maize to buyers of their choice at the time they want. The price is highly influenced by the time of the season (FAO, 2014).

At the time of harvesting, prices are lower because of temporary oversupply of maize. Most actors do not have formal networking relationships and they come into play at different times during the harvesting period. Occasionally an influx of maize can be experienced from outside the districts adding to the existing merchant stocks. The demand for rural milling services (posho mills) lasts throughout the year as grains retained for domestic use can take the families that long. Some farmers store some grains

to speculate on rising prices as the supply reduces, and only sell a fraction of their harvest to meet the cost of immediate family needs.

Traders transport maize from anywhere in the country at a time of their choice and at prevailing market prices. The maize can then be resold to any other buyer immediately or weeks later. During the harvesting period of about two months when maize prices are at the lowest point, some traders operate for only six months a year, when maize is in abundance and can be sold at prices that they consider can make good margins. Unshelled dry maize is never sold as a consumable product, with shelled maize being the most commonly traded product. For those who transport maize to the market, their grain is sold at the prevailing price. They never struggle to recover the cost of marketing, and often are aware to choose the type of measuring unit to be used to measure their produce.

Quite often the agricultural produce is lost or wasted when there are no customers at the time time because they lack right prices, lack of reach to buyer and poor transportation networks. A good transportation system also means it should provide a safe environment for the produce for the time it is transported to prevent spoilage (FAO, 2016). The importance of active trade and markets ensure access to undisputed food both to allocate food in local contexts and at the international level. For densely populated countries or regions with low agricultural production potentials it is vital to count on reliable and affordable food supplies from other regions or countries. At the same time, high dependency on external food supplies may pose a considerable risk to the food security and economy of women and men in these countries, as they are disproportionally exposed to shortages and price hikes on the world market. The importance of functioning local markets becomes evident here (HELVETAS, 2013).

Maize exchange in Kenya for many years had been under the Maize Produce and Marketing Board and later changed to the NCPB which was formed to cater for all the product marketing. Before liberalization of the sector in 1993, NCPB set the price of maize in the country (Odhiambo, 2012). Despite the liberalization, NCPB still plays a major role in price setting as it buys maize on behalf of the government for country's strategic grain reserves. NCPB is the single major buyer of maize with a capacity of over 4 million (90kg) bags. The price that NCPB sets scales down to other marketing channels. This price is also influenced by imports from neighboring countries.

Studies have shown that indebted households may be forced to sell off a portion of their harvest at low post-harvest prices (in order to repay interest on a loan), and then buy back their subsistence needs at a later date at a higher price. With such 'distress sales', they may thus lose out whilst only repaying interest, with the capital debt remaining. They may even have to take out a further loan to enable them to purchase food once their meager stocks run out. The land market is another source of exploitation. Tenants may be forced to pay rents in kind after harvest when prices are low. They may be required to provide rent in the form of labour on the landlord's land at a critical time for their own crops (FAO, 2016).

Such a compulsive involvement in interlocked markets impoverishes those dependent on them at the same time as it profits those in control. Larger farmers, landlords and creditors utilise markets to their own advantage-hoarding their crops and selling large quantities at times when the price is highest and interlocking the markets for food, labour, land and money so as to extract the maximum gain from labourers, tenants and debtors (a majority of the poorest groups are likely to be all three). The ecological Model of Food

and Nutrition by Jerome (1980) shows how global forces, global capitalism and rural-to-urban migration synergistically affect the physical environment such as climate change, social environment such as local food system, social organization such as food sharing, "culture" such as indigenous food knowledge, technology such as agricultural practices, dietary such as individual food consumption patterns and nutritional needs and status for biological maintenance, growth, immune function, reproduction (Pelto et al. 2012).

After harvest it has been noted by scholars that, self-sustaining domestic markets for food are non-existent in the rural areas. This is due to lack of proper planning and coordination. Several other studies on food security such as Sorre (2010), Barasa (2010), Murray (2002), FAO (2000), on Cash Crop Production, Food Security and Nutrition; Rural livelihoods; and The State of Food and Agriculture, respectively, have done little on household food-resource handling procedures, which this study presumes as the major cause of household food insecurity in Gucha sub-county. As Word Bank, (2011) contends, the implication and success of food resource-handling procedures particularly post-harvesting (processing, consumption, exchange/marketing) procedures, are influenced by social-cultural norms, gender dynamics and diversity. However, the study does not go beyond to explain how these variables influence food security status among households.

2.7 Theoretical Framework

2.7.1 Real-life Choice Theory

The theory was propounded by Gladwin (1980). The theory proceeds from the observations that people need a simple procedure to make decisions, and tend to compare alternatives rather than ranking options. In this study, the theory incorporates some of the

simplifying procedures farming households use in making everyday real-life decisions. The theory differs from the economic point of view that decision makers rank available alternatives on preference and/or indifference. Instead, it posits a psychologically realistic two stage model of the choice process or a set of decision rules. In order to overcome cognitive constraints, decision making proceeds through an elimination by aspects and preference stage. Elimination by aspect is often rapid, informal and even subconscious, in which the number of alternatives is reduced to a manageable number by eliminating those that fail to meet certain major criteria for example, specific crops to plant and requirements for capital and labour. The decision is made by the farmer as to whether he/she is satisfied with the choices made in the previous farming year.

According to Gladwin (1980), the most important determinants of farmers' adoption of a given technology for farming is capital, knowledge, labour, or market demand. If farmers thought that capital would not be sufficient to support agronomic activities, then farmers would eliminate those crops directly, and so on. The process of elimination is largely done as a subconscious process (Gladwin & Murtaugh, 1980). The theory also points out that farmers have decision preference in which surviving alternatives are directly compared through a succession of personal preferences such as potential of different crops for satisfaction of family food needs, consumption choices, relative profitability, and relative riskiness.

In this study, the theory explains how the farmers' preferences in decision making during the process of food production to consumption is impacted by allocative efficiency, which focuses on the extent to which farmers make efficient decisions when in a given

situation. Of paramount here is the decision on possibility of increasing output while conserving resource use (Baloyi et al. 2011).

According to this theory, the counterargument by experts (agricultural extension officers) to the claim that 'maize is not the right crop for smallholder farmers' is against farmers decisions. Farmers are the real experts at deciding what they should do. They know all the reasons why they should plant maize. Farmers choose the most practical combination of inputs to produce profit maximizing output level. The study argues that for the farmer to realize his/her objective, the following questions need to be answered; what is the optimal combination of inputs so that output is produced at minimal cost? How much profit could be increased by simply re-allocating resources? Therefore, farmers have to choose a combination of inputs to be used in right proportions and technically efficient at low prices so that output is produced at minimal costs.

Elsewhere the theory has been shown to be effective in both describing and predicting farmer decision making processes in both developed and developing country contexts. For instance, Gladwin demonstrated that the theory typically models successfully 85 to 95% of choice made by individuals, such as market decisions of Ghanaian fish sellers in 1975, Guatemalan farmers' cropping decisions in 1980 and also understanding of farmer decision-making in East Lombok.

Notwithstanding, the theory posits that sometimes individual farmers have to make decisions based on limited information, and hence they have differing perceptions as to both income and risk. This may compromise their production processes. However, it does not explain why people behave in particular ways in the production process, as it only

focuses on behavior rather than motivation. Therefore, this is well addressed by the Personal Construct Theory of Kelly (1955; 1991).

2.7.2 Personal Construct Theory

This theory postulates that people's 'processes are psychologically channeled by the way in which they anticipate events (Kelly, 1955). It rejects the idea that people perceive and make sense of their world by means of conceptions that exist independently of the individual person and instead proposes that people see their world through a set of personal constructs. In other words, their motivation and behaviour are led by expectations of the future. This study holds that people's expectations are determined by their individual construct system, through which they interpret the world and thus, make sense, discern patterns, establish order in the complexity of their life and make predictions about future events and outcomes of decisions. This means that their constructs are created over-time in the course of people's interactions with their environment and their daily activities and express the dimensions along which a person differentiates among objects and events.

Constructs are bipolar in that each construct comprises a similarity-difference dimension, which may for example define a construct as consisting of simple versus complex. This construct is different from the constructs simple versus powerful, in which simple is akin to powerless, and simple versus engaging, in which simple is akin to uninspiring. People differ substantially in the richness of their repertories of construct and, consequently, in the refinement of their ways of construing the world and informing their actions. A person's constructs is not necessarily consistent with each other, and it can be explicitly formulated or implicitly acted out.

Capturing users' thoughts about systems can also be seen as a method for studying the constructs people employ in talking about their use of systems. In relation to food security studies social scientists should try to understand the farmers' way of life from their point of view in order grasp what Malinowski (1922) postulates 'the native's point of view', in relation to life, and to realize the vision of their world. In this regard, agricultural interventionists should be able to understand farmers' rational reasons for farming and food-resource handling processes, the way they do as well as describe indigenous knowledge systems and logic that make some farming practices unchangeable and others changeable. The aim is not only to understand the meaning of native expressions that farmers use to describe their soils, their seeds, their fertilizers, or their harvesting or storage practices, although this knowledge can be very useful (Brush et al. 1981), but also to elicit the decision rules and traditional strategies that farmers use and refuse to change in order to survive in an increasingly bureaucratic world of government and donor agencies that need to change them. The theory has been demonstrated to provide powerful insights, through eliciting relevant constructs from decision makers into understanding their perspectives.

Theory has been applied in understand farmers construction of on climate change and the farming systems on the new cropping lands on East Lombok, which is highly seasonal. Accordingly, the farmer decision processes are analysed here on the basis of planting seasons. The researchers built intuitively the decision trees based upon farmers' responses and their revealed constructs when they were asked to provide reasons for selecting particular crops they were growing and for not selecting other crops and/or for not planting their lands at the season.

The complementarities of the approaches offered by the two theories provide justification for attempting to combine both in this study. Gladwin's real-life theory approach provides a framework in which complex decisions can be structured, simplified and analyzed. Kelly's construct theory provides insights into the importance of individual values, experiences and expectations in relation to such judgments. For instance, the decisions farmers make are optimal not necessarily the best, as long as farmers meet their livelihoods. In this study livelihood means the capabilities of farmers in terms resources (material and social) and activities used by a household for means of living. For example, a smallholder rural farming household's livelihood is secure, when it can cope with and recover from stresses and shocks, and maintain or enhance its capabilities and productive resource base. To achieve better farm production, the resources need to be allocated efficiently. The decision to engage in food production and the food-resource handling practices involved by farmers in the study area are assumed to be practical or real, hence deliberate.

Farmers choose how to attain maximum benefits in their farming activities by considering aspects such as the availability of farming inputs, harvesting procedure, processing, storage and consumption patterns that are as a result of the kind of food-resource handling practices in the production chain. Unfortunately, food production and food-resource handling by farming households may not be rational or systematically done based on modern farming ideas and techniques. This is due to the fact that farmers have their own justification behind their decisions to engage in the kind of food resource handling procedures based on their socio-cultural understanding of how best it should be

done. The two theories give justification for what rural household farmers do, how they do it, when they do it, regardless of whether it eventually ensures household food security or not.

2.8 Conceptual Framework

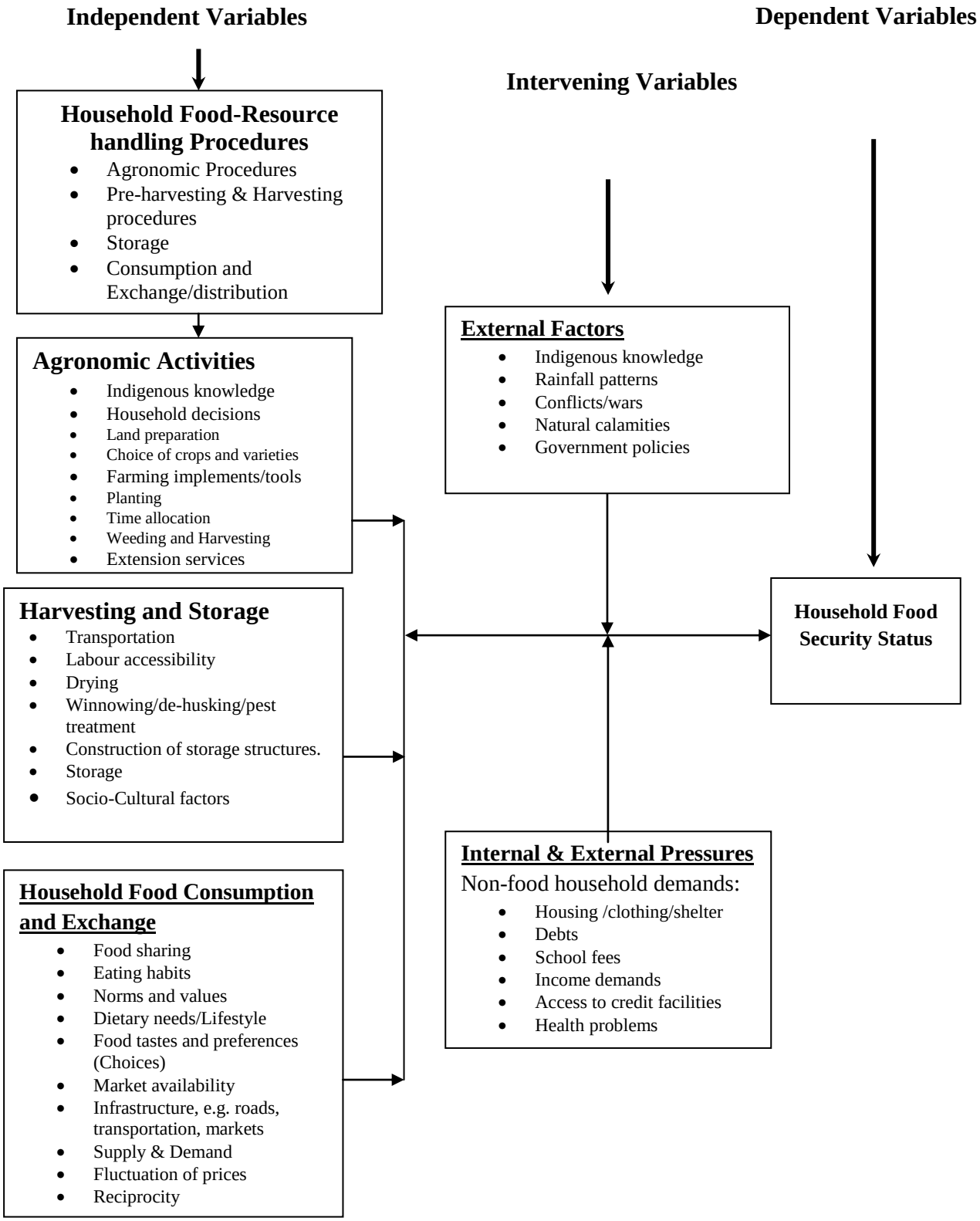


Figure 2.3: The Conceptual Framework

Figure 2.3 above shows that household food-resource handling procedures revolve around agronomic, pre-harvesting and harvesting, processing and storage and consumption procedures. The premise of this study was that that food loss and waste remains one of the most discernible dimensions of poverty and a significant symptom of smallholder farmers in Kenya, which is further aggravated by improper household food-resource handling procedures. There exist inadequate data on food loss and waste, thus, impeding development of effective strategies to reduce food loss and waste and improve coordination of national policies and strategies in order to reduce food loss and waste.

Agronomic procedures including: land preparation, choice of crops and varieties, farming implements/tools, planting, time allocation, weeding and harvesting, and extensional services, determine food losses and waste at the first stage in the value chain. In the harvesting and storage procedures, transportation, labour accessibility, drying, winnowing, de-husking, pest treatment, construction of storage structures. Storage and distribution procedures also determine the amount of food lost in the second (harvesting) and third (storage) stages in the food supply chain. In food consumption and exchange procedures, aspects such as food sharing, eating habits, dietary needs/lifestyle, food tastes and preferences (choices), market availability, infrastructure, such as roads, transportation, and markets, supply and demand, fluctuation of prices and reciprocity are major determinants of food loss and waste in the last two stages (consumption and exchange) of the food supply chain.

The food loss and waste can be affected by other factors such extension services, government policies, access to credit facilities; internal pressures for example non-food demands (housing clothing/shelter, debts, school fees, income demands and farming

implements/tools); drought, rainfall patterns, conflicts/wars and natural calamities. The proposition of this study is that if proper household food-resource handling procedures are practiced, the outcome is reduced food loss and waste hence, food security. And if this is not addressed well and on time, farming households will continue experiencing food shortages out of the losses.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter covers the study area, research design, target population, sampling design and sample size, data collection techniques and instruments, validity and reliability, data analysis procedures and ethical considerations.

3.2 Study Area

Kisii County is situated in Western Kenya. As per the 2009 census, it has a population of 1.5 million with, 245,029 households and covering an area of 1,317.4 sq. km (KNBS, 2010). The area located on a highland equatorial climate, and as such it receives rain almost throughout the year, although there are two main rainy seasons (March to May and October to November). The average rainfall is over 1500mm which is quite reliable, to support cash crops such as coffee, tea and pyrethrum and subsistence crops (maize, beans, millet and potatoes). Temperatures can range from 10ºC to 30ºC.

The study was conducted in Gucha Sub-County in Ogembo Division which has 19,645 households. The division hosts indigenous people who still manifest a much more traditional outlook. Gucha Sub-county is located in Kisii County and is one of the rural Sub-counties in Western Kenya. It has a population growth rate of 2.7%. According to the Gucha Sub-County Bureau of Statistics (2012) about 380,271 persons are living under absolute poverty. Rural poverty is at 57% and the Sub-County contributes 1.74% to national poverty.

The division has three locations that is Majoge Chache, Sengera and Tendere. Majoge Chache location has two sub-locations which include; Mesesi (2,740 households) and Kanyimbo (2,214 households) amounting to 4,954 households. Tendere location has four sub-locations which include; Boochi (2,997 households), Mang'ere (1,909 households), (Nyansakia 1,209) and Keragia (1,217 households) amounting to 7,332 households, and Sengera location has two sub-locations that is Nyaisero (3,689 households) and Bosoti (3,670 households) amounting to 7,359 households. It is poorly interlinked with roads, health facilities, schools and other transport network. It is densely populated with limited and reserved agricultural production that limits opportunities for a number of economic activities. Household access to agricultural land has become a growing problem in the area due to population growth. Average holding is diminishing as plots are subdivided to accommodate more people while the number of landless households is also rising. Often, production takes place on small and fragmented farm plots. In this connection one questions the extent to which the goals of attaining household livelihood and food security in a land deficient region.

The focus of the researcher in Kisii County and in particular, Gucha Sub-county was that the County was ranked second after Turkana with Migori third as the most food insecure Counties in Kenya (Wakibi eta l. 2016). About 39% of households in Turkana County experience chronic food insecurity; followed by 24% in Kisii and 20% in Migori. Only 23% of the households in Turkana County are food secure; 34% in Kisii and 42% in Migori. Moreover, Gucha Sub-county is one of the regions in the country that is assumed to produce adequate food for its residents. It is paradoxical that most of the residents experience food insecurity at various times of the year largely from many factors such as

improper food-resource handling procedures along the food supply chain. Other factors include: poor infrastructure, limited land and HIV/AIDS, Therefore, Gucha Sub-county was an ideal context to answer the research questions and test research hypothesis raised in this study.

Food security constitutes the gist of this study. The food poverty line in 1997 was estimated at Kshs. 927 per month per adult equivalent for rural Kenya and Kshs. 1254 for the urban (GoK, 1996). This line refers to the amount of expenditure that would, on average, meet the recommended daily energy allowance of 2250 calories per adult. A house with food expenditure of less than this amount per equivalent adult was, therefore, deemed to be food poor. The Population Census Atlas of Kenya indicates that between 51% and 60% of individuals in the study area, fall below the poverty line. However, at the household level, a variation in food poverty is noted. A household constituted the basic unit of analysis in the study area.

The study was conducted in Ogembo Division in Kisii County, which is one of the counties in Kenya assumed to be 'food secure'. In terms of the sample size, the study limited itself to 377 respondents drawn from 3 locations in the Sub-county, 15 key informants that is 6 local leaders (2 representing each location), 4 agricultural extension officers, and 4 non-governmental officials (particularly those working in the agricultural and livelihoods sector). The study conducted 6 FGDs, two for each location (one for each gender separately). All the respondents were sampled using proportionate, simple random and purposive sampling techniques. The study used a survey research design. The study focused in Ogembo division as it is the major division that produces grains in Kisii County (KCIP, 2015), whereas other regions concentrate more on cash crops such as

sugarcane, tea and coffee. Additionally, notwithstanding, the sub-county being perceived as one of the food basket counties in Kenya, there is evidence of increasing food insecurity incidences among households in the sub-county, making them more vulnerable to poverty due to chronic food shortages. As shared in the background, 34% of households in Kisii County are food insecure. Moreover, Gucha Sub-county is one of the administrative areas in the County that is assumed to produce adequate food for its residents. Paradoxically, most of the residents experience chronic food shortages, which are attributed to the household organization, food production processes, consumption behavior, food and food exchange behavior, which were of critical concern to this study. Thus, Gucha Sub-County was an ideal context to answer the research questions and test research hypothesis raised in this study. The map of the study area is shown below.

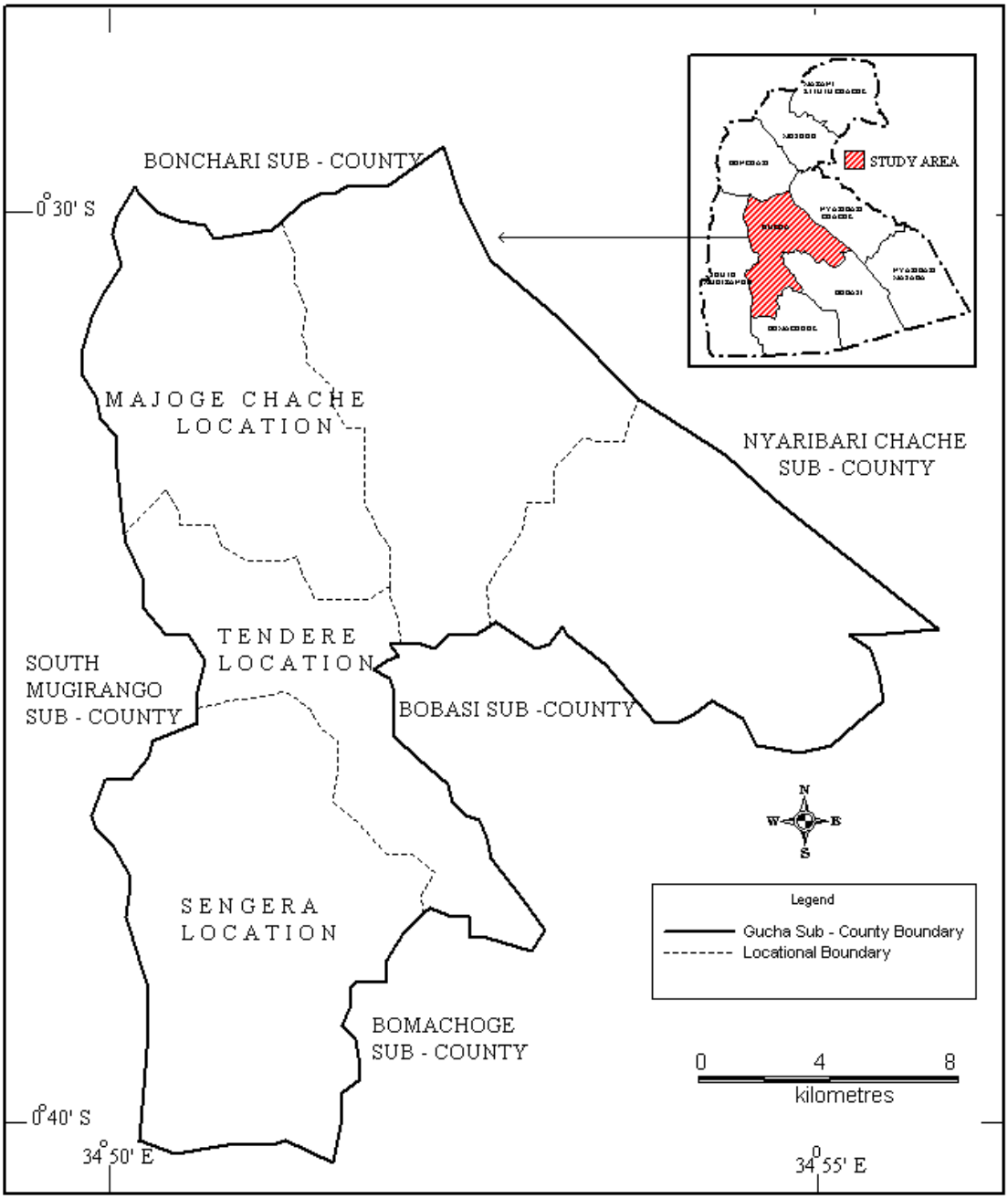


Figure 3.1: Map of Gucha Sub–County showing three locations as the study area

3.3 Research Design

The study employed a descriptive survey design. Descriptive surveys are designed to provide a 'snapshot of how things are at a specific time' (Denscombe, 1998). It is the method of research which concerns itself with the present phenomena in terms of conditions, practices beliefs, processes, relationships or trends. According to Salaria (2012) descriptive research is devoted to the gathering of information about prevailing conditions or situations for the purpose of description and interpretation.

The design is concerned not only with the characteristics of individuals but with the characteristics of the whole sample thereof. It provides information useful to the solutions of local issues-in this case food loss and waste. Survey may be qualitative or quantitative in verbal or mathematical form of expression; such studies are factual and hence supply practical information.

Surveys are well suited to descriptive studies, but can also be used to explore aspects of a situation, or to seek explanation and provide data for answering research questions. Descriptive survey design was used to select respondents from the large population of people in the study area. The researcher used information from a selected sample of 377 households to make inference about the wider population.

3.4 Target Population

The target population were the households and the unit of analysis was household heads. The study focused on smallholder farming households in Gucha Sub-County. This is because the rural farming households are already socially oriented to various household food-resource handling procedures and account for the existing food patterns and systems in the sub-county. The interest of the study was household food-resource handling

procedures and how they influence food security in the study area. Therefore, it was assumed that the rural farming household members have the most knowledgeable information relating to crucial issues of interest to the study. However, for the purpose of corroboration of information, the researcher interviewed key informants from the relevant government institutions dealing with food production in Gucha Sub-county who were selected purposively.

3.5 Sample Size and the Sampling Procedures

By the time of the study, the population in Gucha Sub-county was estimated at 93,530 with 19,645 households (KNBS, 2009). Working with the same estimates, the researcher adopted Krejcie and Morgan (1970) formula of sample size determination to arrive at 377 respondents for the study (see Appendix 4).

3.6 Sampling Procedures

3.6.1 Purposive Sampling

With regard to population density, Gucha Sub-County had the highest density compared to the rest of the eight sub-counties in Kisii County. Thus, Gucha Sub-County was purposively sampled for the study. Gucha Sub-county predominantly grows maize, but faced with frequent hunger. The researcher presumed that populations with small landholdings are prone to low food output and therefore, may experience problems with food security. The researcher purposively selected two locations (Majoge and Tendere) from Ogembo division and three sub-locations from each location still basing on those who grow maize most and are faced with frequent food insecurity.

The researcher enlisted eight sub-locations for the study. Purposive sampling was used to identify key informants and those in focus group discussions (FGDs). Using experience, knowledge and own judgment, purposive sampling was significant in focusing the sample elements (such as local leaders, sages and cultural icons, religious leaders, representatives of relevant government and non-governmental agencies and other people assumed to possess knowledgeable information to provide an in-depth understanding on the topic and objectives of the study.

3.6.2 Proportionate Sampling

The researcher used proportionate sampling to determine the number of households participating in the study from each sub-location as shown below.

No. of households per sub-location (n1) = Household Population of the Sub-location (x)
377 (n)

Total no. of households in Ogembo Division

Table 3.1 The Sampling Procedure

Sub-Location	Population (M & F)	No. of households per sub-location	Sample size from Each Sub-Location
Kanyimbo	10,535	2,214	43
Mesesi	12,947	2,740	52
Boochi	13,838	2,997	58
Mang'ere	7,938	1,909	35
Nyansakia	5,407	1,209	23
Keragia	6,014	1,217	25
Nyaisero	18,477	3,689	71
Bosoti	18,374	3,670	70
Total	**93,530**	**19,645**	**377**

3.6.3 Simple Random Sampling

Simple random sampling is the process of creating a sub-set of statistical population in which each household head has an equal chance of being chosen. After defining the sample size (n1) for each sub-location, simple random sampling procedure was used in selecting the 377 households that participated in the study. It was assumed that each household had an equal chance of participating in the study.

3.7 Methods of Data Collection

The research employed both qualitative and quantitative methods of data collection at various stages of the study. This was done within confines of appropriate sampling techniques. In some cases, a single method of data collection was used while in other cases, it necessitated a combination of two or more techniques. Consequently, triangulation was explored as necessitated by particular situation. Collection of secondary

data was done at the Offices of County Development Officer, Sub-County Agriculture Officer. The information collected was on production of crops, land tenure systems, land distribution and climatic changes in the area. Such information collected was obtained from survey reports (household, demographic and health surveys), books, research reports and NGO records. In addition, the researcher reviewed government policy documents to obtain pertinent information on the issues at hand. Secondary data provided the general framework with which to operationalise the study. To be specific, the following methods of data collection were used:

3.7.1 Questionnaire Method

The main research instrument was the questionnaire-(see Appendix 1) which generated quantitative data. Data was collected from sampled households in Gucha Sub-County through home visits using interview schedule.

3.7.2 Observation Method

The researcher did direct observation using the observation checklist (see Appendix 5). Observation involved a situation where the researcher's presence in a social context is maintained for scientific investigation. During home visits in various sub-locations and villages, the researcher observed, living arrangements, symbols of communication used, household food-resource handling procedures within the household, food consumption habits (general dietary patterns), division of roles, population distribution and non-verbal reactions of the rural households during interview sessions. All these observations were done during the day.

Observation generates qualitative data used to verify data obtained by other methods. Observation checklist was used to assess household food-resource handling processes employed by farmers. Detailed observation was important because it verified some of the information produced during interview sessions.

3.7.3 Key Informant Interview

Key informant interview is a qualitative in-depth interview with people who understand a given community, and knows everyday occurrences in the community. Key informant interview was used to collect information from diverse range of people; village elders, experts and residents, who are believed to have first-hand knowledge about the community under study. These community experts, with their particular knowledge and understanding, provide insight on the nature of problems and give recommendations for solutions. The study employed key informant interviews to collect qualitative data on the specific objectives of the study. This method involved a face-to-face interview between the researcher and the informants using open-ended interview questions. This technique was beneficial to the research as it allowed free-exchange of ideas, and lent itself to asking more complex questions and getting more detailed responses.

The key informants for this study were community leaders, religious leaders, government officials and officers from Non-Governmental Organizations such as One Acre Fund, were in touch with rural households and mostly understand their daily operations in the study area. The key informant was chosen because of their in-depth understanding of the issues under study due to their direct involvement in matters of concern to the study. To prevent bias, the researcher interviewed key informants from the above range of sectors

to generate varying perspectives and underlying issues on food-resource handling and food security. In total, sixteen (16) key informants were interviewed in the study area.

3.7.4 Focus Group Discussions (FGDs)

This is an interactive session between a group of informants and the researcher. FGDs were conducted using an interview guide. The FGD interview method generated qualitative data unique to the target population group(s). The sub-locations in the study area were represented in the study area. The first category of FGDs included selected female members of the households and the second category involved selected male members of the households. Participants in the FGD's were entirely members of the farming households who were knowledgeable on the subject matter. Groups of informants were engaged in lively and participatory discussions on topical issues related to the study.

3.8 Validity and Reliability of Research Instruments

According to Nunnally, (1978) measurements are reliable to the extent that they are repeatable and that any random influence, which tends to make measurements different from occasion to occasion or circumstance to circumstance, is a source of measurement error. Gay, (1987) defines reliability as the degree to which a test consistently measures whatever it measures. In social research, the measurement tools need to be both reliable and valid. The questions used also need to yield consistent responses when asked multiple times (reliability).

Validity is the extent to which a test measures what it claims to measure (Gregory, 1992). A measure is valid if it measures what it is supposed to measure, and does so cleanly without accidentally including other factors. In validity, the questions asked need to get

accurate responses from respondents. In this study to determine the reliability and validity, the questionnaire was tested among 20 respondents. The sample was verified for response errors. The final questionnaire was then prepared on pre-test interview schedule.

3.9 Methods of Data Analysis

The study employed both qualitative and quantitative analysis. Qualitative analysis is defined as the use of qualitative data such as perceptions and knowledge in relation to the phenomenon under investigation. On qualitative approach, the study employed descriptive analysis of the Gusii lifestyles and their social world view in relation to food-resource handling procedures. The main feeder to qualitative information included, key informant interviews, FGD's, and observations. From emic perspective, the socially constructed meaning of phenomena by Abagusii deciphered and described.

Qualitative data was categorized for meaningful interpretations using constant comparative content analysis. The qualitative open-ended focus group discussions and key informant interviews were used to collect detailed views from the participants and to define more clearly some of the issues food-resource handling procedures. In-depth descriptions offered interpretive meanings of phenomena. The findings were presented descriptively and by use of narratives, quotes. Qualitative analysis was used to verify quantitative data.

The quantitative aspect of the study employed a structured questionnaire to collect data. Quantitative data was analysed in SPSS and at descriptive level and more soundly statistics of empirical facts. This involved derivation of statistical descriptions and interpretation of data by use of descriptive statistics that mainly relied on numerical

values. Quantitative data was coded and with the use of SPSS computer program, the statistical summaries were derived and presented in the form of frequency tables, percentages, cross-tabulations, means and standard deviations.

3.10 Ethical Considerations

The researcher followed all codes of ethics and applied the 3 three principles of research ethics: beneficence, respect and justice as prescribed in the Belmont Report, to the fullest use, to ensure prudent ethics of research are followed. The researcher received authorization permit from National Commission for Science Technology and Innovations (NACOSTI) to carry out the study in Gucha Sub-County. Informed consent was sought from rural farming households, key informants and focus group discussion members before administering the interview schedule, and conducting interviews respectively. Privacy and confidentiality was practiced during data collection and with data handling. All data collection tools were applied only after verbal voluntary informed consent was obtained. The researcher informed the respondents that the interview schedules issued and interviews done were solely for academic purposes and the information received would be treated with utmost confidentiality.

CHAPTER FOUR

HOUSEHOLD AGRONOMIC PROCEDURES AND FOOD AVAILABILITY

4.1 Introduction

Recent statistics by FAO (2014) indicates that 32% of the total food produced globally is lost or wasted. In order to substantially reduce the quantity of food lost and wasted, changes have to take place at different levels of the food production chain. One of the objectives of this study was to examine household strategies for agronomic and pre-harvesting procedures for food security among rural households in Gucha Sub-County. This chapter delves into the main subject of agronomic activities practiced by smallholder farmers in the study area, and how they influence household investment in food production, management of farms and availability of food resources. The key variables of concern observed were land preparation, planting, weeding and farm management practices that farming households engaged in. However, the chapter begins with a brief socio-economic and demographic analysis of the target population that provide background upon, which the discussion on agronomic practices is based.

4.2 Socio-Demographic and Economic Characteristics of Respondents

4.2.1 Socio-Demographic Characteristics of Respondents

This section presents socio-demographic and economic characteristics of smallholder farmers as represented in a sample population drawn from Kanyimbo, Mesesi, Boochi, Mang'ere, Nyansakia, Keragia, Nyaisero and Bosoti sub-locations of Gucha Sub-county. The main socio-demographic characteristics were the respondents' age, sex, level of education, marital status and religious affiliation as summarized in Table 4.1 below.

Table 4.1 Socio-demographic Characteristics

Category	Variable	Frequency	Percent (%)
Sex	Male	289	76.2
	Female	77	21.0
	Non-response	11	2.8
Age	21-30	57	15.1
	31-40	113	30.0
	41-50	142	37.7
	>50 Years	65	17.2
Marital Status	Single	13	3.2
	Married	326	86.5
	Widowed	38	10.1
Type of Marriage	Monogamous	286	88.0
	Polygamous	40	12.0
Level of Education	Primary	249	66.0
	Secondary	107	28.4
	Tertiary	5	1.3
	University	7	1.9
	None	9	2.4
Religious affiliation	Christian Catholics	264	70.0
	Christian Protestants	100	26.0
	Muslim	10	3.0
	No Specific Religion	3	1.0

Analysis of the findings in Table 4.1 indicates that more males (289, 77%) than females (88, 23%) interviewed during the study. Majority (265, 67%) of the respondents were within the age bracket of 31-50 years old. Over 86% of them were married, and out of these married, 88% were monogamous. In terms of formal education, 356(94.3%) had

attained between primary and secondary levels of formal education. Ninety six percent of the respondents were Christians with only 4% belonging to Islam and other religions. From the observation of the findings, these findings represents a population that is largely Christian; made of adults in their prime age that are ideal for agricultural production; generally semi-skilled given the level of education; but in stable family relationships.

4.2.2 Economic Engagements of the Respondents

Agriculture is one of the economic sources of livelihoods for most communities in the world. Therefore, the success and/or failure in agricultural production have foundation in the economic conditions of the households concerned. This study focused on household size, occupation, and levels of income as key economic variables that influence the way households handle food-resources. This is summarized in Table 4.2 below.

Table 4.2 Economic Characteristics of the Respondents

Category	Response	Frequency	Percent (%)
Household Size	1-2	21	5.6
	3-4	126	33.4
	5-8	179	56.5
	>8	51	14.5
Number of Children in the Household	1-4	237	62.9
	6-8	129	34.2
	0	11	2.9
Occupation	Formal employment	54	14.3
	Subsistence Farming	247	65.5
	Commercial Farming	23	6.1
	Self Employment	53	14.1
Average Monthly Income	Below 2000	229	60.7
	2001-4000	58	14.4
	4001-6000	41	10.9
	6001-8000	9	2.4
	8001-10000	22	5.8
	10001-12000	14	3.7
	>12000	4	1.1
Adequacy of Income to Meet Basic Households Needs	Yes	77	20
	No	300	80
Number of Children Employed	1	132	35.0
	2	10	2.7
	3	7	1.8
	4	2	0.5
	None	226	60.0

From the above findings, it is evident that over (305, 90%) of the respondents had between 3 to 8 household members, with an average of 6 members per household. Only 2.9% of the households had no children. However, only (151, 40%) had children that were also engaged in income generating activities as employees or casual labourers. Most (247, 66%) of the respondents were subsistence farmers who engage in crop and livestock production as their main source of livelihood. Majority (328, 86%) of the respondents' level of income per month was below Kshs. 6000. Eighty percent 300 (80%) of the respondents said that their incomes cannot meet the basic household needs. From the literature review, as a food security coping mechanism, Thornton (2010) noted that millions of smallholder farmers in the communal areas have their livelihoods largely depended on livestock production.

Animal husbandry constitutes a significant component of the agricultural economy of Kenya and in particular, the study area. Animal husbandry is closely linked to the social and cultural lives of many smallholder farmers. Within this context, of interest to this study was to know whether smallholders in the study area engaged in animal husbandry. The study found 262 (69.5%) of the respondents kept livestock, 115 (30.5%) did not keep livestock. On the type of animals kept by smallholder farmers in Gucha sub-county, the study found that majority 166, (63.3%) of the respondents reared indigenous animals including goats, sheep and cows.

Indigenous cattle breeds were ideal for these smallholder farmers because of their ability to adapt well in low grazing land. Additionally, indigenous cattle are not easily attacked by diseases like exotic cattle. Whereas, 96 (36.6%) kept exotic animals particularly for dairy farming. Thirty six percent (36.6%) of the respondents said that milk production for

sale and household consumption was the most important reason for rearing exotic cattle. This finding was supported by one of the agricultural extension officers in Gucha Sub-County who lamented that: “in this sub-county, smallholder farmers are always ardent on rearing cattle that provide them with high production” (KI: Female informant, 38 years).

The study observed that those smallholder farmers who kept exotic cattle ensured that proper and better management of animal feeds enabled their cows to produce more milk yields for consumption and sale. During interview discussions participants shared that rearing exotic cattle was attributed to inadequate land for keeping large herd of indigenous animals. On the number of animals owned by respondents, they ranged from 1 to 7 with a mean of about 2 cows per household. The researcher inquired from the respondents reasons for animal husbandry with scarce land in Gucha Sub-County. During interview discussions, participants shared that cattle play a major role in household food security in the Sub-County. Since, cattle are kept not only for the production of milk, meat, hides, and manure, but also, display of status, and security against emergencies especially when there are food shortages in the household. Additionally, smallholder farmers also kept cattle for ceremonies. However, there were variations from one smallholder farmer to another in the way they utilized cattle and their produce. For instance, the researcher asked the respondents who had livestock whether they had sold any of their animals in the past two years. Of essence in the study was to understand what smallholder farmers used livestock for. Among the respondents who had livestock, 112 (42.1%) had sold part of their livestock in the past two years, while the remaining 150 (57.9%) had not. Those smallholder farmers who had sold their livestock had a number of reasons why they sold. The results are summarized in Figure 4.1 below.

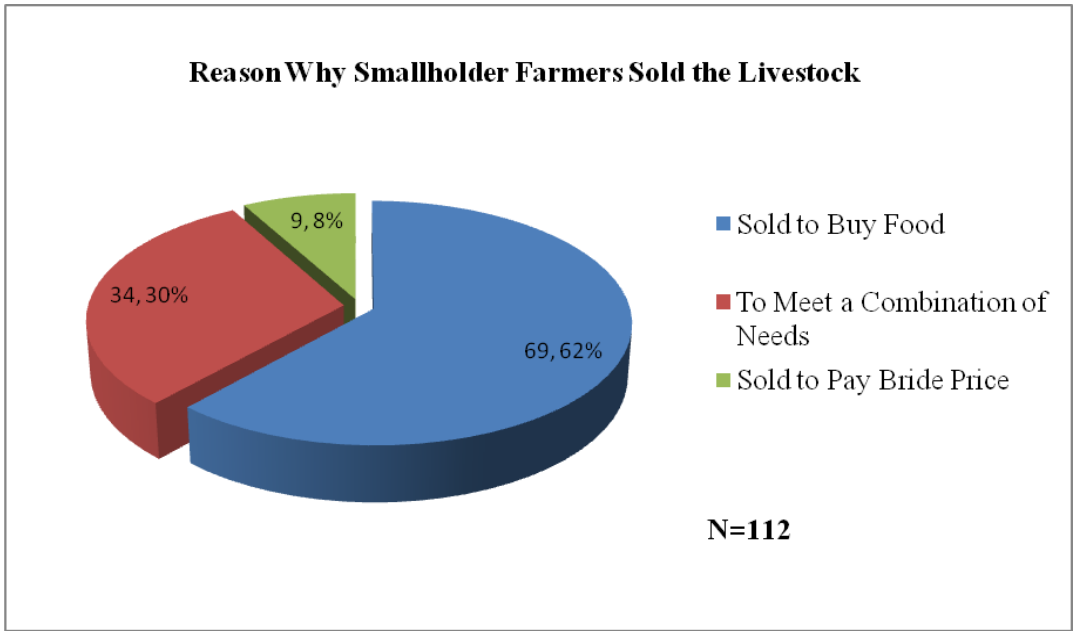


Figure 4.1: Reasons why Smallholder Farmers Sold their Livestock

Analysis in Figure 4.1 above indicates that majority (69, 68%) of the respondents sold their sold their livestock to buy food, while 34 (30%) of the respondent sold their livestock to meet a combination of needs. On 9 (8%) sold their livestock to generate money to pay bride wealth. For instance, one of the participants in the interview discussions said that: "last season, we did not harvest a lot of maize from the farm, I was, forced to sell one of my cows to get cash to buy maize grains for the family" *(*Male participant, 49 years).

Even though a small number of respondents sold their animals purposely to buy food, the study observed that whenever any animal is sold, despite the intention, it had some positive effect on food status of the household. For example, after selling the animals, most of the smallholder farmers devoted a specific amount of the proceeds to buying of food. One of the respondents narrated that: "Whenever the husband leaves home for the market to sell an animal, he leaves me with instructions to send my daughter to follow

him with a container so that they can buy maize afterwards for consumption" (IS: Female respondent, 43 years).

This study, therefore, observes that keeping livestock in Gucha Sub-County is an important venture in enhancing food security in most households. Livestock farming ensures the availability or access of the household to food resources. In a key informant interview, it was shared that: "those who keep animal in this sub-location (Boochi) are generally better off than those who depend entirely on crop farming. This means that these smallholder farmers are embracing diversification and in time of scarcity of crop they can easily depend on animal products for consumptions as well as selling some products to purchase maize. One participant reported that: "instead of selling maize grain to meet other basic needs such as clothing, the smallholder farmer will sell an animal to meet such needs" (FGD: Male participant, 47 years).

The researcher was also interested to relate the level of income and the type of animals kept by the respondents. The results are summarized in Table 4.3 below.

Table 4.3 Matrix Income Level and Type of Animals Kept

Breed of Animal	Level of Income		
	<=1500	1501-3000	>3000
Indigenous	59.5	12.0	13.4
Exotic	40.5	88.0	86.6
Total	100.0	100	100.0

Analysis in Table 4.3 above indicates that smallholder farmers who earn low income are more likely to rear indigenous breed. Findings from interviews with key informants, and participants in FGDs revealed that households with an exotic breed sold milk and earned

more income which they used to buy food stuff. Smallholder farmers are exposed to limited resources as they own small-based piece of land on which they grow subsistence relying almost exclusively on family and/or communal manual labour and other traditional methods of farming. One of the major characteristics of maize production systems of these farmers is of simple, old technology with, low returns, and high seasonal labour fluctuations. Smallholder farmers in the study area are characterized by small farm size, poor resource distribution between food and cash crops, livestock and off-farm activities, and their use of external inputs and hired labour.

From the above discussion, the success or failure in agricultural production has the foundation on the economic conditions of the households concerned. Household size, occupation and levels of income are key economic variables that influence the way smallholder farmers handle food-resources. To cushion hunger and cope up with other household needs, smallholder farmers practiced animal husbandry, which is closely linked to the social and cultural lives of many farmers. For the respondents that kept animals such as cattle, these animals played a major role in household food security in the sub-county. Since, cattle are kept not only for milk, meat, hides, and manure production only, but also display of status and security against predicaments especially when there are chronic food shortages in the household.

4.3 Agronomic Practices and Food-resource Handling in Gucha Sub-County

This section is premised on the studies by FAO (2011; 2015), which established that there is limited accurate data on the magnitude of food losses and waste, particularly in developing countries. In an effort to fill this knowledge gap, this section focuses mainly on the first objective of the study that investigated agronomic activities in relation to food

resource handling and household food availability. When smallholder farmers engage in any farming activity, it is assumed from the real-life situation theory's point of view that they will always have a justification for a decision they make at any given point in time. This objective was achieved through analysis of the land ownership, labour organization and arrangements, land preparation, planting, weeding and management of farms, as discussed in this section. The general say within the larger Gusii community has been that when one has maize, he is food secure. Therefore, this analysis is biased towards maize farming as the main staple crop in the study area.

4.3.1 Land Ownership, Size and Use in the Study Area

Land is one of the main aspects of production in any agricultural enterprise, along other aspects being labour and capital. As a factor of production, whether one owns land or not, would determine the various agronomic activities practiced by the household. Land ownership in this study did not only refer to one having the title deed of that land, as the legal bearer of the land but also, the ability to access and control the use and disposal of the land. Land availability itself is an agronomic input, which is of critical interest because it also affects the decisions households make on whether to plant or not, where and how?

For the 377 respondents who participated in the study, all of them owned land. Majority (283, 75%) of the respondents had inherited land, 79(21%) had title deeds, and a small 15(4%) especially women, owned through their husbands by entitlement as wives. For the farming households that had title deeds, many had inherited from parents and/or bought land and then acquired ownership documents. Those smallholder farmers living on ancestral land were allocated by parents but yet to transfer ownership into their names.

For the women respondents, the lands were mainly in their husbands names and owned them as wives. However, a few women especially those employed as teachers bought their own land either in partnership with the husbands or individually. Generally, the land sizes varied with the majority (229, 52.1%) of the respondents owning land between 1 and 3 acres. Other respondents 93(24.6%) owned between 4 and 5 acres, while 58 (15.3%) had between 0.1 and 1 acre. These are generally small parcels of land that most respondents said were not sufficient for crop production.

When asked on how they met the deficit in food production, it emerged that besides land ownership, several households engaged in leasing land to either boost their production or as a source of income. For instance, 92, (24%) reported leasing land elsewhere, especially from the neighboring Narok County to boost their farming activities. These respondents largely engage in maize and bean farming for both household consumption and sale. Thus, these are some of the smallholder farmers in the larger Gusiiland that engage in maize farming as a cash crop and maize is produced using modern farming techniques.

During key informant and focus group interviews, discussants also raised the issue of witchcraft practices as another factor providing impetus for some of the smallholder farmers to prefer leasing lands away from home. This was specifically common for those smallholder farmers that seemed financially stable and wealthy because they are normally the greatest attraction to witchcraft tendencies. One of the key informants observed that "farms are bewitched through the burial of hot *ugali,* dead reptiles such as frogs (*ebioto),* lizards (*chinsagara*), chameleons (*chinyambu*) and tortoise *(chinkuru)* along with some concoctions that is believed to damage the soil leading to no harvest". When asked why they use these specific objects and actions, an elderly informant explained that the burials

of dead reptiles and hot *ugali* at the farms constitute symbolic communication. In view of the fact that *ugali* is considered dead, the farm is 'killed' and all that is on it including the owner of the farm. 'Killing' the farm symbolically means that it can no longer be used to produce food crops. Another key informant lamented that:

> "If a witch and especially one with evil eyes passes by near farm, when the crop is very healthy and promising good yield, it will wither away and dry up…in the case of planting maize, the maize may even fail to germinate in spite of sufficient rain" (KI: Male informant, 65 years).

The above finings concur with Botchway (2011) and Kareithi (2011) that witchcraft and magic in Africa perform a number of functions such as releasing communal tension, explaining mysteries of life, cautioning against defeat and bad luck. The witchcraft ritual happens continuously in each farming season until the smallholder farmer is finally discouraged and may give up. Therefore, leasing land from Kilgoris in Narok County away from home becomes a better option for such smallholder farmers. With reference to food resource losses, witchcraft is a major hindrance here because it first destroys factors of production: land, inputs and discourages labour investment in food production and secondly, for those farms under crop, witchcraft causes direct loss of the crop through bewitching which causes yellowing, withering and stunted growth thus, leading to total loss of the crop.

From the above findings, it is evident that beliefs in witchcraft could have a negative impact in terms of attitudes towards maize production. In such an environment, witchcraft tendencies may overshadow efforts to improve maize production. For instance, most smallholder farmers in Mesesi and Boochi sub-locations interpret yellowing in maize as effects of witchcraft even when the farm needed fertilizer to enhance soil

fertility. This situation raises the need for extension services to demystify such beliefs. This is because witchcraft is highly revered in the study area. Therefore, the need for science-evidence-based approach to counter-beliefs in farming practices should be prioritized.

The remaining 287(76%) of the respondents that did not lease land from elsewhere as they mainly engaged in investing on their own farms, while for those who did not have the disposable cash to farm maize were forced to lease out their own farms to others that season. Several respondents explained that they did not have cash to meet the cost of hiring and working on the piece of land. One of the participants explained that: "those who hire land get more harvest than many of us, however, to maximize on hired land, one needs a lot of capital for land preparation, buy fertilizer, seeds and provision of security that many of us cannot afford" (FGD: Male participant, 40 years).

The farmers that leased land to others had their own explanations. One of them said that they were not ready to plant that season. Some mentioned that they got less harvest previously and so preferred hiring out their land and using the money to buy food and other immediate basic needs, while others said they feared witchcraft threats from their neighbor. What is emerging from the two cases of owning or leasing land out is that these contribute to loss in food resources. Proponents of food security studies (FAO, 2015 and IFPRI, 2016) have observed that whichever the case, a household and/or nation is food secure when much of its food-resources are from own production rather than the other options like market supply.

The study inquired from the respondents about household status in food security. The study found that most 270, (71.6%) of the respondents indicated that they were not food

secure while 107, (28.4%) indicated that they were food secure. Key informant interviews with Gusii elders in the study area shared similar sentiments as summarized in the Gusii proverbs that says *"endagera ya kogora yanya koigotia inda gose goichora kiage.*" (KI: Male Informant, 64 years). This means the food that is bought can neither satisfy the stomach nor fill the granary.

The land use pattern was almost similar for most of the respondents. For instance, the researcher observed that most of the smallholder farmers engaged in both livestock and crop husbandry. Smallholder farmer keep livestock like cattle, sheep, poultry and goats and also grows food and cash crops. Generally, household land is shared between the homestead compound, livestock shed and food and cash cropping activities. For instance, for a smallholder farmer with two acres of land, the homestead would be about an eighth of the land size as well the same for livestock yard, with the remaining one and three quarters for food and cash cropping and livestock grazing.

With an average of 2.5 acres, most of the farmers keep poultry and a few heads of livestock for milk, meat and oxen for labour. These animals are kept on zero grazing because of the limited space for free-range tethering. These animals are local breeds with a few cross breeds mainly for milk production. The crops grown are mainly for subsistence, except in few instances where some households grow some tea. Other smallholder farmers practice non-farming activities like brick making common in areas like Mosoti in Sengera sub-location, which is another source of income compared to farming.

In overall, most household land was put to three major uses: homestead, livestock and crop farming. When this was illustrated by agricultural officers, ideally, a household with

5 acres needs about 2.0 acres for homestead and food crop farming including vegetable gardens. Then the remaining 3.0 acres may be put to either livestock farming or high value crop farming. However, my practical observation noted a different picture on the ground. Most smallholder farmers also practiced tea, coffee and bananas farming as cash crops, which is common in Boochi, Mesesi and Mosoti. In Bomachoge particularly, many smallholder farmers with less than three acres of land engaged in tea farming. They planted tea and coffee virtually in the whole land with little area for homestead. This means that farmers heavily relied on tea bonuses to purchase food for the household. In these rural villages tea was seen as a 'status crop', which every household would plant for recognition however small the land was.

Since they did not have food crops on their farm, they will have to wait for monthly tea payments and bonuses. This is further worsened by the fact that returns from tea and coffee farming are not forthcoming: most smallholder farmers are making losses. What this means is that they not only produce no food from their own farms, but also have no or little cash to afford the available food resources from the market. The consequent of this is a household living in chronic food shortage condition. Here, there is the loss of food cropping to cash cropping, but with less security of food supply from own farms.

Land ownership, size and use are therefore, foundations of agronomic parameters to determine the nature and type of agricultural enterprises the households can invest in. They have a direct bearing because the households will handle their food-resources in terms of the activities, inputs, harvesting of crops, storage and consumption habits that follow. These findings are confirmed by Mrema et al. (2008) that the efficiency of the inputs depends on the size of the farm land, as well, land fragmentation affecting

productivity and competitiveness of smallholder farms. Chisinga (2008) study in Malawi found that land remains the most significant productive asset for the majority of Malawians, yet it is far from being equitably distributed with smallholder farmers only accessing small sizes of land. Alwang and Siegel (1999) estimate that 70% of Malawian smallholder farmers cultivate less than 1.0 hectare, with the median area cultivated being 0.6 ha, devoting 70% of the land to maize production as the main staple food.

4.3.2 Labour Organization among Smallholder Farmers

One of the key agronomic elements in agricultural production of any crop is labour and how the same labour is organized and utilized to realize productivity. During the study, it was observed that labour availability and arrangements were mainly decided and determined upon by the respective household heads. There were both intra-household and extra household organization on how the households distributed and utilized labour for farming, which was also influenced by the household's socio-economic conditions. The first concern of the study was how the various households recruit labour for agricultural production.

Against this backdrop, the study, found that out of all the 377 respondents that were interviewed, all of them utilized their own household members as the first source of labour, but when further asked on the most reliable source of labour they depended on, 233(62%) depended on household members, 7(2%) hired labour, and the remaining 137(36%) used both household and hired labour as summarized in Table 4.4 below.

Table 4.4 Main Sources of Household Labour

Sources of household labour	Frequency	Percent
Household members only	233	61.8
Hired labour (fully)	7	1.9
Both household members and hired labour (partially)	137	36.3
Total	377	100.0

Analysis in Table 4.4 above indicates that majority of the smallholder farmers rely on labour sourced from the households, with a few supplementing by hiring. Several reasons were given for this situation. First, most of the households have small parcels of land that did not warrant hiring of extra labour to work on them. Other respondents mentioned that they would have wished to hire labour but because of financial constraints or lack of cash to pay for hired labour, they were not able. Some also indicated that where necessary, they preferred rotational labour arrangements with their neighbors instead of hiring. This would involve working for each other in turns especially during planting and weeding when much labour is needed. However, in most cases rotational labour arrangement may delay other smallholder farmers in planting and weeding, which eventually will result to poor quality of the yield, hence food loss.

For those that used hired labour, whether partially 137, (36%) or fully (7, 2%), they lacked enough household labour but were also able to pay for the hired labour. Others said that they used hired labour to boost digging, planting, weeding and harvesting especially on leased parcels of land that are also far from the households. Some also indicated that they periodically hired labour periodically for alternative farm activities like picking tea and taking care of livestock especially during labour intensive seasons. In summary, out of the total 144(38%) who used hired labour, 102(71%) used hired labour

on crop production, 3 (2%) used hired labour on cash crops, while 39(27%) used hired labour on cash and food crops, and livestock keeping activities.

More interesting was the fact that some 173(46%) of the respondents not only provided their own household labour, but were also hired elsewhere by other smallholder farmers as casuals. However, when critically observed, it was found that this group of respondents was the one that earned a living through provision of casual labour. For instance, one of them said that he has to work for others to get cash to buy farm inputs - hybrid seed and fertilizer.

Traditionally, it was said that the Kisii people used to form work groups called '*ebisangio'*. This would involve people living in close proximity like villages forming work groups of between 8 and 20 members, who would work for each other in rotation and also be hired by those who are able to pay for their services on the farm. During data collection, the researcher encountered a few respondents from all the six sub-locations who said they belong to *ebisangio.* However, they were not prominent as sources of labour compared to household and hired labour that were common. The *ebisangio* were also useful as social safety nets for social mobilization and cooperation in times when one would require communal support like in funerals rather than purely a source of labour for agricultural production. From ecological, cultural and economic anthropology perspectives, farmers' mutual cooperation is a special form of behavioral adaptation with regard to their immediate challenges of subsistence.

This group strategy is directly borrowed from the traditional Gusii philosophy of pulling resources together in times of crises. The observation of the study is that this allows smallholder farmers to engage in direct and indirect reciprocity and maintain cooperative

interactions between individual and households in the community. However, results from this study indicate that these groups are waning and losing popularity due to the socio-economic changes and dynamics taking place in the society. For instance, due to fragmentation of land, land surface for farming has reduced and so many people operate individually in terms of labour sourcing. Even in funerals, it is now a trend that every household in the neighborhood must make a financial contribution, not necessarily members to *ebisangio* groups.

In overall, labour is mainly human labour where human beings are physically involved in such activities as digging, planting, harvesting and processing of farm produce. Findings showed that majority 175(58.4%) of the respondents were using *jembe* (hoe) as a basic tool for tilling land, while 94 (24.1%) used oxen as 102(27.5%) used both jembe and oxen plough. This means that most of the respondents that participated in the study were yet to embrace mechanized modes of farming. This also agrees and partly explains why most of the smallholder farmers in the study area were subsistence farmers.

Findings also indicated that labour arrangements among the respondents were skewed along age and gender roles. For instance, children within the households would tend livestock, do weeding, harvesting and processing of food produce under the supervision of the parents. The youths who are strong and energetic, would be used in labour intensive activities like digging, weeding and land preparations. In terms of gender, women were engaged in all agricultural production activities like digging, weeding, harvesting food processing and marketing.

Men on the other hand, were however, limited to land preparation, digging and harvesting, construction and renovation of food to stores, with lesser engagement in

processing and marketing of food resources. Throughout these activities men were the main decision makers, but also supported by their wives and/or elder sons. Gender dimension is also used in hiring labour. For instance, women would be hired for harvesting and winnowing of maize but men for weeding and land preparation to maximize on their productive capacities. Although there are some tendencies for labour specialization in terms of age and gender as highlighted above, there seem to be flexibility depending on the conditions of the households. For instance, there is no farming activity specifically meant for men or women, young or adults. It is only a question of preference rather than a rule. The study was interested to know the household labor time spent on food production processes. The results are summarized below.

Table 4.5 Percentage of Household Labor Time Spent on Food Production Processes

Time Spent on Food Production Processes	Frequency	Percent
Less than 25%	40	10.6
26-50%	90	21.9
51-75%	240	66.6
76-100%	7	1.9
Total	377	100.0

From the analysis in Table 4.5 above, majority 240, (66.6%) of the respondents spent 51-75% of their time on food production, 90 (21.6%) spent 26-50% of their time on food production. It was found that the remaining time is divided between cash crop farming and keeping of livestock. It was also shared during the study that as much as the respondents utilized most of their time in food production, they also spared sometime for livestock practices and cash crop production. Although, livestock production and cash

crop production in the study area required little time because of small sizes of farms which had few cash crops and few animals.

4.3.3 Land Preparation

This study conceptualized land preparation as the process and activities that smallholder farmers engage in readiness for the next farming season. Smallholder farmers use their land ownership and availability status to engage in a process of decision making, resource mobilization, resource allocation and utilization, and sometimes deciding on what would be the best farming activity in the next season. The land becomes the main focus for the kind of decisions that are made. Land preparation in Gucha Sub-County begins with timing of the planting season. Normally, there are two main cropping seasons: February-July (*omwaka)* as the main long rain season and August-December (*omwobo)* as the short rain season.

During data collection, it was observed that there are several variations with regard to when the season starts. This is mainly due to climate change issues where smallholder farmers have to either rely on experience and/or seek information from meteorological informants through mass media to know when the season is likely to begin. Some would also use local natural signs like the direction of the wind; and animal-birds behavior like migration of specific species of birds and butterflies. When these signs are clear, smallholder farmers begin by clearing of land and the initial tilling commonly known as breaking.

It should be noted that after the last harvest, the farms are left fallow and livestock are free to grace in. However, when the planting season starts, the land is cleared by slashing before it is tilled, and if it is not bushy, they directly till it. This first tilling is done when

the area is still dry and the land is hard. It is called ‘breaking the soils,’ locally known as *ogoonchora*. The first tilling will remain fallow again for sometime about three to four weeks before a repeat tilling (‘*okobosa’*) is done and then planting. By this time, rains would have started and the planting season sets in.

As earlier observed, households utilize both hired and household labour in land preparation. The most commonly used sources of labour are human beings and oxen especially in land breaking. Then it goes purely human labour in terms of planting. However, it was observed that in a few of the leased lands especially in the neighboring Narok County, use of oxen and even tractors for land breaking, repeat tilling and planting was witnessed particularly in large scale maize farming. In terms of technical preparations, the study observed that some few smallholder farmers would purchase farm inputs like manure in advance and spread in the farm so that it is mixed with the soil during the tilling. Others use maize stalks by cutting them into smaller pieces that are then also mixed with the tilling ‘*ogoonchora’* land breaking to enhance soil fertility. All these are meant to add value to the soil by enhancing fertility.

Some smallholder farmers also mentioned psychological preparations, which include praying for rains and also for their season to be successful. Some even go beyond by approaching sorcerers to get charms known as *rirongo* to protect their lands from evil eyes and witches. The justification is that if they plant maize with fertilizer without *rirongo* it could still not do well with the presence of evil eyes and witches. *Rirongo* is also used to protect livestock from the evil eyes, theft and other bad omens.

In one of the cases, a discussant in a focus group discussion mentioned that his brother’s cows are protected by *rirongo* and if a thief attempts to break into the cattle yard, the

cows start mowing in a particular sound like an alarm that scares the thief and alerts the owner. To Christians for instance, they literally take 10% of the maize harvest from the previous crop to church for blessings. All these are critical in protecting crops and all other food resources from losses. However, these assertions are not scientifically proven, but based on people's symbolic meaning they attached to issues, evidence and situations.

Economically, households are also engaged in resource mobilization including seeking for money to fund the initial land preparation activities and/or purchase inputs in advance. This is also the stage at which identification, allocation and distribution of labour begins. One of the respondents said that during land preparation, as the husband and household head, he normally migrates from his village in Bomachoge to Kilgoris in Narok County for the whole period of land preparation and such returns after planting. In another case, a few smallholder farmers with bigger land hired elsewhere, would also come in their villages in Gucha Sub-County and take away several young people to work for them during the period of land preparation and planting.

It is emerging from the above discussion that land preparation in Gucha Sub-County is not just an economical activity, but also psychological, cognitive and religious as well as a social affair. All these dimensions of land preparation are also embedded in the sense that they reinforce each other because none is mutually exclusive. For instance, one can have cash but lacks confidence to engage in farming activities until he gets '*rirongo'*. This is because he is not sure of the outcome of his investment until that surety is granted through acquiring the charm. These findings concur with Onyancha (2014) in his study on the impact of beliefs in witchcraft and magic on attitudes towards sustainable

agricultural productivity in Gucha sub-county, Kenya that witchcraft and magic explains beliefs and values that guide people's different orientations.

4.3.4 Planting Process

Maize farming as a practice formed the core of this study. Gucha Sub-County is one of the regions in South Nyanza region which is called 'bread basket', where most of Kenya's maize is grown. Its availability and abundance determines the level of food availability at the household level. It was explained by the respondents that maize was the main food crop grown and consumed by them. Planting of the maize crop in the study area is normally done at the onset of either long or short rains seasons. Planting follows the tilling that is done after land breaking discussed in the previous sub-section. It involves a series of activities the smallholder farmers have to engage in to put the maize seed in the soil to allow germination and growth of the maize. Although the study area has got the long and short rains seasons in a year, most smallholder farmers do not utilize the seasons effectively because they lack proper information on planting patterns, since they have remained conservative to farming techniques.

It is the observation of the researcher that smallholder farmers may not be aware of climate change in the study area, which has greatly affected rainfall patterns in the study area and hence, the cropping system. For example during focus group discussions, discussants said that in January/February 2015, it never rained in time and smallholder farmers had to wait until March to plant their maize. This could be blamed on extension officers' long absence in the study area. According to one of the extension officers:

> For smallholder farmers in the study area, the planting seasons remain using the old calendar, despite current scientific information indicating that due to climate change/global warming, weather patterns have changed in many regions of the country including the study area requiring adjustment of planting seasons. Nevertheless, smallholders have not embraced these changes (KI: Male Informant, 48 years).

One of the unique aspects raised during focus group discussions is that some smallholder farmers especially those who practice three weedings on their farms interplanted new maize within the old ones. One of the participants said that: "we do this because we want to save on time, labor and we want our germinating maize to catch up with first rain…(Female respondent, 52 years)." From this finding the implication is that during harvesting time, farmers and animals transporting harvested maize step on germinating maize hence, damage. This is a direct food loss at initial agronomic stage. One of the participants in a group discussion said that: "in case of damaged maize, we replant (*gokobora)* maize seeds in empty holes" (Male participant, 39 years). An observation from this finding is that there is food loss here at the initial stage (agronomic) of food production chain.

Discussants shared that some smallholder farmers mix maize seeds to be planted with herbal concoctions *'rirongo'* for protection. *Rirongo* is prepared by mixing dung made from several ingredients including soil, grass and shoot. One participant said that: "*rirongo* is used as spiritual protection from evil" (FGD: Female respondent, 41 years). This was pegged on their belief that bad people plant evil in the soil to affect germinating crops and their growth. This is why when germinating maize turn yellow and/or gets some defects, they directly associate it with witchcraft or sorcery. This affects maize quality hence, food loss. One of the concerns of the agronomic variable was selection of

seeds for planting, use of inputs like fertilizer and manure, and the type of technology used in the whole process. These variables are discussed in the subsequent sections.

4.3.4.1 Sources and Types of Maize Seed

One of the issues that trouble smallholder farmers before planting season jets in, is the type of seed that will be used and how such seed will be acquired in time. During the study, respondents were asked what type of seed they normally plant and why? Results showed that 170(45%) of the smallholder farmers use local seed, 140(37%) use both hybrid and local varieties of maize, while the remaining 67(18%) use hybrid seed only, as summarized in Table 4.6 below.

Table 4.6 Type of Maize Seed Variety Planted

Maize seed Variety	Frequency	Percent
Local varieties	170	45
Hybrid varieties	67	18
Both local and Hybrid varieties	140	37
Total	377	100.0

From the analysis in Table 4.6 above, for the 45% of the respondents that use local seeds, various reasons were fronted. First, they argued that the hybrid seed was expensive to afford. During visits to agrovet shops, the researcher established that most of the hybrid seed cost an average of KSh.350 for a 2kg packet. One of the observations the researcher made during in-depth interviews was that despite most of the smallholder farmers in Gucha Sub-County apportioning blaming the existing government institutional arrangements like extension services and the Kenya Cereals and Produce Board for delaying to supply subsidized hybrid seeds and fertilizer, the same smallholder farmers

were not in position to afford those inputs even when subsidized input is available because many lacked the money.

Further observations indicated that this was not the only cost they mentioned. They also said that when one uses hybrid seed, it will need fertilizer and extra labour that increases the cost of farming beyond the reach for many. In focus group discussions one female participant said that: "in some cases, to decide what to plant in the current season, we refer to the amount of yield from a given seed (hybrid or traditional) produced in the previous year" (FGD: Female participant, 64 years) This is in concurrence with real-life choice theory where Gladwin (1980) observes that during agronomic activities if the smallholder farmer feels that he/she may not be satisfied with the yield of a given choice of seed variety made in the previous farming season, then the smallholder farmer will eliminate it directly. The process of elimination is principally done as a subconscious process. This means that farmers have 'decision preference' to which surviving alternatives are directly compared through a succession of personal preferences such as potential of different maize varieties for satisfaction of family food needs, consumption choices, relative profitability and relative riskiness.

Respondents during the study also mentioned that they go for local seeds for planting because they seeds are well-adapted to local weather conditions. One of the respondents asserted, "hii kienyeji haiwezi kurusha," (IS: Male respondent, 36 years) meaning that the local seed cannot let a farmer down. It will always assure you of some harvest. Others said that the local seed varieties are sweet in taste compared to the hybrid and are therefore, preferred by many. One of the respondents said that local varieties have the best *ugali* taste and one gets satisfied compared to when you eat *ugali* from hybrid maize.

This implies that sometimes individual farmers have to make decisions based on limited information, and hence they have differing perceptions as to both income and risk. This may compromise their production processes or increase food loss and waste. For instance, poor choice of seed/ choice of bad seed meaning a wasted season and thus crop loss in that season.

Smallholder farmers acquired the local seed by use of traditional methods/indigenous knowledge of selecting the best cobs of maize from the previous harvest, then drying them on smoke as shown and explained in chapter five in Plate 5.4. Those respondents that said they plant hybrid seed only had various explanations. One of them said that hybrid maize is the best to maximize returns especially when one has hired land. This was a respondent that hires land from Kilgoris and he said that when one has a big piece of land and is planting maize as a cash crop, hybrid seed is the way to go because with the use of the hybrid seed and fertilizer, the harvest is over twice what one would have got using local seed. It therefore, implies two things. One is that these are smallholder farmers who are willing and able to spend on the seed and fertilizers, and secondly, they are motivated by maximizing on returns per land space used. The farmers said that they purchase seed from agro-vet shops. Being few in numbers could also correspond to the few respondents that have stable occupations and higher level of income as earlier indicated in Table 4.1.

During interview discussions, participants said that there are times when smallholder farmers face shortage of certified or hybrid seeds, and at times the seeds come late. This is the time unscrupulous traders sometimes fraudulently take advantage of such shortages and sell fake seeds to the unsuspecting farmers. One of the participants shared that:

> Last season, (August, 2014), I bought maize seeds at Ikoba trading centre, but it never germinated, and when I took the empty seed packet to one of the extension officers in Ogembo division, it was counterfeit seed (FGD: Female participant, 52 years).

The observation from the above finding is that the seed maize was fake that is why it never germinated. This episode questions the knowledge of the smallholder farmers in the study area to identify the correct seed variety. According to other participants, some of these seeds may germinate but, farmers did not realize good germination and eventually end up with poor crop yields, hence food loss. The third category of the respondents said that they use both hybrid and local seed. This was explained as follows. In most of the occasions, most of the smallholder farmers in this category would use hybrid maize varieties for long season and local varieties for short season. Others would prepare local seed but in case one gets cash, then he/she would opt for the hybrid than local.

Availability of cash is a critical determinant here as well as the need to harvest more. It was shared that food losses in maize plant is experienced when planting locally adapted varieties for a given location. It was reported by one participant that: “some seed varieties mature very fast and coincide with the rainy season hence, predisposing them to fungal infection” (FGD: Male participant, 48 years). The above findings are similar to Haaij et al. (2017) study in Uganda, which found that 40% of the seeds varieties used by smallholder farmers are fake. The fake seeds proliferated in the market discouraging them from buying the improved certified varieties. The study observes that the choice of the right maize seed variety adapted to a given production location is an important consideration at the food production stage. This observation is also supported by Kader (2002) and HLPE (2014) who have asserted choosing a wrong variety of maize seeds,

will result in produce of inferior quality leading to high losses from culls. For choosing maize varieties that are prone to logging in regions where winds are prevalent, will contribute to high losses.

4.3.4.2 Use of Fertilizer and Manure Inputs During Planting

Ideally, use of manure and fertilizers during planting would enhance crop performance in any agricultural production. This is why during the study, the researcher asked the respondents to state if they used fertilizer or manure in planting and the findings are summarized in Table 4.7 below.

Table 4.7 Use of Fertilizer and Manure during Planting of Maize

Use of Fertilizer and Manure	Frequency	Percent
Farm Yard Manure (FYM)	51	15.3
Chemical fertilizer	218	56.1
Farm Yard Manure (FYM) and Chemical Fertilizer	108	28.6
Total	377	100.0

Analysis in Table 4.7 above shows that majority of the respondents use chemical fertilizers when planting their maize. On the other hand, 108(28.6%) of the respondents use both farm yard manure and chemical during planting time. Whereas, 51(15.3%) of the respondents used FYM only during planting. Those respondents that relied on farm yard manure only were those that had kept livestock and poultry such as chicken, sheep, goat and cattle that helped in production of manure. The farm yard manure was prepared through a process of daily gathering of the livestock waste in a composite site where it would stay and decompose over a period of time.

When planting period begins, smallholder farmers would dig out the manure that is well decomposed and carry it to the maize field putting a handful of the manure is in each hole dug by a hoe before a maize seed is dropped in, and covering to wait for germination. Their first preference for manure was its availability as option to fertilizer; and also the explanation that it lasts longer in the soils compared to fertilizers, while to some fertilizers destroy the soils when used for a longer time. For instance, in an interview with smallholder farmers that had leased land from Narok County, where the land is still vast, they argued that some of the host Maasai community members always tend to resist use of fertilizers saying that it will poison their land.

Analysis in Table 4.5 also shows that most of the smallholder farmers are using fertilizer to plant maize. This is explained by various reasons. Firstly, all farmers that leased land for maize farming prefer using fertilizer to maximize the returns. This is because they could afford artificial fertilizers and since the land did not belong to them, they did not see much risk of the land loosing fertility because next season they would hire elsewhere. Others have through experience and observation realized that use of fertilizer leads to better harvests. Therefore, many smallholder farmers are now adapting fertilizer use despite the various attitudes and beliefs cited earlier.

The study observed that smallholder farmers are still lacking knowledge on the proper application of fertilizers. For instance, in virtually all the farms, the issue of quantity of fertilizer per acre and the ratio of fertilizer per hole was a major challenge. A case in point is where a smallholder farmer may buy a bag of fertilizer and expects it to be enough for the whole farm without regard to the land acreage. This is why I noted that many smallholder farmers during planting, start by using the tea spoon of fertilizers per

hole then and when they realize that the remaining land is big and the fertilizer will be less, they resort to dropping just a few granules of the fertilizer in each hole. In occasions when the fertilizer is not enough, they would use local seeds to plant with no fertilizer. Consequently, such kind of decisions would lead to low output due low quality seeds leading to poor harvest and losses.

The respondents that used both farmyard manure and fertilizer said that they normally prepare their land and use manure during planting and then fertilizer to top dress the maize after the first weeding. However, some of them maintained that they use either manure or fertilizer but not in the same season. For instance, during the long rain season they use fertilizer and change to manure during the short rains season. This was explained by the fact that the short rains season sets in when most smallholder farmers are not financially able to purchase fertilizers. On the contrary, Mzangwa et al. (2017) study found that inorganic fertilizer was the most preferred fertility management option for the smallholder farmers (43%), in spite of it being costly and the season, followed by a combination of both manure and inorganic fertilizers (23.7%).

4.3.4.3 Planting Techniques Used

With the seed and other inputs available, this study sought to interrogate the techniques used by smallholder farmers when planting. Out of the 377 respondents that participated in the study, 257(59%) said that they used traditional techniques, 86(23%) said they use modern techniques, while the remaining 44(18%) use both traditional and modern techniques as summarized in Table 4.8 below.

Table 4.8 Planting Techniques Practiced by Farmers

Techniques of Planting	Frequency	Percent
Traditional Techniques	257	59.2
Modern Techniques	86	22.8
Both Techniques	44	18.0
Total	377	100.0

Analysis in Table 4.8 above indicates that majority (257, 59.2%) of the respondents used traditional methods for planting, 86 (22.8%) of the respondents used modern techniques during planting and 44(18%) of the respondents pointed out that they utilize both traditional and modern planting techniques. The respondents who used traditional techniques explained that they do not use lines to plant. Instead, they plant by digging holes randomly using a *jembe* and drop two maize seeds in each hole together with manure and then cover it. They said that they have maintained these methods because it is what their fore parents used to do during planting. In some cases, they said, some smallholder farmers would even broadcast maize seed especially near anthills and in rough terrain. When broadcasted, fertilizer and manure are not used. Here the local yellow maize seed is then used for planting. This is an indication of food loss due to congestion after germination and eventual poor quality yields.

Respondents that use modern techniques during planting said that first they set lines by the help of a planting rope, dig holes then use fertilizer and certified seeds before the holes are covered. They explained that planting in lines has many merits including ease of weeding and intercropping. Normally, it is also easy to estimate inputs with line planting, which ensures proper spacing and the crops grow healthy and perform better

that in random or broadcast methods. Other respondents who favored line planting argued that in terms of productivity per unit land, the yields are more because it takes up more plants. Some smallholder farmers also felt that the lines prevented maize from falling in heavy winds.

Line planting has also gained popularity because it allows ease of transition between seasons, when the first crop is drying and about to be harvested, then the next maize crop for the subsequent season is planted between lines in the older crop so that by the time one is harvesting next crop has already germinated and grown. However, the study observed that although this type of transition becomes easy for the smallholder farmers, it contributes to losses of food resources. In particular, during harvesting, a lot of the maize seedlings growing in the older crop are stepped on and destroyed. This eventually leads to fewer crops per area.

The above calls for extra human labour to ferry the mature crops from the farms because if donkeys or oxen are allowed in such a farm, they would eat and destroy the newly growing crop, thus, increasing the overall cost of production that also implies food loss and waste. The germinating maize also becomes thin because of the shade created by the older crop that is just to be harvested. In overall, although many smallholder farmers seem to embrace this form of transition planting, there are more disadvantages than the merits.

The most notable aspect of this oscillation between modern and traditional techniques was that these respondents preferred using modern techniques during the main long rain season and then revert to traditional techniques in short rain seasons where the local seeds are favored. A few of them also mentioned the use of modern techniques on hired parcels

of land and traditional methods on their farms. This is because the modern methods maximizes on crop performance and yields despite the fertilizers having an effect on the soils as earlier discussed. Labour demands for each of the techniques used were a major factor here. The study observed that during planting, issues of speed and number of people needed to use a particular method affected the decisions of the smallholder farmers. For instance, one of the smallholder farmers in a focus group discussion said:

> When you don't have the rope, you keep on borrowing, but remember this is the period when everyone is planting, and they may delay you, therefore, you decide to apply staggering technique. At the same time some smallholder farmers may not want to give out their rope (FGD: Male participant, 45 years).

This means that one may have wanted to use modern techniques but because of the timing, labour demands, and other situations at hand, he/she goes back to the traditional methods. Here, it means one can randomly dig holes without using lines for hybrid seed and with fertilizer, thus, the mix.

Respondents were asked whether agricultural extension officers visited their household. Only 62% of the household were visited, whereas, 38% were not. Non-visits to smallholder farmers' households was blamed on limited number of agricultural extension officers in the study area. One of the extension officers remarked that: "We are few officers on the ground and the area of coverage is wide with poor terrain, which makes it difficult to reach all farmers" (KI: Female informant, 52 years).

With regard to visits, which were done by extension agents to 61% of the households, only 30% of smallholder farmers were adopters of the new information disseminated and a significant (70%) number of smallholder farmers were non-adopters. One participant said that: "the new innovations are quite expensive to afford, thus many of us rely on

indigenous knowledge for farming practices." From the above evidence, it implies that low output of extension services, principally relying on their own knowledge that most probably impacted negatively on adoption decision. This justifies the researcher's argument that food loss and waste along the food production chain often result from inter-related causes ranging from technology, environmental, but to a larger extent social behavior of individuals farmers. Therefore, people's social cultural behavior must be understood within the context of the cultural values in which they occur, and how they impact on food-resource handling processes and eventual food (in) security.

Consequently, the argument here is that if such smallholder farming household social and cultural behavior can be understood, then it would improve household food availability since it accounts for most of the qualitative losses that are not given prominence by other interventions. For instance, 95% of the research investments have focused on increasing productivity and only 5% directed towards reducing losses (Kader 2005; Kader and Roller 2004), and none on social and cultural aspects in relation to food loss and waste.

One of the critical observations the study made was that there is a general tendency among respondents and farms in the study area to be intercropped. Although maize was the staple crop, most of this maize was intercropped with legumes like beans, roots like potatoes and cassava, vegetables, and banana crops in the small uses. Ideally, intercropping has the basic rational to maximize the returns for a piece of land. The main agronomic questions would then revolve on the issues of the type of crops intercropped and the way the intercropping is done. This is because if these two issues are not checked, then intercropping can become counterproductive in some occasion and even lead to total crop failure.

Visits to various villages in the study area revealed that in occasions where maize was intercropped with maize, maize within maize, the yields were diminished. A household in Majoge Chache for instance, explained the variance in yields when they planted maize within another maize crop. In this particular case, maize harvest was as low as 6 bags per acre when maize was intercropped with maize compared to 18 bags when not intercropped. This therefore, suggests a correlation between planting patterns and yields per acre, hence, a source of loss.

Findings further showed that out of the 377 respondents, majority 321, (85%) intercropped their crops on the farm. The respondents gave reasons that in their traditional inter-cropping systems, the diverse crop varieties usually grew together to complement one another in different ways. It was also shared during interview discussions that crops intercropped were grown either as a strip and/or single row pattern alongside the maize crop or in between each row of maize. Despite most smallholder farmers in the study area using intercropping, rows of the intercrop were planted either beside the maize field or in single rows in-between rows of maize.

When asked to name some of the crops they commonly intercrop with maize, the following results were recorded as summarized in Table 4.9 below.

Table 4.9 Crops Inter-cropped by Farmers

Inter-cropped Crops	Frequency (n=343)	Percent
Maize, banana and beans	75	23.3
Maize to maize and beans	216	62.6
Maize, millet, beans and bananas	52	14.1
Total	343	100.0

Analysis in Table 4.9 above shows that majority 216, (62.6%) of the respondents inter-cropped maize with maize and beans, while 75(23.3%) of respondents intercropped maize, banana and beans, whereas 54(14.3%) of the respondents intercropped maize, millet, beans and bananas. The researcher found that many smallholder farmers were doing it for the sake of maximizing land. This the reason why in small land sizes intercropping is done by farming households to maximize land productivity that the land is small and, intercropping is done by farming households to maximize land productivity.

Despite intercropping being ideally advantageous in ensuring higher yields, findings from this study indicated otherwise, questioning the type of crops used for intercropping and the timing of the same. For instance, when maize is intercropped with maize leads to losses through destruction of the younger crop, and when some bean varieties grow bushy while climbing on maize crops that make the maize weak and thin, hence, yield poorly. This questions farmers' level of knowledge on when, what and how to intercrop.

The above analysis on intercropping above was further brought to the limelight during key informant interviews with agricultural officers from Gucha Sub-County. They indicated that given the current farming practices, nature of soils and level of information so far with the smallholder farmers in the area, monocropping technologies would offer better yields and support higher returns than when smallholder farmers insist on intercropping that is poorly done. Further, they argued that with the exhaustion of the soils due to continuous farming every year, intercropping maize with maize further drains the soils and that is why the second maize crop normally yields low returns.

According to the officers, a mix of crop varieties makes better use of available nutrients and water in the soil, increases the diversity of products, and minimizes risk. The

challenge here is that most of the smallholder farmers do not seek help from agricultural officers on when, how and what is viable in their respective farms. Much of the new ideas the extension officers share with farmers are initiated at their office, yet the current extension policy advocates for demand driven extension with little or no facilitation for the traditional field trip visit (FTV) method. From the above finding, smallholder farmers make uniformed decisions, which leads to poor yields and losses. The above findings concur with literature from Malawi by Lewin and Fisher's (2009) who found that at least one visit to each household from an agricultural extension agent during each cropping season is important as it would reduce food insecurity by 7.3%, which seems not to be the case in the study area.

From the above findings, intercropping is preferred among smallholder farmers as it helps them to increase their production in small pieces of land. These findings are supported by study by Belton et al. (2015) in Bangladesh where smallholder farmers practiced intercropping both in leased and own land to increase food production. Those smallholder farmers who practice intercropping, did it to improve soil fertility as well for household income after sales. Smallholder farmers intercropped maize with legumes such cowpeas, pigeon peas and beans. The findings also concur well with Ngwira et al. (2014) where the smallholder farmers were adopting intercropping practice because of the reasons cited above. However, on the contrary, Kamoyo et al. (2017) found that land use restrictions in Myanmar make intercropping illegal, hence, smallholder farmers fear practicing it.

4.3.5 Weeding and other Management Practices

Ideally, after the maize crops have germinated, there are several care-related management practices that include weeding, provision of security, pruning, thinning and application of inputs like fertilizer and guarding against pests. All these constitute vital management practices that would ensure successful transformation from young to mature and healthy crops with optimum yield. In this section, the focus of the researcher will be on weeding, application of inputs and security of the maize crops until they attain maturity.

Advice from agricultural officers asserted that as an agronomic practice, weeding is paramount to reduce weeds on maize farms. It also reduces crops vulnerability to stress in early stages of their growth. This means that if maize crops are kept free of weeds for the first few weeks after germination, they have a good chance of growing vigorously and being able to compete with weed plants. However, the main constrain in the study area is that, the first one month of planting is generally a very busy period for smallholder farmers who would be planting other crops and also looking after livestock at the same time. This creates a labour deficit that is worsened by the fact that schools are in session and children, who are part of the household labour sources, are only available during weekends. Evidence from focus group discussions associated yield loss among maize smallholder farmers to infestation by the *striga hermonthica* weed just to demonstrate the importance of weeding.

First and foremost, the researcher was interested in understanding the types of weeds common in the study area. It was found that grass and broad leaved weeds were common. However, the most stubborn of them all was the *striga hermonthica,* which is commonly referred to as a witch weed. It is locally known as e*keyongo.* The weed has purple

flowers. This weed causes characteristic yellowing blotches in the maize foliage about 1cm wide. Despites its medical properties, this use cannot compensate for its negative impacts on the maize crop.

E*keyongo* contaminates the maize crop, damages it and reduces its yields, hence, maize loss. This weed is widely found in Boochi bordering South Mugirango in Nyamarambe Sub-County. The weed is said to have spread from sugarcane farms in the neighboring counties (Migori and Homabay). Evidence from agricultural officers in Gucha Sub-County indicated that in a single growing season, each *Striga* weed can produce over 500,000 seeds, which may remain viable whether buried on the ground or not for 14 years. These are just some of the characteristics of the weed that makes it the most difficult to manage for most of the smallholder farmers in the study area.

It was shared in the study that the critical period of weed interference is the maximum length of time during which weeds emerge soon after crop planting can coexist with the crop without causing unacceptable yield loss, and also the weed-free period or the minimum length of time required for the crop to be maintained weed-free before yield loss caused by the late emerging weeds is no longer a concern. The researcher found that some smallholder farmers delay in second weeding, and this result in competition between maize and weed for nutrients as shown below.

Plate 4.1: Maize Farms Encroached by Weeds

As shown in Plate 4.1 above, weeds compete with maize plant for light, water, and nutrients. They chock maize stems leading to some dying leaving empty farm space as shown above. Some plants become thin and yellow hence, affecting the quality of the maize plant and later loss. In addition to witchweed discussed above, broadleaf and grassy weeds, are widespread in the study area and cause tremendous yield losses to maize plant. According to agricultural extension officers, to reduce the spread and effects of striga to maize crop, smallholder farmers can frequently walk through their farms and uproot any growing striga plant. This should be done early enough before the weed produces seeds. When smallholder farmers were asked whether they were aware of this strategy, one of the respondents said that: "we are not aware, and even those extension officers have never come here to inform us" (Male respondent, 45 years).

From the above finding, it is evident that lack of knowledge on how to handle on farms weeds, rendering smallholder farmers into eventual food loss at harvest. Rodenburg et al.

(2016) and Tadele (2017) report that a lot of food is lost because of poor handling processes during agronomic activities on the farm. Therefore, crop management should be given a priority in order to maximize food production among smallholder farmers. Tadele (2017) and Rodenburg et al. (2016) further propose that innovative techniques such as AFRO weeds, the electronic tool with both the online and offline function for identification of weeds can assists smallholder farmers and development agents in fast identification and management of weeds.

With regard to weeding, the researcher was interested to know how smallholder farmers do weeding in their farms. During interview discussions, it was shared that all the smallholder farmers do manual weeding on the farms using hand, hoes commonly known as '*obokombe'*. However, it was also observed that for some of the smallholder farmers who lease land in Narok County use ox plough to weed, and a few of them may use herbicides to control weeds. Ox ploughs and herbicides are used because the farms are big and are economical. The of use hand hoes was the most common practice in the study area. This was done by individual farmers and, their household members and in some cases; community group labour was solicited depending on the timing and condition of the farm.

Generally, the type of weeding and the persons weeding varied from one farm to another. However, each smallholder farmer employed several methods or persons respectively, for the same. Women and children provided most manual labour on the farms. One informant said that:

> Given the small size of our farms, we do weeding with our children during weekends when they are not in school. Sometimes they come and find we have finished doing weeding, but they can help in other chores like grazing animals in the evenings or fetching firewood and water from the river (KI: Female informant, 33 years).

Beyond hoe weeding, hand weeding was also done especially for cases where maize was intercropped with sorghum, millet, and beans. This involved selective hand picking by pulling out the weed crops. The advantage was that it avoided destroying the main crop especially when planted by broadcasting and at the same time, if a hoe is used when beans have flowered, all the flowers will drop and lead to no or low harvest. This was illustrated by an informant who asserted that:

> When beans are nearing the end of flowering stage, they don't need to be disturbed including weeding by a hoe. This is because shaking them will lead to premature falling of flowers and pods resulting into loss of the beans. This is why even the hand weeding has to be done carefully by an experienced adult to avoid uprooting of the main crop (KI: Male informant, 54 years).

Ideally, maize in the study area is weeded twice especially when the land preparation was properly done. This is to retain soil moisture and avoid continuous disturbance to the crop. Table 4.10 below summarizes the number weeding the respondents said they did on their farms.

Table 4.10 Frequency of Weeding Maize Crop

Weeding on Farm	Frequency	Percent
1-2 times	349	95.4
3-4 times	18	4.6
Total	377	100.0

Analysis in Table 4.10 above, indicates that majority (349, 95.4%) of the respondents did weeding once to two times. The first weeding happens one and half months after planting and when maize started to flower. For those 18 (4.6%) that weeded their farms 3-4 times

in a season, these were respondents that preferred to weed after harvesting beans and in preparation for maize intercropping for the next season. Weeding was a contributing factor in reduction of maize attack by pests and insects on the farm. During interview discussions, discussants shared that they experienced many insects and pests during all stages of pre-harvest and were responsible for direct and indirect losses of maize on the farm. Therefore, they were forced to carry out frequent weeding to discourage insect and pest intrusion on the farm.

The above findings were supported by agricultural extension officers who shared that field pests such as stalkborer (*Busseola fusca*), leafhoppers (*Cicadulina mbila*) and mole crickets (*Gryllotalpidae*), were most prevalent in Gucha Sub-County. These findings concur with Mihale et al. (2009) who found that in Tanzania, pests are responsible for 15-30% pre-and post-harvest losses of grains in developing countries. Fascinatingly, some of the farming households that preferred hired labour than themselves, failed to supervise laborers especially in food crops. According to one participant: "some of the people who are hired for labor never weed well, unless they are supervised, which is not the case in many instances, hence, render maize into thin and yellow growing" (IS: Male respondent, 52 years).

Additionally, some farming households reported that they wait until the weeds are at the same level with maize crop as shown in Plate 4.1, then they do weeding. These findings demonstrate that there is a high possibility of weak and poor quality maize plant, signaling food loss and waste at the end of the season, because the weeds compete with maize crop for light and nutrients. The study observes that the health of maize plant

depends largely on efficient weed control. The time of weeding and the length of the period the maize field is free from weeds has a direct bearing on the final yield.

Beyond weeding, the study also observed that 177(47%) of the respondents did top dressing of their maize crop. This was done by use of nitrogen fertilizer locally called UREA or CAN. This was done once when maize is at a height of one to one and half-metres tall. The timing was strategic depending on the availability of rain for ease of absorption of the fertilizer. The main purpose was to enhance fertility of the soil and productivity for the respective crop. Throughout the maize production processes discussed above, smallholder farmers also provide general security to their farms to avoid pests, animals and even human beings that may destroy the crops. However, this may become demanding especially when crops are nearing maturity because of increased stealing of fresh maize that is common in the study area. Human beings and livestock are the most common sources of damage to crops especially when the crops are about to mature. Human beings trespassing into farms damage crops by stepping on them, breaking their stems or even stealing part of the crops that seem to show signs of maturity. This contributes to the general losses of the food. Livestock were also mentioned as a source of damage to food crops. They cause damage to the growing maize as shown in Plate 4.2 below.

Plate 4.2: Maize farm damaged by Livestock (May, 2016)

As shown in Plate 4.2 above, the damage happens especially when the cows, sheep and goats stray from the grazing fields into the crop farms and in other cases, the livestock may cut the rope tethering it and directly go for food crops in the neighboring farms. Some of the damages are enormous and have ended up being reported to agricultural offices for compensation or even warning the owner of the livestock. This is further exacerbated by lack of fencing or weak fences on the side of the livestock farmers. For instance, one of the smallholder farmers complained about his neighbor who has cows and goats but has no paddocks or fences to control the livestock. The study also found that maize damage household harmony and/or relationship and the inter-household relations are also weakened.

4.3.6 Sources of Agronomic Information

Evidence from the various agronomic activities discussed so far points to the questions of what type of information and how much of it do smallholder farmers possess to inform their agronomic practices. Therefore, respondents were asked to state sources of agronomic information and their responses have been summarized in Table 4.9 below.

Table 4.11 Sources of Agronomical Information

Source of Agronomic Information	Frequency (n=377)	Percent
Formal sources:		
Exhibition	12	3.2
Leaflets	5	1.3
Radio	196	52.0
Television	26	7.0
Extension workers	98	26.0
Informal sources:		
Knowledge from parents/family	347	92.0
Knowledge from friends/neighbours	311	82.5

Analysis in Table 4.11 above indicates that majority of the respondents acquire their agronomic information from informal sources: family (92%) and friends/neighbours (82%). However, a significant number of them (52% and 26%) acquire information from radio and extension officers respectively, as the main formal sources of agronomic information. In overall, exhibition (3%), television (7%) and use of leaflets (2%) were the least common sources of information. Evidence from in-depth interviews further supported these findings with one of the discussants saying that:

> We are just left on our own. The extension officers do not walk to meet the people for advice and interaction as it used to be before. There are no field days, no demonstration farms, as it used to be in the past. Unless one goes to those agricultural offices no one will visit your farm. Most smallholder farmers here in Boochi, need agricultural information for their agronomic activities, but this information is scanty, we have relied on fore fathers and friends to access information but it isn't enough (FGD: Male Participant, 45 years).

Another informant further asserted that: "most of these officers just stay in the office, they do not meet people, and if you go in the office, some of them are not there. They pretend to be in the field when they are just in their own businesses" (Female respondent, 33 years). Basing on these findings the researcher interrogated extension officers to get their opinion on the same. However, it emerged from them that what the smallholder farmers were saying was partly right because the extension policy in Kenya has changed from the Farm visits and Tours (FVT) to user demand approach.

The above means that only smallholder farmers that seek for help will be reached. This however, seem not to be clear on the side of the smallholder farmers that seem to assume the old trends. The challenge here is that user demand approach requires smallholder farmers who are well-informed and unlike in the study area where smallholder farmers are still using traditional methods of farming and are yet to embrace new farming ideas. Here smallholder farmers' expectations are determined by their individual construct system, through which they interpret their agronomic activities and thus, make sense, discern patterns, establish order in the complexity of their life and make predictions about future events and outcomes of decisions. According to the personal construct theory these expectations are created over-time in the course of smallholder farmers' interactions with their environment and their daily activities.

The above findings concur well with findings by Kingiri & Nderitu (2014) who found that field days and demonstrations were found to be effective by both smallholder farmers and agricultural extension agents. This was because of the ability of agricultural extension agents being able to reach many smallholder farmers as well as stakeholders within their jurisdiction. But in most cases, smallholder farmers preferred individual farm visits for the reason they tend to be smallholder farmer demands driven and agricultural extension agents tend to provide personalized attention to their specific needs.

Respondents were asked on kind of information they were interested in. The researcher found that respondents sought information on new seedlings (87%), use of fertilizers (94%), treatment of crop disease (69%), new methods of farming (68%) and crop patterning (58%) were the most sought after. Findings further indicated that getting the information was one thing and using it another. In particular, it was observed that for most of the smallholder farmers, there are several constraints that may fail to translate this information into productive actions on their farms. From the study findings majority of the respondents (54%) mentioned illiteracy and in particular, inability to read and write, and low levels on income (42%) were cited as the main constraints to adoption of new farming ideas. When asked about the same, one extension officer commented that:

> Most of the modern farming techniques would require capital investment, however small one's farm project may be, it becomes a major constraint for such a population with low levels of income. This is because they would prioritize food and other basic needs to agricultural trials when it comes to household expenditure. If government has funds, subsidies would be the best way out. (IS: Male respondent, 49 years)

Further findings of the study indicated that despite the low level of government intervention, there is still a window of hope. In one of the discussions it emerged that some of the development agencies associated with either the government and/or non-

governmental organizations have previous had successful interventions especially in the area of livestock development. For instance, informants named activities by the National Agriculture Livestock and Extension Programme (NALEP) and Agricultural Sector Development Support Programme (ASDSP) that are based at Kisii town but operate in the study area through farm and community visits. For instance, since the year 2000, NALEP has encouraged livestock farmers in Mesesi, Machoge and Tendere to form Common Interest Groups (CIG) through innovative and productive capacities of the smallholder livestock farmers to attain self-sufficiency levels in food security requirements. One of the respondents asserted that:

> Despite the normal challenges we face in maize production, NALEP's major strength has been to encourage smallholder farmers to form Common Interest Groups and capacity building them. NALEP and ASDSP have also been vocal in involving local farmers through the Focal Area Development Committees. (IS: Male respondent, 52 years)

Inquiry by the researcher at the NALEP office found that, a Focal Area Development Committee (FADC) composed of women, men and youth elected by the community, whose role is to ensure that agricultural action plan is implemented and continuity is guaranteed. FADC is trained in group dynamics, including leadership, democracy and governance, transparency and accountability in the pursuit of food security in the target area.

A notable issue of concern during the study was the fact that although it is evident that the way agronomic issues are handled in the study area contribute to substantive losses in terms of maize grains, as it occurs in small quantities in each stage that the smallholder farmers only realize about it when it is too late. In Gucha Sub-County, late planting, unsupervised and late weeding, inadequate and unorganized labour, consumption of the

green maize and lack of securing the farm, would result in the overall food loss and waste due to low harvest from own farms, even though most smallholder farmers do not recognize them as major sources of future food shortage. This is a critical pointer as the need for smallholder farmers to be informed about how losses accrue throughout the production processes and how each crop stage from the type of seed selected, to how one plants and the management of the crop is significant to the overall productivity of the farm within a particular season. This chapter concludes with a conceptual framework that shows how agronomic activities and food-resource handling practiced by smallholder farmers in the study area, and how they influence household investment in food production, management of farms and availability of food resources.

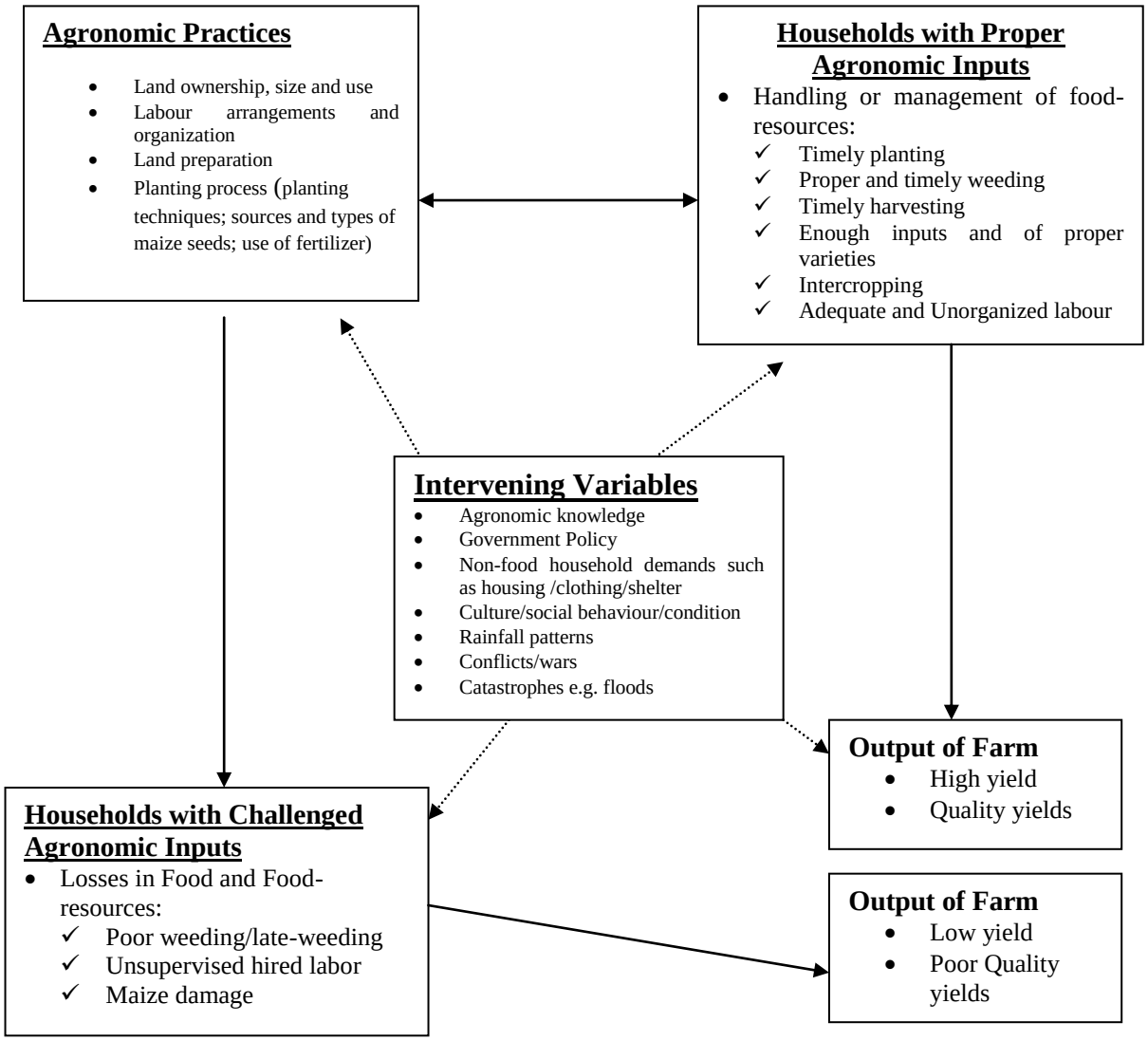


Figure 4.2: Conceptual framework showing the link between agronomic practices and farm output in the study area

The illustration in Figure 4.2 above indicates that agronomic practices and food-resource handling processes along the production chain are the main contributors to output of farm in Gucha Sub-County. From the analysis, it is evident that food loss and waste are heavily dependent on the specific conditions and local situation in Gucha Sub-County. For instance, in agronomic practices, land ownership, size and use, labour arrangements

and organization, land preparation, planting process such as planting techniques including sources and types of maize seeds and use of fertilizer that result to improved soil management to preserve ecosystem functions are major determinants of farm output.

Figure 4.1 indicates that if there is poor food-resource handling processes for instance, late planting, poor weeding, late weeding, maize damage and lack of using hybrid seeds, there is a likelihood of low farm output in the study area. Therefore, depending on the knowledge of the smallholder farmer, factors such as agronomic information**,** government policy, non-food household demands such as housing/clothing/shelter, drought, rainfall patterns, conflicts/wars and emergencies/catastrophes including floods may lead to low farm or high farm output in terms of yields and quality. It is observed that one of the most crucial and significant factors in ensuring a successful agricultural food production among smallholder farmers is agronomic knowledge, required throughout the food production process. However, smallholder farmers lack strong and consistent agronomic knowledge on improving food production and the situation is more prevalent in the study area.

From Figure 4.1 above, food losses are interlinked and complex, but the primary driver is food-resource handling procedures during agronomic practices. This means that in the study area, food loss results from land preparation strategies to pre-harvesting techniques, and this is influenced by social and cultural conditions such as different productive and social roles that men and women play at different levels of agronomic practices in the value chain are often underlying causes of food loss. This is as a result of inadequate knowledge to build skills in food-resource handling. For instance, smallholder farmers struggle to balance pressures for short-term income and the longer-term benefits

associated with shifts to more sustainable practices. In addition, social acceptance of innovation and new technology can encounter barriers based on the social norms and values of different farming households.

From the foregoing discussion, proper food-resource handling procedures during early stages of production will lead to reduced food loss and could be one of the leading strategies for achieving a sustainable food future. In conclusion, therefore, food loss is gaining prominence among smallholder farmers as a critical issue. According to SDG target 12.3, reducing global food loss and waste will not only boost food security, but also improve livelihoods. To achieve this, there is need to shift the dialogue from increasing farm production towards improving household food-resource handling processes along the food value chain with an emphasis on changing people's social behaviour towards improved farm management practices. In the next chapter, the researcher examines the harvesting processes and how they further lead to food losses and wastes depending on how the smallholder farmers handle their food-resources.

CHAPTER FIVE

MAIZE HARVESTING AND STORAGE PRACTICES ON HOUSEHOLD FOOD AVAILABILITY

5.1 Introduction

This chapter examines two objectives of the study which include; household maize harvesting and storage beliefs and practices that affect food security in Gucha Sub-county. The chapter is divided into three main sections: the first section examined household pre-harvesting, second examined harvesting practices and the third focused on storage beliefs and practices. Before harvesting the matured maize, prior preparations have to be done. Therefore, the chapter begins with pre-harvesting processes.

5.2 Maize Pre-harvesting procedures

One of the most crucial and significant factors for ensuring a successful agricultural food production among smallholder farmers is food harvesting and storage procedures. Harvesting is considered the last step in production, and should be approached as the first one in the post-production system, due to its impact on subsequent food-resource handling processes. This is required to ensure harvested food does not go to waste or loss before it is consumed or stored. The researcher was interested in understanding how smallholder farmers know that the maize crop is now mature and ready for harvesting.

In a focus group discussion, smallholder farmers shared that for maize to be ready for harvesting, it has to be left to dry in the field until all the leaves of the maize plant turn brown. It was also shared that the maize is mature and ready for harvesting when the silky hairs come out of the top of the maize cob turn to brown and a black coloured line

forms at its point of attachment on the cob. As well, the maize cobs ready for harvest should face downwards as an indication that moisture content has reduced to required levels. This is shown in Plate 5.1 below.

Plate 5.1: Dried matured maize with cobs upside down ready for harvesting (July, 2016)

It was shared by research participants that maize becomes mature and acceptable for harvest when the kernels reach the hard dough stage. At this stage, the kernels are full, hard and have reached their natural colour. One participant said: “one can confirm whether maize is ready for harvesting by scratching the kernel with a fingernail or pressing hard; if the maize is hard, then it is ready for harvesting” (KI: Male participant, 59 years). Another important indicator was the presence of many birds, rodents, and pests visiting the farms to feed on matured maize.

The researcher was interested to know whether birds, rodents, pests and thieves led to maize loss on the farms before harvesting. Seventy four percent (74%) of the respondents mentioned rodents, 58% said pests and birds, and 57% mentioned theft. For the respondents who mentioned rodents as a source of maize loss, they shared that this was a persistent cause of food loss in the pre-harvest period. As maize cobs are drying, they are traditionally left prior to harvesting through stoking, or left standing in the mother plant in the fields for 2-3 weeks. This is the time rodents invade and feed on the matured maize cobs. This is confirmed by Rao et al. (2001) that during stoking about 5% of maize loss is incurred through rodents, mainly rats and squirrels.

During a focus group discussion, participants said that they employed control measures particularly when only rodent symptoms were seen and/or when damage was observable. This means that food loss has already occurred. Some smallholder farmers used acute rodenticides because of the perceived efficacy. However, to some, it was not affordable. To smallholder farmers who could not afford rodenticides, they preferred controlling the rodents such as rats using the manual traps. The above finds are also confirmed by the Kenya's Ministry of Agriculture which reported in the year 2008 that in Western Kenya, food crop damage by rodents was between 1% and 5% (GoK, 2009).

On theft cases, food loss was rampant when maize matured earlier or later as passersby could steal maize from the farms. Discussant in a focus group discussion shared that smallholder farmers were forced to organize individual and community security and/or neighborhood watch for maize crops especially when they are mature and drying on the farm. However, as a mitigation strategy in minimizing maize theft, smallholder farmers encouraged same time group planting and harvesting. Although, other smallholder

farmers could not afford same group planting due to unavoidable circumstances such as lack of inputs like maize seeds and fertilizer for planting. Therefore, this group of smallholder farmers could wait until they purchase inputs, and then plant later. This led to varied time of harvesting.

A visit to various farms by the researcher would show farms that are fenced using timber logs, barbed wire, live fence, and even in some cases, there was physical surveillance of the crops by the owners of the farms. This implied that the smallholder farmers needed additional finance to manage maize on the farm before harvest. To other smallholder farmers, extended pre-harvest field drying was required to ensure good preservation since, harvesting before drying increases the risk of maize grain loss through moulds and the rotting of some of the seeds. The researcher however, observed that many smallholder farmers wait for too long to start harvesting given that they lack suitable drying facilities. According to a key informant:

> If drying facilities are not available in the homestead, harvesting is delayed by the smallholder farmer until the moisture content in the maize grain is reduced to 15-20%. The rate of drying on the maize plant will depend upon weather conditions during the season (FGD: Male Participant, 64 years).

From the above finding, leaving maize to dry on the farm for too long will expose them to other vulnerabilities such as attack from pests. This was also evident in a study by Oerke (2006) who found that the pre-harvest maize damage attributed to pests is estimated to be 26–29% in mass of soybean and 31% in maize. On theft cases, the study found that some smallholder farmers hired security guards to provide security on the farm. In other cases, family members especially husband and boys if available, were required to provide security on the farm to prevent maize from theft by neighbors and

passersby. This finding was supported by one of the agricultural extension officers in the study area who observed that:

> Smallholder farmers in Gucha sub-county use their traditional knowledge in agronomic practices without consulting us…they leave their maize in the field beyond physiological maturity to allow it dry in order to facilitate direct storage into the store without sun drying (KI: Male informant, 49 years).

From the above evidence, smallholder farmers practice traditional knowledge they possess for local level decision making in food-resource handling processes. This concurs with Dei (2000) who notes that indigenous knowledge is about the common sense ideas and cultural knowledge of local people concerning day-to-day life. The study observed that indigenous knowledge for smallholder farmers is critical to the way households determine their daily food-resource handling practices and cope with daily living.

Before maize has dried for harvesting, some smallholder farmers especially those who are faced with chronic hunger hastened maize harvest. In this study, hastening harvest is the process of removing maize from the fields before it is ready for harvesting. The researcher was interested to know whether all respondents engaged in *ogotobora* or not. Findings indicated that 249 (66%) of the respondents had engaged in this practice season in season out, whereas 128 (34%) of the respondents waited until the right time to harvest. From the above analysis, *ogotobora* is a practice that is commonly used to bridge the gap between agronomy and harvesting periods in the study area. The operation entails removing maize grains (green cobs) otherwise not mature from the field and sun drying it until it is suitable for milling. Other smallholder farmers could sell green maize cobs to vendors to get money in return to purchase maize grains from the market for milling. The maize vendors then boil the green maize or roast it for selling.

The households that hastened harvest gave various reasons for this practice. For instance, during the study, respondents explained that they were forced to remove wet maize from their farms due to a number of reasons. Fifty two percent (52%) of the respondents said that they ran out of stock. Twenty six percent (26%) were not able to purchase more food to wait until maize dries well, while 22% did not find enough food in the market to purchase for household consumption. For the respondents who had run out of stock and were not able to purchase food from the market, they did not have enough money to buy food for the household. The study observed that, when the actual harvest time reached, these respondents had less to harvest. From the researcher's observation, hastened harvest makes maize grains to shrink, since it has not dried well on the farm hence, quality loss.

One participant explained that since, he engaged in *ogotobora*, his actual output fell far below the normal harvest expected. This is for the reason that, soon after the harvest, his granary was empty again. But for him, *ogotobora* is a coping strategy, which cannot be ignored as it enables households to meet their immediate food needs just before the actual harvest begins. *Ogotobora* is a food loss and waste endeavor since more maize cobs/grains are used unlike when they could have been used had the maize dried naturally on the farm.

During focus group discussions, the study found that before harvesting, all equipment such as granaries and transportation containers that will hold maize grains as it moves from the field to the homestead for storage should be thoroughly cleaned prior to harvest to minimize mould and pest infestations and protect the purity of individual maize grains. Additionally, a smallholder farmer needs to prepare well in advance a place where to keep the cobs clean and dry in order to avoid fungal infestation. It was also shared that

containers used to carry maize such as baskets, carts, wheelbarrows and bags have to be cleaned to remove dirt and old grains and cobs.

During interviews, one of the participants explained: “for the tools to be clean, they have to be treated with boiling water to kill pests and/or their eggs” (IS: Male respondent, 48 years). From this finding it is implied that this is done in order to avoid infection of new maize grain by pests and their eggs. However, the researcher’s observation on some smallholder farmers through their expression during focus group discussions, they did not have skills and were unable to effectively prevent or control field losses. This is also confirmed by World Bank (2011) that for the low income countries, pre-harvesting management knowledge is limited hence, eventual food loss. In this study, it is observed that such loss is invisible that the smallholder farmer realizes it during harvesting time.

Before a household decides to harvest, it has to organize labour in advance. Where family members are not enough to do harvesting, the household will have to ask for help from their neighbors or hire. One of the participants narrated that: “in some cases during harvesting, you find that you do not have money, but you can compensate neighbors’ time by providing food and local brew” (FGD: Male participant, 48 years). This implies that the maize cobs/grains to be harvested are going to be less if it is shared with those who are going to provide labour during harvesting. The above findings are in agreement with Takane (2008) study in Malawi where he found that apart from family labor available within the household; labor exchanges among relatives that involved other households and even outsiders were also practiced. In some cases, laborers were paid in cash and if the household did not have cash, labourers were paid in kind-usually-in form of maize and/or cooked food.

From the foregoing discussion, it evident that pre-harvesting is an important aspect in the food production chain. As Florkowski et al. (2009) points out, pre-harvest conditions and actions in the field can indirectly lead to losses at later stages in the chain, as differences in production and agronomic practices can result in different quality at harvest, different suitability for transport and shipping, different storage stability and different shelf-life after harvest. With this regard, pre-harvest phase helps us in understanding the level of preparedness of the smallholder farmer in the next step, which is harvesting. It is the observation of the study that, if pre-harvesting is done well before the actual harvest, and smallholder farmers have knowledge on how to avoid pre-harvest losses, less food is going to be lost at harvest. The researcher now turns attention to maize harvesting procedures to explicate the various aspects involved.

5.3 Maize Harvesting Among Rural Farming Households

As a preamble to post-harvesting practices, the researcher revolved around harvesting and post-harvesting food-resource handling variables such as labour for harvesting, drying, threshing, storage, consumption and food exchange practices in the study area. Maize harvesting, storage, consumption and exchange practices are a chain of interconnected food handling processes from the time of harvest to the delivery of the food to the store or consumer. In chapter four, the study found that maize planting in Gucha Sub-County happens in two seasons in a year. That is, within the months of February/March and August/September.

The study sought to understand when the smallholder farmers in Gucha Sub-County harvested their maize for the first season and second season of the year. It was shared that harvesting for the two seasons in a year is done around the months of January/February

(long season) and July/August (short season) respectively, to pave way for land preparation for planting in the next season, which followed immediately in the same month, that is, February and August respectively. In addition, the second maize growing season that commences around August/September helps to boost household food security situation through the beginning of the following year.

Harvesting is the most stressful and busiest period of the entire season for a smallholder farmer. It requires long hours of standing on the farm and transporting maize cobs/grains. This is due to multiple factors including; unpredictable human labor challenges, theft and weather, which may not be favorable sometimes especially when it is raining and increases the risk of maize cobs/grains damage by humans and eaten by animals such donkey as shown in Plate 5.3 below.

Plate 5.2: Maize cobs and grains being consumed by donkey and chicken (August, 2017)

Plate 5.2 above shows that the donkey involved in transportation exercise also feed on some maize cobs, leading to maize loss. As well, the chicken shown above in the second photo also feed on the shelled grains being dried for storage and/or consumption. The observation made by the research in Plate 5.2 above, there is a clear manifestation how significant losses of maize are experienced.

The study found that for smallholder farmers, the time of harvesting is determined by the degree of maturity and dryness (62%), while for others, it depended on food availability in the household (25%) and market supply (13%). As discussed in the pre-harvest section, maize has to dry well before it is harvested to minimize moulding and shrinkage when drying in sun after harvest. For those respondents who had some maize in the household for consumption, they could wait until the right time of harvesting, whereas for others, the major determinant was whether the maize was available in the market for purchase for consumption. All respondents in the study area harvested maize manually by hand. The research was interested to know how the harvested maize was handled on the farm. Majority (78%) of the respondents picked the maize off of the stalk, whereas (22%) of the respondents cut maize with a portion of the stalk and transported the harvest with stalk to the homestead for drying and storage. It was shared that after maize cobs have been removed the stalks are heaped together at the homestead for animal consumption**.** However, it was revealed that the exercise was labor intensive.

In some areas in Gucha Sub-County, rainfall forced smallholder farmers to postpone the harvest, but harvest before rainfall was preferred. They gave reasons that after drying maize cobs during raining period, the grains may be discolored or rot because of wetness, hence, food loss. In addition, delayed harvest can lead to yield losses particularly through theft. One of the participants in Focus Group Discussion said that: “the remaining food in the field tempts people and children to steal” (FGD: Male participant, 43 years). One key informant said that: “maize theft mostly happens when it is raining as this is the time people are gathered together in the homestead and prefer roasting maize to keep time moving” (KI: Female informant, 47 years). The researcher noted that timely harvesting is

fundamental in reducing losses during harvesting. Therefore, harvesting should be timed to coincide with dry weather to reduce food losses and waste. However, dry season is not predictable in Gucha Sub-County because of continuous rainfall throughout the season.

The harvested crop, though meager, may be used to satisfy subsistence needs for a little longer. Prices of staple foods are usually stabilized by the availability of the harvested crop. In addition, the second maize growing season that commences around September helps to boost the food security situation through to the beginning of the following year**.** This means that smallholder farming households will utilize harvested food until January in the next year. However, this may not be the case because many smallholder households harvest little maize than their expectations. The problems in food accessibility are encountered at the beginning of January therefore occurred when most households are challenged by starvation. This cyclic pattern reoccurs each year. This also explains why households keep on experiencing seasonal hunger. At the same time, it explains why farming households experience a food crunch in the early and mid-term of every year.

During the study, discussants shared that harvesting time should be decided by household head when maize stem becomes dry enough to be broken by hand easily. Most important is who participated in harvesting process. The study therefore, sought to know the source of labour during harvesting. The results are shown in Table 5.1 below.

Table 5.1 Source of Labour during Harvesting

Source of Labour during Harvesting	Frequency	Percent
Household labour	222	58.9
Hired labour	100	26.0
Both (household and hired labour)	55	15.1
Total	377	100.0

Analysis in Table 5.1 above indicates that majority (222, 58.9%) of the respondents used household labour. The other 100 (26.0%) of the respondents utilized hired labour whereas, 55 (15.1%) used both household and hired labour during harvesting. On the use of household labour, the study found that men, women, boys and girls participated in harvesting processes. They divided the tasks among themselves. For instance, children were used to collect and pack de-husked maize cobs in one place. However, some maize could remain behind if the children were not carefully supervised hence, food loss. Once the maize cobs are packed together, in most cases, children are used as maize transporters to the homestead, while parents continue with harvesting.

It was also shared that the respondents who used household labour, most of them were older smallholder famers who had large family size and utilized their social networks to access free labour. However, during times of need, those who offered free labour could benefit through food assistance from the household where they had worked, thus indirectly leading to food shortage. The above findings are confirmed by Musemwa & Mushunje (2012) in Zimbabwe that older smallholder farmers are able to easily access labour than younger smallholder farmers because they have larger families. As also noted by Bagamba et al. (2008) in Kenya, family size had a positive effect on family labour use

in maize production processes. From the above findings, it can evidently be concluded that household size is the indicator of household labour in this study.

Those respondents who used both hired and household labour shared that they only hired labour when household members were few. The study observed that hired labor was short term. During focus group discussions, one participant who was also a village elder said that hired labour is socially recognized in rural households since it is an outcome of socially embedded relationships. This means that for one to access labour he/she must utilize the social networks available to choose trusted labourers. In most cases female members (wives) of the household were in charge of harvesting processes. However, during allocation of labour, there was need for negotiations with the head of household to get cooperation from other members of the household on how to participate and/or access extra labour if required. This was pegged on the premise that, in current times, things have changed due to poor socio-economic conditions of most rural households providing labour and cannot trust anybody to work on the farm without knowing the profile of the person.

From the focus group discussions participants shared that when using hired labour it sometimes came with risks as narrated by one participant: “we lose some maize harvest to dishonest maize collectors on the farm, who deliberately leave some maize cobs on the ground for later picking/scavenging (*korogota)* for their own use.” This practice *okorogota,* makes smallholder farmers to experience a lot of food loss.

The researcher was interested to know what was harvested and how it was harvested. The study found that majority (347, 92%) of the respondents harvested maize cob, dropped them on the ground, and later collected to the homestead. Whereas, 30 (8%) of the

respondents harvested grains, where they used agricultural machines to shell grains from maize cobs. Those who harvested grains were a group of smallholder farmers who had high level of income and in most cases leased extra land for cultivation. One of the participants in a group discussion said that: “when you harvest maize from many acres of land, it is expensive to transport huge amounts of maize cobs to the homestead. That is why we prefer shelling maize cobs on the farm and transport grains to the homestead” (IS: Female respondent, 57 years). One of the observations from the group discussions is that when maize cobs are shelled on the firm there is a likelihood of grains spilling into the bushy or grassy ground and/or the heaps of dry maize stalks. According to the discussants the spillage was more especially when the hired laborers are not closely supervised. This resulted to food loss.

Of the 92% of the respondents who harvested maize cobs, during de-husking of maize cobs, 68% of them used knives of various sizes and sharpened wooden tools whereas 32% of the respondents used bare hands. Those harvesting break the stalks of the plants or the ears so that their tips are pointing downward. For smallholder farmers, when maize cobs are facing down, it is an adaptive aspect for maize not to rot especially during rainy times when the maize is drying, hence, maize loss. Besides, one of the advantages of this practice is that, it allows all maize to be harvested, since any remaining maize cobs can be easily spotted.

On the contrary, however, the researcher observed that in some farms maize plant remained standing. This causes maize rot when it is raining, as well, some maize to remain on the farm un-harvested if those harvesting are not keen hence, food loss. It was shared by key informants that during harvesting, all maize should be harvested once. This

is because maize that is left standing un-harvested start to show diminishing quantitative and qualitative returns through shatter losses and attacks by pests and birds, moulds and rodents. It was shared that smallholder farmers should wind-up harvesting as soon as possible to avoid any delays that will render maize cobs to destruction or theft as discussed in pre-harvest section. These findings confirms studies conducted in India and Bangladesh by Kannan et al. (2013), which found that delayed harvesting results in large losses due to high shattering losses and the loss can even be up to 3%. The delays are caused by lack of enough farm labour, inadequate harvesting equipment and continuous raining season.

The study observed that after harvesting, it is important to sort out the maize as shown in Plate 5.2, remove all rotten maize cobs together with the cobs that show signs of weevil infestation mould and damage by birds. The maize store is cleaned thoroughly; remove any existing maize grains, cobwebs and any material in the store that can harbor pests in preparation to receiving new harvest for storage. The study sought to investigate the amount of maize harvested in a season by farming households. The result is shown in Table 5.2 below.

Table 5.2 Amount of Maize Harvested in a Season

Amount Maize Harvested in a Season	Frequency	Percent
1-5 bags	190	50.5
6-10 bags	98	26.0
11-15 bags	45	12.0
>16 bags	13	3.5
Unspecified	24	6.5
None	7	1.5
Total	377	100.0

Analysis on Table 5.2 above found that out of the 377 respondents, majority (190, 50.5%) of them harvested between 1-3 bags, 98 (26.0%) got between 4-7 bags, 35 (17.5%) said that they got over 7 bags, 24 (12.0%) harvested 4-9 bags, 13 (3.5%) said that they got over 10 bags, 24 (6.5%) could not specify the amount of maize they harvested in the last season, while 7(1.5%) did not harvest any maize. The above findings show that majority of the smallholder farmers in the study area, have low harvest and therefore, do not have enough maize for their households for consumption and exchange. The main reason for smallholder farming is that the land is highly populated and smallholder farming households own small pieces of land in the study area.

During focus group discussions, the study found that part of land was used to plant bananas and cash crops such as tea and coffee. It was observed that cash cropping competed more with maize cropping. This means that the harvested maize may not be enough to cushion families from hunger. For smallholder farmers who shifted more to cash cropping, they were in a better position to afford cash inputs for maize purchase from local traders who sell almost exclusively on a cash basis only. The above

observations are consistent with evidence from other studies such as (Von Braun and Kennedy, 1994 and Strasberg, 1997) that cash crop smallholder farmers rely on buying food items from food crop farmers.

The researcher sought to confirm from the respondents whether maize harvested was enough for the household till the next season. Out of 377 respondents interviewed, majority (151, 75.5%) did not harvest enough maize to last up to the next season. While 49 (24.5%) shared that they harvested enough maize to last till the next season. As earlier indicated in Table 5.1, most of the smallholder farmers in the sample population had harvested between 1-3 bags of maize from their farms. The maize harvested is not adequate to last up to the next season' harvest given the large number of family members. Due to a relatively low production of maize grains, the harvest may not sustain households for a long stretch and this explains why households begin to experience food crunch two months after harvest.

In a focus group discussion they reported that after harvesting, they take less than two months before they start buying maize from the market to cushion hunger. The respondents who did not harvest enough maize grains were asked to comment on how harvesting as a food-resource handling procedure may lead to food loss and waste. Although time of harvesting falls between pre-harvesting and post-harvesting period, its effects have direct linkage to food-loss or food waste along the food supply chain. The rest of the smallholder farmers 111(29%) were satisfied that the harvest would last till the next harvest.

A significant number of respondents in this category were those who had fairly large size of land and those who supplemented their land with leasing extra pieces of land for

farming. One of the key informants shared that: “my family is large and I harvest six 90kg bags of maize grains from my farm. The harvested maize is consumed within two months before we start depending on buying from the market or food assistance from the relatives” (KI: Female informant, 44 years). The researcher observed that the buying or depending of food assistance is not a good venture since it is never sustainable for households. Despite the fact that most of the smallholder farmers have an interest in food crop production, it seems that there are other factors that could be contributing to the low harvest from farms. The study therefore, enquired the reasons behind shortfall in maize harvest. The results are shown in Table 5.3 below.

Table 5.3 Reasons for Shortfall in Maize Harvest

Reasons for Shortfall in Food Harvest	Frequency	Percent
Poor Harvesting practices	195	51.7
Poor Storage practices	118	31.3
Small land sizes	64	17.0
Total	377	100.0

Analysis in Table 5.3 above indicates that majority (195, 51.7%) of the respondents experience shortfall in harvest due to poor harvesting practices. This is due to poor handling procedure employed from the field to the homestead. While 118(31.3%) of the respondents, experienced maize shortfall as a result of poor storage practices such lack of cleaning granaries, storing maize before it tries as well as unventilated storage facilities that allows rotting of maize to take place., and 64(17%) had shortfall in harvest because of small size of farm land hence, could not harvest enough for the households.

From the key informant interviews with agricultural extension officers as well as observation by the researcher, most of the smallholder farmers have small farms in terms

of size, which were not sufficient for maize, bananas, tea and coffee growing at the same time. As discussed in chapter four, most smallholder farmers in the study area have primary level education. This limited them to traditional methods of farming. As well, most of the smallholder farmers were not happy with the current extension services that were being offered by the Ministry of Agriculture. This is because most of the agricultural extension officers just stay at the office, and do not go out to meet smallholder farmers. When one visits the office, rarely are the officers found there. This study observes that most of the smallholder farmers cannot come out of their low harvesting status without an external intervention such as extension services.

Weather changes are other aspects related to poor maize harvest highlighted by the respondents in the study area. During focus group discussions, smallholder farmers reported that the weather especially raining patterns have changed and alter the planting patterns. Smallholder farmers lack information from extension offices, which they can use to adjust with changes in weather patterns. Some of the smallholder farmers shared that they had poor harvest because of a combination of these many factors. For instance, 67% of the respondents said that the rains were on when the study was being carried out, but most of them had not planted for the short rains. Sixty four percent (64%) of the respondents were too sure of the reliability of the rains. The researcher observed that these respondents did not bear in mind the changing rain patterns over years in the study area.

Fifty three percent (53%) of the respondents lacked the knowledge on the varieties of maize seeds they could plant to maximize the short rains. It is out of such confusion that some of them failed to plant on time leading to poor maize harvest hence, losses. The

implication is that most of the smallholder farmers cannot come out of their low maize production status in food production without an external intervention of one kind or the other. External intervention in the view of this study will help to mitigate the challenges the smallholder farmers are facing in the study area. The literature sourced from the Ministry of Agriculture in Kisii County shows that Gucha Sub-County experiences continuous rainfall throughout the year, which affects maize handling procedures before and after harvest. According to a key informant who was a village elder shared that: "wet weather has greatly affected harvested maize grains thus, causing damage and rotting" (KI: Male informant, 56 years). Studies such as (IFPRI, 2016; FAO, 2015) have found that grains contaminated beyond 10ppb with fungal infection, are rendered unfit for human consumption and hence, not marketable. This contributes to food loss and waste.

Some smallholder farmers engaged in early harvesting of maize cobs and sometimes the maize was harvested fresh. As discussed earlier in the pre-harvesting section, this is a practice that increases rotting of maize cobs/grains because of high moisture content hence, food loss. Some respondents harvested maize earlier for fear of maize being invaded by thieves or animal predators. This was confirmed by a key informant who shared that: "thieves and monkeys invade on our farms resulting to loss of our maize cobs and this is why sometimes if you do not have enough farm security, you are forced to harvest early" (KI: Male informant, 39 years). After harvest has taken place, the maize cob/grains have to be transported to the homestead. This activity involved both men and women. The researcher asked respondents to indicate the mode of transport used by smallholder farmers in the study area. This is summarized in Table 5.4 below.

Table 5.4 Mode of Transporting Maize Harvested to Homestead

Mode of Transport Used	Frequency	Percent
Foot/human head	330	87.5
Motor bikes	7	1.9
Donkey/Animals	40	10.6
Total	377	100.0

Analysis in Table 5.4 above indicates that majority (330, 87.5%) of the respondents transported maize manually on the head to the homestead. The other 40(10.6%) used donkey/animals in transporting maize to the homestead whereas a minimal number 7(1.9%) of the respondents utilized motorbikes transporting maize grains to the homestead. From the analysis above, foot/human head was the most prevalent mode of transporting maize from the farm to the homestead. Individuals used a sack *'egunia'* made of manila or sisal and/or traditional basket known as '*egetonga'* carrying maize home mostly by women as men continue threshing maize from the cobs in the farm. This is an indication of differentiation of roles between men and women in the household. Above and beyond, it was noted that even men nowadays transport maize on the heads from the farm to the homestead and even participate in the drying processes as shown in Plate 5.2 on maize drying.

From the above evidence, it is clear that the roles in the household in maize handling and especially in transportation have changed over time. In the past women would carry the maize on their heads from the field to the homestead and load the granary and/or roof tops, but in the contemporary society, men transport the maize using the ox-cart, donkeys and even their heads. This is also confirmed by Mulunga & Kandiwa, (2015) in their study in Zambia on gender analysis of maize post-harvest management, where they found

that nowadays men and women in the households are collectively working together to take care of the maize crop on the farm from harvesting, transportation, drying and storage.

The use of a sack or basket in transporting maize to the homestead as observed in the study is a manifestation of meager maize output in Gucha Sub-County. This is largely attributed to the smaller sizes of land in the sub-county. For large scale farmers, they use tractors and/or carts to transport harvested maize to the homestead and this is particularly in land leased from the Maasai. Additionally, the use of human transport especially with an open container such as basket could lead to some maize falling down. It was reported that sometimes the person carrying the cobs on the head does not have the possibility to pick it up again because of heavy load on the head, hence, food loss. During the study, the respondents who used donkeys and oxen as shown in Plate 5.3 below, had relatively huge harvest and use of human transport was not efficient enough.

Plate 5.3: Donkeys used for transporting maize cobs from farm to homestead (March, 2015)

Observation on Plate 5.3 above shows that donkeys are mainly used to transport maize to homestead. Some respondents reported that sometimes maize harvested may lie on the ground for some days as they look for means of transport. One participant in a focus group discussion explained that:

> The harvested maize grains may lie on the ground for some days as we seek for means of transport, such as motorbike, individuals, donkeys or oxen, in case the ground is wet, sometimes you find maize cobs have started rotting. At times, some maize cobs are stolen by passersby (FGD: Male participant, 41 years).

Another participant narrated that:

> During this time of the season, everyone is harvesting maize and therefore, one has to book early the means of transport, which are scarce and as you are waiting for help, the maize on the ground may start rotting before you find someone to

> help you to transport them to the homestead for storage and consumption (FGD: Male participant, 53 years).

From the above evidence, in case the ground is wet, maize will increase chances of fungal infection of maize cobs. It was also evident that sometimes transporting animals such as donkeys step on or consume the maize cobs/grains, leading to their damage. Maize cobs/grains carried using carts, can fall down and end-up being stepped on or eaten up by animals doing the transportation. The losses also occurred due to overloading in the carts that precipitate maize to fall and also because of bad muddy roads, which are sometimes impassible. From the above discussion, it can be deduced that transportation is an important operation of the maize value chain, as the cobs/grains need to be moved from one place to another in preparation for storage. The lack of adequate transportation results in damage of food products through bruising and losses due to spillage.

It was shared that bulk handling of maize cobs/grains involved loading and unloading from wagons, motorbikes and trucks as this practice was performed manually by most households and resulted in high spillage hence, food loss. Additionally, hooks used to lift bags tear them and resulted in high spillage. Even in cases where carts were used, they were not totally suitable in transporting maize cob/grains. As highlighted by the participants that some ox-carts are wide open on the top and when it is raining, the maize cobs/grains are rained on. This leads to maize rot due to wetness, which eventually leads to quality loss. The above findings are in agreement with Alavi et al. (2012) in their study in Southeast Asia, which reported 2%–10% losses during maize handling on the farm and transportation.

5.4 Food Storage Procedures and Practices

Food storage is a household food-resource handling practice that is critical to smallholder farmers in the food production chain. In this study, storage was one of the post-harvest handling procedure and an important variable in understanding food loss and waste in Gucha Sub-county. Before storage, harvested maize has to undergo various processes. First, the maize has to be dried to the required moisture content before storage. During interview discussions, the study revealed that maize was left to dry in the field for 2-4 weeks beyond maturity to allow quick storage when it reaches home.

Unlike other regions like Trans-Nzoia and Narok Counties where maize stalks are cut down and piled in one place for drying, in the study area, for most (92%) respondents as discussed in the harvesting section, maize remains as standing stalks until it dries and thereafter, harvested and transported to the homestead for further drying, shelling and storage. However, according to one of the agricultural extension officer, this is not right for smallholder farmers since, in case of strong winds and rains, the drying maize stalks fall down and come in contact with wet soil resulting to rotting, hence, food loss.

Respondents were asked how they dried their maize cobs from the farm. Overwhelmingly, 320 (85%) respondents said that they stockpiled maize on the bare ground particularly, on grazing grounds. The other 57 (15%) of the respondents dried the grains using a drying crib, canvas or a raised platform. Stockpiling maize on the bare ground was also observed at nearly all homesteads of the key informants and participants of focus group discussions. This is shown in one of the Plates below captured from the field:

Plate 5.4: Maize drying on bare ground as household members are sorting them (March, 2015)

Analysis from Plate 5.4 above shows that maize cobs/grains are in contact with soil and the moisture creating a favorable environment for increased maize contamination and rotting. As also observed above, maize cobs that are in contact with the ground will pick up dirt and pests. This means that maize grain quality will be reduced. One of the participants during a focus group discussion said that:

> After the grains have been harvested, I usually spread out them in the sun to dry before the actual storage begins. I then confirm that the grains are completely dry before storing them in the granary or any other storage available such as containers or on the roof of the house (FGD: Female participant, 36 years).

Notwithstanding, the above method of drying being a cheaper method for smallholder farmers, it also made maize cobs/grains more prone to contamination, as the grains easily

scatter on the ground and can be stepped on and/or disappear on the ground. Maize is also lost when offloading from transporters (both human and animal), which results to damage. In some cases, there is risk of rain falling on the maize cobs, resulting to rotting, hence, loss. It was also shared that at this time, birds and chicken take advantage of these methods by consuming a lot of grains, thus food loss.

Respondents were asked whether they were aware of the negative effects of drying maize cobs/grains using the above method. Majority (86%) of the respondents were aware, whereas only 14% were not aware of the negative effects that come with the above method (Plate 5.4). Those who said they were aware and continued practicing the same methods revealed that, sometimes they do not have the means of using alternative methods. For instance buying drying materials is expensive for them hence, they risk with the above method. For the smallholder farmers who were not aware that drying maize cobs/grains on the bare ground increases chances of grain contamination, they claimed that during harvesting season, there is plenty of maize and the spillages and those grains consumed by birds and other animals are very minimal.

Key informant interview with agricultural extension officers indicated that the maize grain that is in contact with the ground as shown in Plate 5.4 above, will absorb moisture and pick up dirt and pests hence, food loss in quality. The key informant further pointed out that:

> This practice should be discouraged because it leads to maize loss since, someone should keep watch on the grain while it dries, and at night or when it rains, the grain must be brought under shelter. At the same time, maize cobs can be washed away in case of a sudden down pour, risk of contamination from dusts, soil, stones, animal droppings, fungal and pest infestation or losses from birds, poultry and domestic animals, resulting into contamination and quantitative losses (KI: Male informant, 54 years).

Observation in Plate 5.4 above indicates that smallholder farmers continued with their traditional ways of handling and/or sorting healthy maize cobs/grains from the rotten ones. The study observed that the above claims are true since, the maize handling process technique is time consuming and labour intensive and involves lots of maize cobs handling hence, big losses. This was a common practice in all sub-locations that participated in the study. Another important observation from Plate 5.4 above is that members of the household are involved in sorting maize cobs that are rotten from good maize cobs. The rotten maize cobs are not thrown away, but used for other purposes including mixing them with clean maize grains for cooking *ugali* for animal feed or preparing *busaa*. Other smallholder farmers dried maize cobs on the roof top through smoking it over fire as shown in plate 5.5 below.

Plate 5.5: Maize cobs hanged at the roof top for drying before storage (March, 2015)

Analysis from Plate 5.5 above, in the in-house smoked storage methods, maize is stored within the dwelling in space on the roof over the cooking spot to receive the heat. It was shared by participants that maize cobs are usually stored in the roof/top left section of the house above a fire as shown in Plate 5.5 above. The work of the smoke and heat from the fire is preservation strategy that helps in killing pests and/or drive them out of the grain. The above findings compares well with a study by Pantenius (1988) in Togo, which found that in-house smoked storage is a common maize storage practice, which ensures that maize cobs/grains are preserved well, without loss. However, further discussions with discussants, it was shared that the procedure is not always effective because some pests such as the larger grain borer or Osama may not be killed, and will persistently consume the grain hence food loss.

As revealed from the foregoing discussions and illustrations, drying is an in important aspect in determining amount of maize loss or waste in the study area. Drying can be performed naturally, which involves sun and/or shade drying or using mechanical driers. Natural drying and/or sun drying are traditional and economical practices for drying the harvested maize, and most popular in the study area. Maize cobs and grains lying in the open as shown in Plate 5.5 above for sun drying are eaten by birds and insects, and also get contaminated due to mixing of stones, dust, and other foreign materials. During focus group discussion it was shared that some farmers use mats or plastic sheets for spreading the grains, which reduces the contamination with dust and makes the collection of grains easy.

Inadequate drying can result in mould growth and significant maize losses during storage. The presence of sudden rains or cloudier weather may restrict the proper drying, with the

maize being stored at high moisture leading to high losses due to mould growth. Sun drying is weather dependent, labour intensive and slow causing large losses. The above findings are supported by Abass et al. (2013) who reported about 3.5% and 4.5% losses during maize drying in Zambia and Zimbabwe respectively. Overall, drying is a critical step after harvesting to maintain the maize grain quality and minimize storage losses.

Out of 347 respondents who harvested maize cobs and transported home, 226(60%) shelled through physical beating, grinding stone or by hand with the use of devices like a knife, while 121(40%) of the respondents did not shell but processed the cobs for storage as it is. On the contrary, those respondents who shelled maize cobs in the study area revealed that physical beating resulted in grain cracking resulting to maize loss in terms of quality and content. Physical beating maize with stick also resulted in physical damage which makes it more vulnerable to pest entry and physical damage. A group of participants shared that they only practiced physical beating of maize if only the maize cobs have dried well. However, for others they could not wait maize to dry hence, damaged more maize grains.

On the other hand, the study revealed that maize on the cob should not be stored for long because it is prone to pest damage. Maize cobs should be shelled as soon as they dry. Once they have been shelled, the grains should be dried in the sun for three to four days. According to a key informant during the interviews: “drying the maize grains for 3-4 days in the sun is aimed at bringing the moisture content to around 12% to 13%, which is ideal for storage” (KI: Male informant, 46 years). After drying the maize grains, respondents revealed that they pack the maize in bags, seal well and then store for future consumption or sale.

Overall, it was shared by discussants that careless handling of either maize cobs or grains during shelling can lead to spillage. This process leads to loss and waste in terms of quantity. One participant said that: “when spillage occurs, there is loss of quality just in the event that contaminated cobs or grains are again mixed with the clean stuff” (FGD: Male participant, 73 years). In this case, contamination will lead to mould development. The above findings were confirmed by Agricultural extension officer who asserted that: “spillage is very prevalent when shelling is done by physical beating of the maize cobs with sticks, and the situation is worse if the spillage gets into contact with soil moisture” (KI: Male informant, 59 years).

One of the main issues revealed during the study is that maize shelling activities leave all kinds of trash mixed with the maize grain. These trash include; vegetation, kernels and other materials such as soil, stones, sand and metal particles. According to the agricultural extension officer: “the trash adversely affects subsequent storage and processing activities thereafter” He further said that: “using a maize shelter is favoured although it is not affordable by most smallholder farmers” (KI: Male informant, 56 years). The researcher was interested in understanding how respondents processed dried maize for storage. This was an important aspect as successful maize storage is core to smallholder farmers' food security status and enables the respondents to generate quality seeds for planting in the next season. Discussants shared that cleaning is the first step conducted to remove as much trash as possible from the threshed maize grains.

Broken maize grains were removed with the husks before bagging them for storage. This was done through traditional winnowing (kwera), which is mostly done by women and uses wind to remove light elements from the grain as shown below.

Plate 5.6: A Woman Engaging in Winnowing of Shelled Maize (March, 2015)

Observation on Plate 5.6 above indicates that the woman uses a traditionally developed container (bamboo and cow dung) for winnowing. Winnowing should be done well and carefully to avoid spillage of grains. In most cases, it is the older women who are involved in winnowing because they have experience and always avoid maize loss by ensuring that there is no spillage. It is only in rare cases young women are involved, though they are taught how to do it. The chicken have to be kept away to avoid grain consumption. If this is done well, fewer grains will be lost or wasted. The above findings confirm findings of the FAO study on post-harvest losses (2015), which reported that women are mostly involved in winnowing of shelled maize. The older women are more knowledgeable and faster as they have gained experience over the years, especially in

timing the wind which blows off the chaff. However, FAO (2017) found that the practice exposed women to health problems during the winnowing practice such as chest problems, aching shoulders, flu, eye problems and itching.

The study found that farmers applied pesticides such as actelic powder on the grains in preparation for storage. However, this was possible for only those smallholder farmers who afforded to purchase the pesticide or harvested a substantial amount of maize for storage. The treatment of maize grains soon after harvest often determined the quality of stored maize and influenced grain quality after harvest. The primary motive in any maize grain storage handling procedure is to maintain the stored grains in good state and maintain both quantity and quality. During storage, maize grain should remain dry and clean.

The researcher was interested in understanding smallholder farmers' level of preparedness in storing maize. The respondents were first asked whether they store maize or not. A significant number 295 (64%) stored maize cobs/grains after harvest, whereas 72(36.0%) of the respondents did not store any maize after harvest. For the respondents (64%) who managed to store maize cobs/grains for future use throughout the season, a relative high number of smallholder farmers sold unspecified amount of maize harvested later to meet household needs.

For the respondents who did not store any maize, they sold off their maize grains cheaply soon after harvesting due to anticipated losses in storage handling and later buy food at exorbitant prices. Despite the desire to store maize in order to meet food requirement and future cash needs, some smallholder farmers often sell large proportion of their produce at harvest when the price is low. This is also a source of maize loss. This is frequently

observed in the study area where smallholder farmers must satisfy cash needs immediately after harvest, only to buy maize grains again in the season for family consumption.

It was paramount for the research to know, the amount of maize stored by the respondents. Out of 295 respondents of those who stored maize after harvest 51(25.1%) stored between 1 to 4 bags, 35 (17.5%) stored between 5-9 bags, 20(10.0%) stored over 10 bags, and 15(7.5%) stored unspecified amount of maize. From the above evidence, it is clear that smallholder farmers in Gucha Sub-County store very little amount of maize for later use. This is as a result of low acreage of farms on maize production as explained earlier.

During focus group discussions, both male and female participants mentioned that when the maize was to be kept in the granary, it remained the responsibility of the woman of the household to retrieve some maize for food and controlled accessibility to the storage facility. Participants further said that, in the event that the man in the household has no spouse, the daughter or any woman in that household controlled accessibility to the storage facility and has the authority over retrievals. One of the participants during the study focus group discussion remarked that:

> Traditionally, in our community the granary is the property of the woman, and if a man is seen involved in the affairs of maize storage in the granary you would be mimicked in the village because it is not socially acceptable, however, nowadays things are changing, men and women can share responsibilities (FGD: Male participant, 70 years).

From the above evidence, it has been confirmed that traditionally, it is the responsibility of the women to be in charge of the storage facility. This is confirmed by a study by FAO (2017) in Zimbabwe, that women are the overseers for maize grain storage and keep an

eye on the remaining food levels and ensure that the maize grain does not have pests. However, in recent times this is changing and people are collectively working together to take care of the maize harvest. This is unlike the past where specific roles were done by women and vice versa. From the literature, Mvumi et al. (2015) found that this behavior is more prominent in younger couples, where both women and men are often responsible for overseeing grain storage.

During focus group discussions, it was reported that on grain management in the storage facility, it is the woman's role to make decision with regard to what should be sold or kept and how food-resources should be handled. The study found that within a month of storage, a significant (46%) number of the respondents had utilized most of the maize grains in their stores through consumption and selling. This finding compares well with a study conducted in Tanzania by Adebayo et al. (2013), which found that within a month of maize storage only 13% of the households had maize in the store. The foremost goal in any maize grain storage system is to maintain the stored maize cobs/grains in good condition so as to avoid deterioration in quantity and quality. The researcher sought to know the kind of storage facilities used by smallholder farmers in the study area. The findings are shown in Figure 5.1 below.

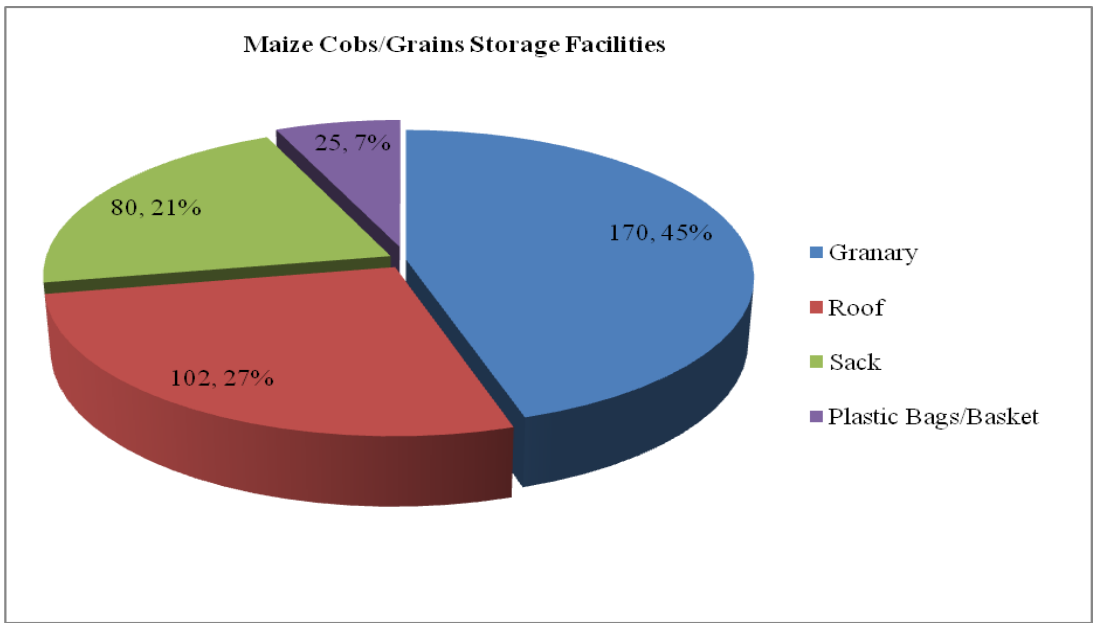


Figure 5.1: Storage Facilities used by Smallholder Farmers

Analysis in Figure 5.1 above shows that 170 (45%) of smallholder farmers stored their maize grains in the granary, while 102 (27%) stored in the roof of their houses, 80 (21%) stored in sacks and 25 (7%) of the respondents stored in plastic bags and/or baskets. Twenty four percent 90 (24%) of the respondents said that much of the maize grain loss occurred during storage processes. Those respondents who stored maize cobs/grains in granaries said that they were constructed from locally available materials such as straw, bamboo, and mud. However the researcher's observation revealed that the granaries were in dilapidated conditions. Samples of granaries that stored maize cob/grains are shown below

Plate 5.7: Traditional Granary, (February, 2015)

Plate 5.8: Traditional Granary in the study area (February, 2015)

From the above plates, traditional granaries are common in the study area. For maize storage as shown in Plate 5.7 and 5.8 above, circular traditional granary is used with

some modifications to store maize cobs/grains. The basket has to be more loosely woven, or the wall should be slatted with at least 40% airspace and with a diameter of up to 150 cm, depending on the humidity of the air. Although it can be used with small modifications for any crop that needs to be kept ventilated, it is mostly used for drying maize on the cob without the husk. Additionally, smallholder farmers are using traditional storage facilities, which are still susceptible to environmental damage and infestations by rodents and pests. According to Costa et al. (2014) the traditional granary and other storage structures are made of locally available materials but without any scientific design, and cannot guarantee to protect maize grains against pests for a long time. In their study in Sub-Saharan Africa, the estimated losses as high as 60% in maize grains after storing them for 90 days in the traditional storage structures including granary, and polypropylene bags.

Roof storage was primarily used for storing smaller quantities of maize cobs/grains. For the case of maize cobs, they were hung over a fire place in space between the ceiling and roof over the cooking spot to receive the heat (refer to Plate 5.5). During a focus group discussion, discussants pointed out that the smoke prevented the seed from spoiling and from pest infestation. However, the researcher observed that the quality of the maize grains stored in this way may be reduced due to shrinkage, leading to low germination rates and lower yields.

Participants that maize grains mostly stored this way end up being quality seeds for planting in the upcoming season. This assertion was supported by Modi (2003) that roof-stored seed have more vigor during germination than commercially available maize hybrid seed. Most smallholder farmers in the study area were not aware that maize grains

stored in plastic bags and with relatively high moisture content stored for slightly longer periods (1 or 2 months), are likely to develop fungal infestation. Fungal infestation was detrimental to the health of human beings. Respondents were asked to state the causes of maize cobs/grains loss in the storage facilities. The results are summarized in Figure 5.2 below.

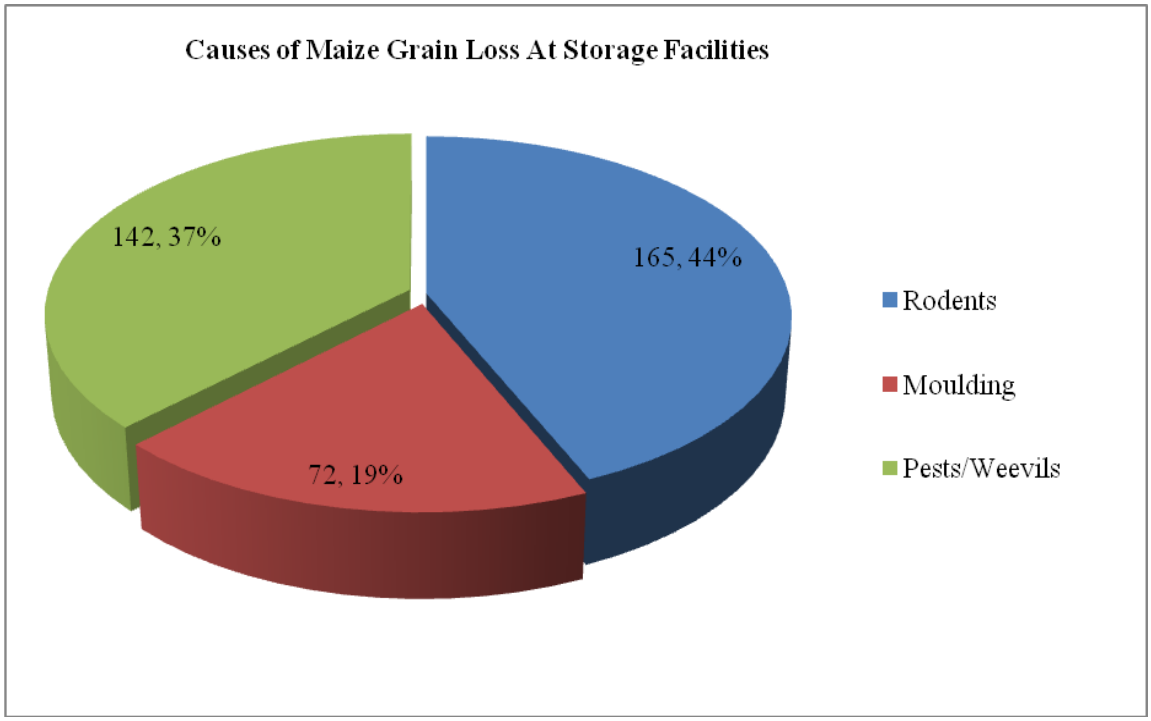


Figure 5.2: Causes of Maize Grains Loss at Storage Facilities

Analysis in Figure 5.2 above shows that 165(44%) of maize grain loss was caused by rodents in Gucha Sub-County especially in households that used traditional granaries, which have wide open spaces on the walls. The study found that 137(37%) of respondents reported that grain losses were caused by weevils, whereas 72(19%) reported maize grain loss at storage facility was caused by moulding. During a focus group

discussion with selected smallholder farmers in the study area, it became evident that, rodents were a major source of maize cob/grain loss in the stores.

Rodents were able to access maize cobs/grains because of poor maize storage facilities that paved way for entry of rodents into the storage facilities. One participant said that: "life has been difficult for us, as we are forced to sell all our produce immediately after the harvest to avoid such losses" (FGD: Female participant, 43 years). Another participant remarked that: "sometimes even when you reduce space gaps in the storage facilities, small rats will always find their way into the granary, eat grains and damage others" (FGD: Female participant, 53 years).

For those respondents who said pests/weevils were a major cause of maize grain loss, they pointed out that the most significant pests/weevil associated with maize storage were the grain weevil, larger grain borer and grain beetle. One participant in a focus group discussion narrated that: "we produce enough for our families but it does not last long, because of food loss due to rains during harvesting season, and infestation by pests" (Female informant, 33 years). The above findings are partly in concurrence with World Bank (2011), which found that there is low adoption of post-harvest technologies in most Sub-Saharan African countries.

According to the agricultural extension officers, the pests start infesting maize grains right from the field and are brought into the storage facilities and increase infecting more grains. It was revealed that some smallholder farmers ignore applying pesticides hence, the attack. One participant narrated that: "sometimes even when you apply the pesticides, the weevils do not die but keep on eating the maize grains" (FGD: Female participant, 53

years). The above evidence indicates that some pesticides are not effective even when they are applied hence, consistent damage of the maize grains in the store.

The researcher found out that untimely handling of maize grains by dusting with the recommended pesticides and lack of scouting during storage also contributed to food loss. Information elicited from key informants revealed that although majority of the respondents stored their grains in shelled form, those that stored their grains in unshelled form perceived the attack as not severe. This is because shelled maize is sometimes stored in portions in bags or other containers and can easily be observed by the smallholder farmer on regular basis. This is possible unlike maize cobs, which are congested in one granary causing stuffing of some cobs.

From the foregoing discussions, it is evident that poor conditions of storage facilities make smallholder farmers vulnerable to high rates of food loss in the study area. The eventual result is that not only the marketability of the stored maize grains that is affected negatively, but also household consumption. This is the reason that the maize grains available are not all fit for human consumption. Discussants shared that training of smallholder farmers is a pointer to proper maize cobs/grains handling during storage processes. Evidently, smallholder farmers use their own limited knowledge to practice storage processes, without considering new technologies and innovations in food production chain. In a key informant interview with one of the Kisii County agricultural officers, it was revealed that in the County, where Gucha sub-County is located, smallholder farmers have not adopted modern technologies in order to reduce post-harvest food losses and waste.

The literature documents available at the Kisii County Agriculture office showed that the damage after post-harvest ranges between 10%-30% on maize grains, with major sources of maize grain loss being storage and drying as indicate from the forgoing discussions. It is the observation of the study that, there is need to adopt post-harvest management practices especially for grains and cereals produced in order to curb the huge losses and waste experienced. Therefore, the researcher observes that, this could serve as a useful point of attention for interventionists empowering smallholder farmers.

From the above findings, while the harvest normally provides family with months of food, many smallholder farmers struggle with a dilemma to store their maize grains safely, hence, loss of a significant portion of their maize grains to weevils and other pests. These smallholder farmers are forced at times to sell their grain, soon after the harvest when maize supply is high and prices are low. This is the worst time for a smallholder farmer to sell, but many have no choice other than to sell for less or lose significant amount of food. In the literature review on food losses and waste, it has been revealed that sub-Saharan Africa, and in particular Kenya, losses over 4 billion U.S. dollars annually in post-harvest maize grain due to lack of storage facilities (World Bank, 2011).

According to Kenya Agricultural Research Institute (KARI), (2014) at least 20% of food is lost or wasted after harvest due to lack or poor storage during the handling process in harvesting and storage. Additionally, institutions like Kenya Agricultural Research and Livestock Organization have acknowledged that post-harvest research especially on food loss and waste still lags behind in the country (KALRO, 2016). However, this situation is blamed on allocation of inadequate funding for research by the Kenyan Government. For example, in 2015 and 2016 financial years, the government allocated only Kshs. 68

million (0.1%) to research. This amount does not even meet the required 2% of the budgetary allocation for research. Based on these reasons, this study is paramount in proposing proper food-resource handling procedures that can be employed to aid in reduction of food loss and waste in smallholder farming households in Kenya and beyond.

This researcher was interested in understanding the challenges faced by smallholder farmers in curbing post-harvest losses. Smallholder farmers highlighted a number of challenges they faced in terms of quantity and quality food loss and waste. In terms of qualitative loss, 44% of the respondents lacked adequate information on drying of maize cobs/grains, whereas 37% of the respondents said that maize cobs/grains were infested by pests, whereas, 19% of the respondents said that maize loss occurred after being discarded due to apparent damage or spoilage.

On drying processes, some smallholder farmers did not understand the extent of drying, and this made some capacity of smallholder farmers to over-dry maize grains before storage. The researcher observed that smallholder farmers seem to have limited knowledge on drying processes, hence, food quality losses. Economic food loss and waste occurred when the maize produce missed market opportunity or lost attributes that make it appealing to consumers. This is explained further in chapter six on food exchange. Maize grains reduced in weight and quality after sometime, when infested with pests.

In terms of quantity losses, discussants in during focus group discussions shared that some maize grains were lost after being discarded due to apparent damage or spoilage. The study observed that capacity of smallholder farmers in post-harvest maize grain

management is an important household food-resource handling aspect in reducing food loss and waste. The observation by the researcher is that smallholder farmers should have adaptive capacity in order to adequately reduce food loss and waste. According to this study, adaptive capacity is the ability of a smallholder farmer to develop skills and technical know-how that may enable him/her to cope up with current demands on household food security, while minimizing food loss and waste.

With this regard, the adoption of any new technology such as the use of modern silos by smallholder farmers should be given priority. However, non-adoption of these technologies is prompted by inadequate extension services as well as demand for extra labour for drying, shelling and storage practices. Participants shared that due to low adoption of new technologies during post-harvest practices such as mechanical shelling and construction of silos, smallholder farmers are subjected to maize handling challenges. These challenges include maize cobs/grains rotting and theft in times of chronic food shortage.

In the foregoing discussion, food storage as a household food-resource handling practice is critical to smallholder farmers in minimizing food loss and waste and ensures food security is achieved. In this study, storage was one of the post-harvest handling processes and therefore and important variable to minimize losses not only in quantity, but also in quality. From real-life situation theory point of view, smallholder farmers use their own experiences on benefits in their food-resource handling activities by considering affordable, but efficient storage processes. Smallholder farmers have their own justification behind their decisions to engage in any kind of food-resource handling

procedure. This is based on the premise that whether or not the decision will yield optimal benefits in terms of food security.

Findings of the study indicated that food loss and waste occur in the field, during harvesting, processing and storage. Most smallholder farmers lack access to modern methods for harvesting, processing and storage. Local structures such as granaries were dilapidated and ineffective against storage pests including larger grain borers, grain weevils and lesser grain borers, which damage stored crops. Adverse weather because of continuous rainfall in Gucha Sub-County also contributed to high post-harvest losses and consequently food insecurity. In a nut shell, pre-harvest practices and actions on the farm indirectly lead to losses at later stages in the chain, as production and agronomic practices influence quality at harvest, aptness for transport and storage stability.

CHAPTER SIX

FOOD LOSS IN HOUSEHOLD FOOD CONSUMPTION, DISTRIBUTION AND EXCHANGE PRACTICES

6.1 Introduction

The chapter interrogates food consumption and exchange procedures and their influence on food security in Gucha Sub-County. The researcher argues that consuming food represents a basic locus of identity, conformity and resistance. Even those who appear otherwise powerless, exercise choices in food preparation and consumption. Later, the chapter examines exchange procedures that smallholder farmers practice in Gucha Sub-County. The chapter begins with interrogation of food consumption variables in the Sub-County.

6.2 Food Consumption Procedures among Smallholder Farmers in Gucha Sub-county

In this study food consumption is the amount of maize food available for human consumption. Household food consumption is one of the stages that food loss and waste occur. In this study, social cultural factors such as societal beliefs, norms, and customs are important variables in determining food choices, preferences and consumption habits. From the analysis of the preceding chapter, maize was the staple cereal in the study area, where beans and other crops such as millet, sorghum, sweet potatoes and bananas played a supplementary role. An important observation from literature documents in Kisii County is that, for the past two and half decades despite a repeated history of maize

production, maize consumption in the County is unreliable, with a steadily increasing consumer base. Unreliable maize supply has not only caused immediate food security problems, but also reinforced poverty cycles. The main question here then is that is this trend continuing? If yes, what must be changed to interrupt this poverty cycle?

The study began with an interest to understand the kind of products of maize consumed by respondents in the study area. When respondents were asked what their main maize product for consumption was, an equal proportion of men and women (that is 50%) indicated *ugali* (prepared from maize flour) as their main food. During a focus group discussion, participants shared that members in the household are socialized into *'ugali'* consumption. This was mostly consumed during lunch and supper with vegetables or meat roast or stew.

It was shared that at the beginning of maize harvest season, every household that has maize no matter the amount, the consumption is high. However, its consumption declines as the season edges to the next harvest. During the study, the researcher found that once maize has been harvested dried and shelled, 53% of the respondents stored the maize grains in the household, whereas 35% of the households sold much of it and stored little maize grains for household consumption later, it was only 12% of the respondents who sold everything to the village traders or neighbors after harvest. As it is discussed in this chapter, village traders are business brokers and usually move around the villages sourcing grain from smallholder farmers. It was also shared during focus group discussions that smallholder farmers sold some maize grains to non-farming households who needed it for domestic consumption.

The study also found out that small scale millers (posho millers) are located in rural areas where they offer milling services to clients who come with their already dried and clean maize grain. The researcher observed that the main maize mills are hammer mills, which operate almost everywhere throughout Gucha Sub-county. As pointed out by one participant: “sometimes you do not worry where you can access grain because some millers stock grain for sale to their customers” (Male participant, 40 years). The stock however, warrants serious protection against weevils and other pests, which invade the stored grains. This leads to food loss and waste in terms of quality and quantity. The researcher asked respondents to mention what they ate within the last seven days. The results are shown in table 6.1 below.

Table 6.1 Foods Taken Within the Last Seven Days

Type of food	Frequency	Percentage
Porridge(maize/sorghum)	355	96.1
Maize (ugali/chiyoyo)	377	100.0
Rice	234	62.1
Lemons /Mangoes/Pineapple	13	6.5
Bananas	200	53.1
Bread	1	0.3
Meat (chicken/cow/goat/sheep/pig)	79	20.9
Sweet potatoes(irish/nduma)	102	27.1
Fish	15	4.0
Groundnuts dried	49	13.0
Vegetables	377	100.0
Milk products	158	41.9
Beans	41	10.9

Analysis in Table 6.1 above indicates that all (377, 100%) respondents took maize in form of ugali or chiyoyo (boiled maize grains) within the last seven days, 234 (62.2%) took rice, 200(53.1%) took bananas, 155(41.9%) took milk products, 155(41.1%) took sorghum/porridge, 377(100%) took vegetables, 102(27.1%) took sweet potatoes (irish/nduma), 49(13.0%) took dried groundnuts, 45(11.9) took meat (cow, goat, sheep, pig and chicken), 41(10.9%) took beans.

Other households reduced the number of people eating in the house. For example, a key informant said that they reduced the number of relatives in the household by not allowing many of them visit and stay in the household as well as selling livestock to purchase

food. Towards harvesting period, most households are maize grains deficient. They increased consumption of cassava and other roots and tubers. This is a time when rural households change the tradition of maize consumption and compensate with other food items such as rice for maize. Other foods consumed in the study area included; bananas, legumes, tubers, milk, eggs, beans and other cereals.

Despite Gucha sub-county being among the rich banana producing sub-counties in Kisii County, and banana being the fourth most widely consumed crop after maize, rice, and wheat (Rarieya and Schmidt, 2009), its uptake as food was low compared to maize (ugali). In a focus group discussion, the researcher wanted to know the reason for this low uptake. One participant said that: " we consume bananas as snack, even after eating bananas, one expects to eat ugali every time…in the evenings, members of the household will always demand ugali in the evening before they sleep, even if there is cooked bananas" (IS: Male respondent, 46 years).

From the researcher's observation, such habits lead to food loss and waste, especially in cases where both maize and bananas are cooked at the same time, remnants or inedible food is disposed. It was also discussed that at the start of the season, there is plenty of maize harvested and members of the household are not keen to reduce food portions. Therefore, a lot of ugali is cooked and eaten, thus, overconsumption and the end result is food wastage. However, one participant said that: "leftover ugali is used by household members in the morning as a snack with tea or porridge" (FGD: Female participant, 36 years). The hard outer covers of leftovers are peeled and household members consume the soft part.

Despite the above assertion, the researcher observed that in times of plenty, household members receive excessive food ratio for consumption hence, food waste. Additionally, the peeled parts of food remnants are not eaten, thus, food loss and wastage. With regard to this, respondents were asked to indicate the number of meals they took on daily basis. This is summarized in Table 6.2 below.

Table 6.2 Number of Meals Taken on Daily basis by a Household

Category	Frequency	Percentage
One	30	8.0
Two	271	71.9
Three	74	19.6
More than three	2	0.5

Analysis in Table 6.2 above found that, majority (271, 71.9%) of the respondents indicated that they took two meals a day, 74 (19.6%) took three meals a day, 30 (8.0%) took one meal a day while 2 (0.5%) took more than three meals a day. To cushion hunger in the study area, most respondents reduced the number of meals they took in a day (maintained at two meals a day). In the study area, the day typically starts with porridge or tea and a baked sweet potato or *ugali* remains, eaten either at home or in the field during work. The researcher was interested to know what influenced household food consumption behavior as highlighted in Table 6.2 in the study area. The results are summarized in Figure 6.1 below.

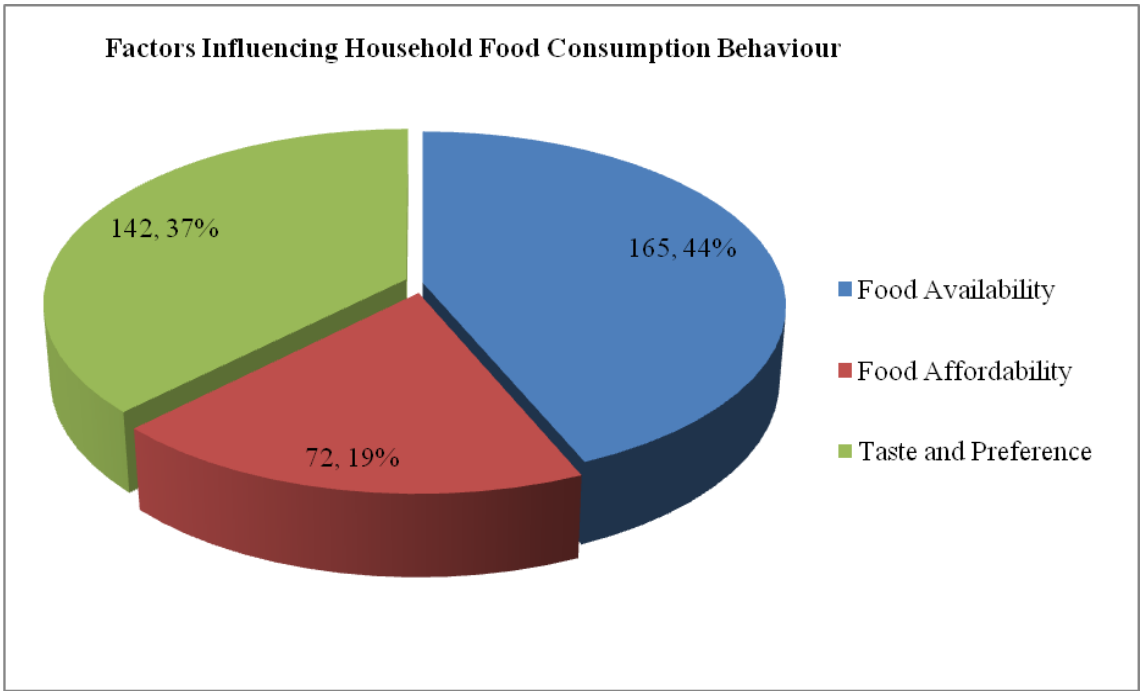


Figure 6.1: Household Food Consumption Behavior

Analysis in Figure 6.1 above indicates that 181(48%) of the respondents said that food availability was the main factor. Thirty four percent 128 (34%) mentioned food affordability as the main influence of what household consumed. Eighteen percent 68(18%) of the respondents said that their household food consumption behavior was determined by food tastes and preferences. In this study food availability or accessibility means the amount of maize produced by smallholder farmers, which was used for consumption purposes. During key informant and focus group discussions, it was observed that higher income households have had a greater access to enough maize for consumption along with a greater purchasing power to access such foods than poorer households.

From the above analysis, it is clear that 34% of the respondents mentioned food affordability as the main determinant of consumption behavior. According to this study, food affordability is the capacity of the household to access enough food either through purchase or exchange to ensure its household members access it for consumption. However, it was noted in a focus group discussion by one participant that: “due to low income in most households here in Boochi sub-location, we have reduced the amount of food we exchange or share with neighbors and relatives” (Female participant, 64 years). This finding shows that in the contemporary, households are experiencing weakened communal ties, rendering people not to engage in food sharing practices. The researcher got similar responses from other sub-locations.

As highlighted above, only eighteen percent of the respondents were influenced by tastes and preferences on maize products to consume. In this study, food tastes and preferences refer to the household food choices and eating habits people adopt. According to the discussants, food tastes and preferences were largely determined by the kind of foods and accompaniments available for consumption and value attached to such food. The above findings are in concurrence with a study in South Africa by (Viljoen, 1996), which found out that food consumption patterns are determined by food eating habits and food preferences made by households. Additionally, Hoddinott (2012) shared that social norms regarding foods and who should consume them, and different levels of understanding of what foods to consume and in what quantities.

The research was interested in finding out how social factors influence food consumption patterns among respondents in the study area. Out of 377 respondents, 294 (78%) of them were influenced by household type, 266(69%) were influenced by family lifestyles,

211(56%) were influenced by individual behaviors and perceptions of and expectations towards foods, whereas 190 (48%) were influenced by smallholder farmers' lack of awareness on what to consume at particular times of the day. On individual's behavior, it was shared that eating and the perceptions of respondents' consumption behavior were critical factors influencing food loss and waste in the study area. For instance, on household type, large households were forced to cook a lot of food in the house because all members must get satisfied and some food must remain on the plate. A key informant said that: "once the food cooked is eaten, it should remain as a sign of satisfaction, if it does not remain especially for the case of children it is believed that the children are not satisfied" (KI: Male informant, 46 years). The above findings relates well with Albisu (2016) who found out that food waste results from consumer's social behavior. This include; cooking loss, plate waste and sharing of cooked food with friends and neighbors. Therefore, this study maintains that households' social behavior influences the amount of food lost or wasted. However, this aspect is widely ignored by most food security interventionists and studies.

Still on households' social behavior, the study further revealed that to some households, satisfaction among children was measured through observation of the stomach or belly of the child. A key informant shared that: "If the belly of a child protrudes to a certain level as per the observant's knowledge, then the child is satisfied" (KI: Male informant, 54 years). This is one of the reasons children are encouraged to continue eating as much food as possible thus, food wastage. As shared by a participant:

> Some children are tricky and they want to show you that they can finish eating all *ugali* in the plate. Once their stomachs are full and they want to continue with eating, some of them hide behind the houses to vomit, and then come back to continue with eating the remaining *ugali* (FGD: Female participant, 48 years).

The study also observed that smallholder farmers neglect this behavior, and give it attention on its effects on food loss and wastage. Resonating on similar sentiments, Lipinski (2013) recognized that food loss and waste is generally associated with behavior such as negligence and unconscious decisions, which eventually affect household food handling and management decisions.

Discussants also shared that culture dictates that bulky food should be cooked since at any given point in time, a visitor will arrive. Giving food to a visitor is a source of blessing to the household, a way of creating more friends and expanding social networks. Guansheng (2015) confirms the above findings by reporting that in Chinese society, households/people usually treat visitors with meals in order to make new friends and enhance established social relationships. One participant said that: *"*even if a visitor tells you that I am satisfied, he/she must be served with some meal*"* (FGD: Male participant, 39 years). To some households again, a visitor is given some food to take for his/her children, thus, reducing the amount of food remaining in the household. Additionally, a man in the household should not complain about the amount of food prepared in the household, this implicates him as lazy or selfish. This is the reason why rationing the amount of food to be cooked in the study area is not taken into consideration especially when there is plenty of maize. This has a direct impact to food loss and waste within the household.

From the above findings, it is the observation of the study therefore, that smallholder farmers are not willing to lose or waste food-resources, but are rather influenced by accultured social behavior from senior members of the household. This is supported by findings of Evans (2012) in his ethnographic studies in the U.K that consumers do not

carelessly loose or waste food, but rather, it is the socially-determined practices in food choices, eating habits and eating patterns in which food consumption is embedded. Similarly, in the USA, Neff et al. (2015) found out that food loss and wastes of 31% to 40% of its post-harvest food supply is highly experienced at consumer level. This is based on consumers' social behavior in food-resource handling processes. Overall, this momentously impacts consumers' loss and wastage of food-resources in the household.

One of the important aspects observed in the study area was meal serving procedures. For instance, members of the household do not serve themselves, but rather the wife or the mother of the household knows how much food to serve to each member including visitors. It was pointed out that every time, the wife or mother assumes that a member of the household consumes the same amount of food holding all factors constant. However, this is not the case because the amount of food consumed by a member of the household may differ at different times.

The above situation is attributed to factors such as type of work engaged in a day, health conditions of an individual and type of meal cooked and with which accompaniment, for example, what is accompanying *ugali* during supper time. As shared by one participant: "during ceremonies in the neighborhood, members of the household usually feed in those ceremonies, and when they come back home, they are required to feed again" (FGD: Male participant, 45 years). This is a clear manifestation of food waste, since junks of food in the household will remain unconsumed, hence thrown away when not used.

One of the aspects that led to food loss and waste in the study area is when porridge (*erongori*) is cooked for all, but it is rarely introduced as a 'desirable' food for adults, but only to the young. *Erongori* is prepared from fermented maize flour as a beverage for

human consumption mostly for breakfast. It was cheap and easier to prepare for a bigger group. According to one respondent: "*erongori* is easy to make and takes just about 10-15 minutes to cook and serve" for young children, adolescent, nursing mother and those who are sick and *erongori* was preferred because of its high nutritional value. *Erongori* was also used especially during household communal labour activities.

One of the respondents confirmed that: "whether we have enough porridge or not for all members of the household, *ugali* must be cooked for all" (IS: Male respondent, 48 years). Therefore, a lot of food and porridge is cooked, but not all is consumed, thus, food wastage. It was shared by participants in the focus group discussions that there are times in the season when all household members are forced to drink porridge, even if *erongori* is usually prepared for children. This is the time when almost every household in the study area is faced with chronic maize shortage and households are forced to resort to preparing porridge out of maize for breakfast and lunch for all family members including adults who earlier on avoided it. This was aimed at minimizing cost of food purchase as maize porridge is cheap and easier to prepare.

In Gucha Sub-County, availability of food-resources is challenged by household financial constraints, and this led to inability of smallholder farmers to procure adequate food for consumption. The researcher was interested in understanding respondents' social behavior in times of maize shortage. The study found that 72% of household women took fewer meals during periods of food shortage, whereas the percentage of husbands, other family members and children was 10%, 12% and 6%, respectively.

The women interviewed during the study lamented that the husband other senior male members of the family were given first priority, while the children and other family

members were given second priority in meal distribution. The above findings compares well with studies conducted in India and Indonesia on household food consumption behavior during shortage of food, which found out that 80% of rural women took a smaller number of meals during periods of food shortage, whereas the percentage of husbands, other family members and children was 6%, 11% and 3%, respectively (Zhou, 2013).

Food borrowing was also allowed among households. In times of maize shortage, some members of the household depended on borrowing and/or sharing the little maize they have. As confirmed by one of the key informants: "some of us do not harvest enough for our families and therefore, depend on our friends and neighbors in sharing food items, whatever little we get is utilized by all members of the household, however it is a belief that a man should consume a bigger share of food than the rest of the members" (KI: Male informant, 54 years). The finding above indicates that smallholder farmers in the study area managed their lives by adopting various communal strategies such as food sharing ('egieseri') as a social safety net. In this study, a social safety net refers to the collective intra and inter-household assistance or support members of the households receive to address their food needs.

The general consensus among participants in different interview discussions was that consumption trends change once people harvest their maize grains. Some respondents also said that they were forced to sell assets in the house to meet their consumption needs. The researcher observed that household assets are measures of household resilience, which cushions the effect of adverse circumstances, such as crop failure or on household food insecurity. Household assets include livestock, machineries and land

which could be sold, if need be, so as to purchase food used in feeding the households in times of adversity. As Kang'ara et al. (2001) noted livestock are considered a means of security and means of coping during crop failure and other calamities.

Despite the existence of food sharing practice for decades, it is not rampant today because of increased individualism and scarcity of resources among households. As such, farming households are forced to make decisions on how to mitigate the problem of little food harvested and dietary needs by practicing reciprocity. These findings are confirmed by Morton et al. (2008) who observed that reciprocal non-market exchanges of food as will be extrapolated late in the chapter, occur frequently among smallholder farmers and influences how households access food for consumption. However, the practice has deteriorated over time.

As mentioned earlier in the study, reciprocity is one of the main strategies employed by rural farming households to ensure food availability. In this study, reciprocity is a non-economic mechanism that is used to provide food-resources to those who are unable to fully participate in their food needs at a given time. As asserted by Lomnitz (2002), households create adaptive mechanisms to counter food harvesting deficits and the shortcomings of market systems, and the farming households in Gucha sub-county are no exception. The researcher observed that smallholder farming households in the study area, sharing of food-resources are done at household level rather than communally.

The informal systems used by households in accessing food are currently fading away because of economic challenges experienced by majority of households in the study area. This has forced many smallholder farmers to work independently thus, moving away from collectivity. One participant narrated that: "Nowadays it is not easier to share food

like before (old times), because people are faced with many economic challenges such as scarcity of land for farming and inadequate income" (FGD: Male participant, 45 years). Additionally, some households have taken advantage of intimate bonds and reciprocity and do not work hard in their own farms, hoping that they will be considered by those who have plenty. This has reduced the willingness of people to help in times of need.

The levels of awareness and knowledge about food loss and waste are two important aspects important in addressing food security in Gucha Sub-County. When respondents were asked whether they know that food loss and waste occurred in the households, all respondents unanimously agreed that sometimes in the process of handling maize grains, some loss or waste is experienced. Respondents acknowledged having the knowledge on how to reduce food loss and waste during consumption in the household. In describing their knowledge about how to reduce the amount of food they lost or wasted, 51% described themselves as very knowledgeable and 49% described themselves as fairly knowledgeable.

Eight six percent (86%) of the respondents indicated they had received or heard information about food lost or wasted from various sources as those indicated in chapter four on sources of agronomic information, while 14% sought information on food loss and waste. On whether respondents used this information in reducing food loss and waste within their households, majority (70%) of the respondents did not use the information they have. For example, it was shared that in most cases when there is plenty of food particularly during harvesting season, respondents are not keen to avoid food loss and waste until they become food deficient.

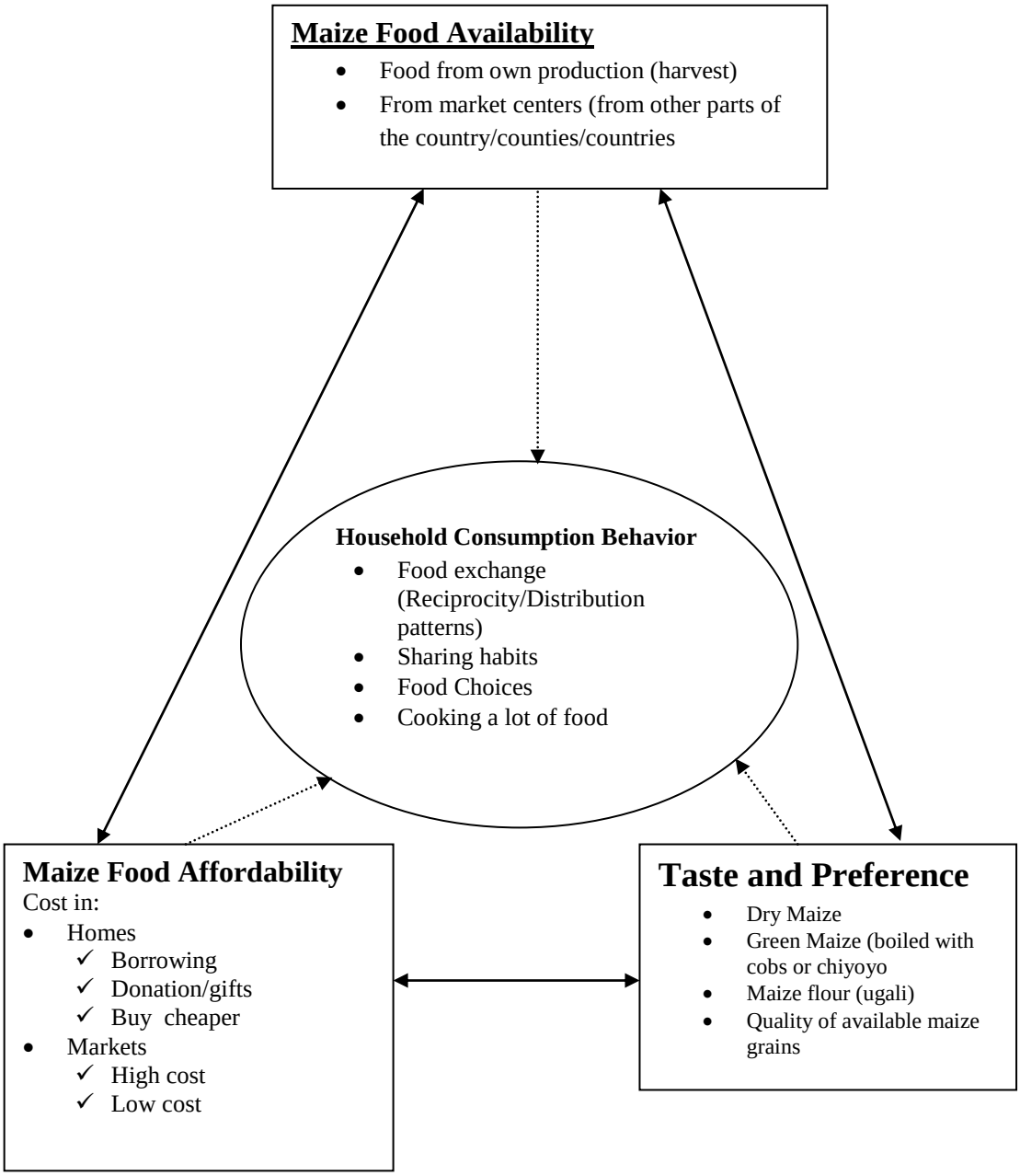
As well, household and individual social behavior and perception of expectations towards food affect the food-resource handling processes at the household level. For example, when food is plenty, households do not exercise meal planning activities, but rather become reactional on food consumption. It was shared by discussants in a focus group discussion that, a household can cook food at anytime and any amount without considering the number of people in the household at a given time and their food needs. The eventual result is more food is cooked and ends up being lost or wasted.

More often than not, households base their justification on the social norms, beliefs and customs on food consumption, which affect meal planning processes. Respondents were asked how much it bothered them to throw out food because it was not eaten, Eight two percent (82%) reported that food loss and waste bothered them a lot, while18% reported that they were not bothered at all. From the above analysis, majority were really bothered on food loss and waste, however some of them were not in control because of culture demands cooking a lot of food, which will go to loss or waste. Additionally, it was shared in the focus group discussion that sometimes food is lost or wasted based on how it is handled over the season from the storage facility to consumption. This study observes that maize loss and waste while handling it from store over the season are not always accounted, but assumed as minimal.

During a key informant interview, it was shared some households tend to underestimate food loss and waste at consumption level. This is the reason why not much is done to reduce the loss and waste. As construed by Lebersoger and Schneider (2011), this is true whether in a developed or developing country, since consumers generally underestimate their own food loss or waste and eventually turns to be a chronic problem.

As discussed early in the chapter, cooking a lot of food and ensuring that there are remnants for a visitor who may arrive at anytime or for later use, is a culturally recognized behavior in Gusii community. This is confirmed by Barr, (2007) that social norms people are accultured to play a paramount role in shaping attitudes towards household food-resource handling and management. Besides, due to the complexity of social behavior that may affect the amount and likelihood of food loss and waste in the household, the anticipation of food loss and waste does not constitute an easy task (Quested et al. 2013). As pointed out by Graham-Rowe et al. (2015), actions aimed at reducing food waste at household are characterized by low efficiency, if they do not concern key psychological and social mechanisms, constituting the basis for motivation for reducing food waste in the household.

In the forgoing discussion, overall food loss and waste at consumption stage in the household is mainly driven by social factors, including habits of food preparation, serving and consumption. Additionally, household food consumption habits and perceptions are largely shaped by household members' upbringing, social and cultural background. All these factors are moderated by the social environment created by households themselves. The study observed that understanding the extent to which smallholder farmers are actually knowledgeable can help to inform whether interventions ought to be implemented in reducing more food losses and waste. This chapter concludes with conceptual framework, which illustrates interactions of main variables influencing household food consumption behavior in the study area. This is illustrated in Figure 6.1 below.



Source: Author, 2017

Figure 6.2: Food Consumption Among Smallholder Farmers

Figure 6.2 above indicates that food consumption behavior among smallholder farmers is an outcome of many variables including; food availability/access, food affordability and food tastes and preference. These variables are influenced by household's social behavior. Food availability/access, affordability and taste and preference are moderated

by the household consumption behavior. Food availability or accessibility in this study means the amount of food produced by smallholder farmers, whereas, food affordability means the capacity of the household to access enough food either through purchase or exchange for its members for consumption. As shown in Figure 6.1 above, maize Affordability is determined by cost in homes through borrowing, donation or gifts, buying at cheaper prices at home or buying at high or low cost in the market.

Taste and preference refer to the household food choices people make. Some smallholder farmers, prefer dry Maize, which they can grind and cook *ugali* of prepare porridge, other preferred green maize for boiling with cobs or as chiyoyo. Above all, quality of maize grains was a major determinant for taste and preference in the study area. The study shared that because of low income among smallholder farmers in the study area, they experience minimal food exchanges because of loose communal ties in recent times. This is because of reduced bonded social relationships and food prices playing a significant role in determining the amount of food purchased, shared and eaten in the households. Food tastes and preference are determined by the kind of foods available for consumption.

The above framework observes that household food consumption behavior is important in determining food availability/access, affordability and tastes and preferences in the study area. As discussed in the study, food availability or affordability significantly influence the general food exchange processes in the study area. This consists of the amount of food harvested, processing and distribution. A smallholder farmer's access to capital, marketing opportunities and production choices will influence food availability, affordability, tastes and preferences. Additionally the economic status of a household

influences its general food security, its purchasing power as well as their food choices in a particular household.

The study observed that higher income households have a greater access and purchasing power to enough food for consumption than poorer households. From the above framework the household consumption environment also determines what household consumes in terms of quality and quantity. In this context, consumption environment is the physical and social context in which households and individuals decisions on food consumption processes are made. This is based on questions like how rustic or inaccessible is the household? What types of varieties of maize crop grow best in a certain physical environment? Is the physical environment fertile for maize production? Is the cultural context favorable for maize production, harvesting, exchange and consumption? What are the gender and power relations as well as division of labour in relation to food consumption patterns?

The above framework suggests that household food consumption factors bear significant influence on food availability, affordability, taste and preferences. For instance, the food, which households consume in quantity and quality, the location of eating, the number of eating events, and even the composition of the persons at each eating event have changed. This is attributed to food production, processing and distribution systems including reciprocity and eating preferences. The study observed that understanding social behavior on food-resource handling within households is an important scientific and policy issue for interventionists addressing household food security.

As Duflo (2012) notes, understanding household organization, social behavior, and cultural contexts which influence decision making processes in relation to food security

are important in effective food-resource handling processes within household. This is the reason that significant food among smallholder farmers in rural areas is lost during consumption processes. Therefore, the researcher argues that there is need for a clear understanding of inter-household and intra-household dynamics in the food-resource handling processes are influenced by social and cultural context of smallholder farmers in relation to consumption patterns. Data obtained can be translated into effective policies and interventions that promote sustainable household food security. Quested et al. (2013) supports this assertion by emphasizing on better maize storage practices, appropriate portion sizes, improved food preparation, and use of leftover food in meal preparation will help curb food loss and waste. Overall, food consumption patterns in any given household are governed by the food-resource handling behavior.

6.3 Food Exchange Procedures among Smallholder Farming Households

This study defines food exchange as the process of intra and inter-household food sharing and exchange of maize products among household members. From the preceding discussions, post-harvest food resource handling is a chain of interconnected activities from the time of harvest to the delivery of the food-resource to the final user (consumer). The farming sector in Gucha Sub-County is considered one of the biggest and impoverished sectors that force households to depend on food exchange systems to survive. In this study, food exchange was one of the variables the study examined. As discussed in the previous section, there are respondents who had sold maize and those who did not have or had less and bought it from the market for consumption.

In this section, the researcher delves further in maize exchange procedures in the study area where majority (236, 62.6%) of the respondents had sold food harvested while 141

(37.4%) did not. Besides, majority (300, 79.6%) of the respondents had indicated that the family had ever bought grain while 77(20.4%) indicated that they had not. As discussed in the previous section, village traders were the main buyers of maize grains from the smallholder farmers. One of the key informants shared that:

> Because of little harvest by smallholder farmers here in Gucha Sub-County, some smallholder farmers sell the little they have to small trade brokers at the local market centres such as Ogembo, Ikoba, Mesesi, Malaba and Tabaka. This is where traders compromise prices and smallholder farmers sell a lot of maize grains at very low amount (KI: Male informant, 42 years).

The participants also explained why many people still experienced hunger despite enjoying bumper harvests. A participant in a focus group discussion said that:

> I do not know what happens after food is harvested, even after I have learnt and planned that I am not going to use food in a particular way. I just find myself using food in a different way. As a household, we just find ourselves eating more and tending towards buying other food items like fish and meat and other items we did not plan for (FGD: Male participant, 44 years).

From the above finding, it is evident that farming households in the study area sell harvest to buy other things they 'value' and in most cases at low prices (low season) hence, become food deficient. In the study area, informal market systems are dominated by local traders who are sedentary. These traders usually source maize grains from farms or from other local traders in the maize grain surplus sub-locations. They store it in their homes or shops and transport it to informal markets in the deficit areas, where they sell the grains to other traders and consumers later. This is similar to what happens in Uganda where USAID (2010) found out that 62.6% of smallholder farmers bought maize grains from the market for consumption.

Odhiambo (2016) in his inaugural lecture in the University of Eldoret, Kenya confirms that the informal market system in Kenya consist of mainly small scale traders who

operate the system by buying maize from smallholder farmers or other traders in the maize surplus areas and then move the maize to deficit areas where they sell it at some profit. This study confirmed from the respondents that the same maize smallholder farmers sold to traders is the same maize stored by traders and sold later to smallholder farmers at higher prices. One of the observations made by the researcher during field work is that smallholder farmers would sell maize to the informal market at times of plenty (harvest time) to meet some financial household obligations such as purchase of clothes, medical care and even meat. They only return to the same market later at peak season to buy maize again when they had exhausted their maize stock.

From the policy point of view, the informal marketing system blossoms despite the movement restrictions emphasizing on formal marketing systems. From the literature review, this is the reason why about 30%-50% smallholder farmers do not have easy access to NCPB market, yet, those who have access to the NCPB find the quality requirements of the board being too strict to meet in terms of maize grading and dry moisture content, hence, rely on the informal market system for their maize sale.

During the study, the researcher observed that there were respondents who neither had enough maize nor bought from the market to supplement the little they had. Respondents were asked how they managed to meet the household food deficit after the harvest. Most (63.1%) of the respondents said that they bought (‘*gotonda’)* supplementary foods from the market to take them through next season, while (36.9%) indicated that they did not buy and had specific people to go to for assistance (*ogosuma*) or borrowing during food shortages.

On the contrary, in recent times, *ogosuma* from neighbours and friends has diminished due to reduced reciprocity and increased independence in food-resources in the study area. Some respondents borrowed food items from their neighbors with a promise to return later when they harvest their own food. The borrowing of food is risky because no one knows whether the person to borrow from has enough food to lend or not. It was clear from focus group discussion that those households who did not seek for *ogosuma* and had low income, they depended on casual labour on other people's farms to raise income for purchase of food items.

Some smallholder farmers reported that they were tempted to sell bananas in order to buy maize grains. However, due to high price of maize, the amount of bananas sold are more than maize grains bought, hence food loss on the side of bananas. Whereas, other smallholder farmers reported that they could sell their livestock and other assets like trees to buy maize grains. The above scenario is an indication that that most respondents (76.5%) in Gucha Sub-County buy food. This means that even the social support systems such as reciprocity or food assistance do not offer adequate support to other household members. The question that arises is whether smallholder farmers are able to pay or buy enough or not?

As earlier noted in the food consumption variable, households place much value on maize/ugali or '*chiyoyo*' than bananas due to smallholder farmers' financial insecurity in the study area. The purchase of maize mostly occurred when smallholder farmers, who planted tea had been paid tea bonuses by Kenya Tea Development Authority (KTDA) during mid-year (June) and end year (November). It was noted that smallholder farmers have to weigh food purchase against meeting other needs such as clothing and school fees

for their children. This is an indication that some households buy food, whether in times of shortage or not. The question would be, are they able to buy enough for household sustainability? And if they do, what do they buy in terms of diversity?

During interview discussions, it was shared by respondents that the amount of maize sold varies by size of maize fields, amount harvested, and food requirement of household. However, most smallholder farmers sell maize in small amounts mainly in the period 2-3 months after harvest, depending on the household's cash needs. The grain sold is neither graded nor dried to achieve low moisture content. One respondent said that: "we test the quality of maize grains by touching to feel the texture, smelling and physical outlook of the grains" (Female respondent, 40 years). This form of assessment may not help to ascertain the proper quality of maize, hence, leads to later food loss or waste. As noted earlier, selling is done at home (farm gate) or at the village markets to small traders. More often than not, smallholder farming households have no access to market information on prices and transportation costs. Therefore, they may the produce at a loss.

It was also reported that most of the smallholder farmers do not buy maize grains to store but for immediate consumption since, most of them did not have enough capital to buy plenty for storage and sell in future. In support of these findings, Engel's law states that, if the society is at subsistence level, smallholder farmers will spend proportionately more food or the poorer the smallholder farmer, the greater is the proportion of its total income devoted to provision of food. According to the respondents, if any maize grain purchased is stored, it is just waiting to be consumed soon.

In terms of amount, most smallholder farmers buy few plastic tins (*Kasuku) or (Kimbo gorogoros)* of maize for immediate use depending on their income. A gorogoro is 2kg tin

or plastic for measuring maize. Most smallholder farmers buy between two and eight *gorogoros* of maize grains, which they grind into the flour. Since most smallholder farmers earn less than KShs. 2000 in a month (refer to chapter 5), in that case, it is logical that they spent less than Kshs. 927 per adult, which is considered by the government as the food poverty line in the rural areas. From these findings, this is an indication that many of the purchases people make are in small quantities. As revealed in chapter five, most families have large family size, and as such, whatever maize produce they harvest is used for household consumption. But, because of many needs in the household, they immediately sell grains after production regardless of price on offer. One of the participants in the study narrated that:

> I inform my husband whenever I want to sell maize grains to meet certain pressing needs like buying clothes, paying school fees for children. Although my husband has never stopped me from selling maize whenever I planned to, I still inform him in the hope that he might offer to give cash to help meet other needs and therefore, rescue the maize from sale (FGD: Female participant, 47 years).

From the above finding, this however, depends largely on whether the husband has cash and whether he is willing to commit the money to other family needs. A few of the respondents who had big acreage of land (above five acres) and had not planted coffee or tea in large portions, spared some maize grains for sale, though most of them did not have direct access to market for their maize grains. This rendered them to other threats such as low prices and storage problems, hence food loss. One of the key informants narrated that:

> Smallholder farmers like me are always exploited by middlemen just after harvesting, when there is a lot of maize in place and prices are low, they do not have high value market networks in the rural areas to help them sell their produce" (KI: Male informant, 51 years).

The above findings in Gucha Sub-County are confirmed by HLPE, (2014) on smallholder farmers in Philippines are exposed to an environment vulnerable to exploitations by dominant groups such as traders and manufacturers. The study was interested in examining food exchange patterns in Gucha Sub-County the results are shown in Table 6.3 below.

Table 6.3 Household Food Exchange Patterns

Statement	Yes		No	
	F	%	F	%
Have you ever exchanged food items for other items other than food	278	73.7	99	26.3
Are the items proportionate with food items given in exchange	133	35.3	244	64.7
When the household does not have enough food resources, are the markets adequately stocked with food sources like grains that you need	114	30.2	263	69.8
When seeking the market option, are the food prices controlled by the government	97	25.7	280	74.3

As shown in Table 6.3, majority 278(73.7%) of the respondents indicated that they had exchanged food items for other items other than food, while 99(26.3%) indicated that they did not practice food exchange. Besides, majority (244, 64.7%) of the respondents indicated that the items were not proportionate with food items given in exchange. Similarly, most (263, 69.8%) of the respondents indicated that markets were not adequately stocked with maize grains they needed while 114(30.2%) indicated that they had, because they could find food items they needed for their consumption.

Moreover, 280(74.3%) of the respondents indicated that when seeking the market option, the foods prices were not controlled by the government. This means the traders determined maize prices based on demand and supply at certain times. Most 215(57%) of the respondents indicated that they had ever had credit facilities by the government to support food production in the County while 167(43%) indicated that they did not. Majority (258, 68.4%) of the respondents indicated that one could blame the government for the food deficit situation they found themselves in. this is base on the failure of the government to make available to smallholder farming inputs such as fertilizer, hybrid seeds to increase food production processes.

From the findings in Table 6.4 above, those who exchanged food items said that exchange took place between homesteads in Gucha Sub-County and happened mostly through *ogosuma*. This is where smallholder farmers embrace social distributional networks for obtaining food-resources to compensate household food deficits and due to low harvest and weak competitive market systems. Households shared that they exchanged vegetables such as pumpkin leaves, kale (sukumawiki) and beans and bananas for maize grains. However, the study observed that exchange varies across households as well as by individual household willingness to participate in mutual food exchanges.

During focus group discussions, participants shared that food exchange transcended beyond borders. One of the key informants confirmed that Luo traders still arrive in Gusiiland on donkeys loaded with salt, pots and fish in exchange for maize and beans. Apart from barter, households shared food-resources when they were in need of them. This sharing obligation, exchange of food items and hospitality were some of the main ways of establishing and maintaining relationships between households. The nature and

forms of sharing and the number of people involved were viewed as an indication of the strength and scope of one's social network. Evidently, a key informant indicated during the study that food exchange had tremendously changed over time and it had reduced its meaning, because people's needs keep on changing and have become individualistic. He remarked that:

> In the pre-colonial period, Gusii exchange took place within the homesteads, and livestock and agricultural products such as maize, sorghum, and wimbi were exchanged beyond borders. During the Nineteenth Century, regular barter between the Luo and the Gusii, conducted by mostly women, took place at periodic border markets. There was a regular and voluminous trade of grain for Luo livestock taking place at Gusii farms, however nowdays people are mainly depending on the market to sell and buy what they don't have (KI: Male informant 68 years).

In Gucha sub-county, sharing was most intense at intra-household level. The members who regularly shared food in the family comprised of those in the nuclear family, married sons and their wives who did not live on their own (*had not yet set up their own fireplace*). The Gusii say: "*omwana ohoo negete kio omogongo*" meaning that your child is your back borne. Children were also expected to share their resources with their parents. Offering financial support to parents on a timely and regular basis was one of the important ways in which children were judged. Parents and children were expected to share between themselves.

Food sharing relationships within the household gave members a sense of security. The bond between the individual and the group provided a sense of security. The fulfillment of this bond necessitated sharing within the collectivity, and that was the Gusii social safety net. A good reputation in the community was earned by giving, which also afforded one the right to draw upon the community when in need. Sharing and informal

hospitality were also very common among neighbors. Neighbors informally visited each other's houses to deliver a share of freshly harvested maize grains. As shared by one elder during a key informant interview: "a guest who imposed on the hospitality of other people and failed to reciprocate was disliked, but rarely point-blank denied food by his or her host" (KI: Male informant, 68 years).

In Gucha Sub-County, food-sharing was an indication of a high level of food supply that allowed people to display a significant degree of generosity. However, the study observed that sharing norms are changing gradually today, perhaps in part because of increasing scarcity associated with severe land shortage and individualism. Some children increasingly neglect and even decline to share food-resources with their aging parents. One respondent narrated that:

> "our daughters in-law nowadays do not easily share cash gained through trading and self-help activities with us, only a few children are willing to share food-resources with parents, this tells you how social values and customs are changing... though, the amount of food sharing extended from children to us parents is decided by the extent to which they believe that we can curse or bless them" (FGD: Male participant, 51 years)

From the above findings, due to scarcity of resources and individualism in current times, sharing norms are not taken into much consideration. The adoption of a certain household food-resource handling procedure therefore, involves individual and/or household choice making process. This is why agricultural extension institutions in the country have not adequately trained farmers to access and control their markets. It is the observation of the study that to some extent, weak institutional frameworks such as access to agricultural extension services in Gucha Sub-County limit farmers with opportunity to achieve household food security.

From the forgoing discussion, the findings and analysis in this chapter have provided a foundation to answers in regard to food consumption and exchange procedures in Gucha Sub-County. The study found out that majority of the smallholder farmers are small scale and do not harvest enough for consumption and exchange. This is because the land is densely populated and households own small pieces of land. A significant portion (40%-50%) of maize grains harvested by smallholder farmers in Gucha Sub-County were lost during post-harvest handling processes. The reasons for losses were complex and diverse as discussed in the chapter.

Smallholder farmers' household food-resource management is determined by a number of interacting aspects such as perceptions, beliefs, and attitudes, which have been under-researched by most studies. Smallholder farmers become more constructive according to their own knowledge they apply in food-resource handling processes. The culture of people and how it influences food-resource handling procedures is critical in reducing food loss and wastage among smallholder farmers. As they enter the food system, they are acculturated into the local behavior of individuals, which impact on food-resource handling procedures in different ways. Regrettably, the existing interventions by various stakeholders such as the government, and non-state agencies seem to ignore this critical social dimension, which influence food-resource handling processes.

From an anthropological view, smallholder farmers' culture, values, experiences and expectations in relation to social judgments influence food-resource handling processes. For instance, the decisions smallholder farmers make are optimal, but not necessarily the best, as long as farmers meet their livelihoods (both material and social). The crucial problem is the consumers' lack of sufficient motivation, ability and opportunity to reduce

food waste, with problems specifically in lack of knowledge, planning and prioritizing. More significant in the study was the interplay between household consumers and their social environment surrounding food loss and waste at consumption level. The social environment, which include social norms, beliefs and habits influence how individuals handle food-resources in their households. In overall, from the researcher's observation, a significant amount of maize is lost, with regard to how it is handled.

CHAPTER SEVEN

SUMMARY, CONCLUSION AND RECOMMENDATIONS

7.1 Introduction

Over the years, there have been concerted efforts by the Kenyan Government, Non-Governmental Organizations and individuals to address food insecurity through reduction of food loss and waste in Kenya. However, such efforts have failed to achieve the objectives due to inadequate local knowledge on how household food-resource handling procedures contribute to food insecurity. This has resulted to failure of many interventions initiated to address food insecurity. The International Food Research Policy Institute (IFPRI) has been running the Food Security Portal for countries since 2008. In the IFPRI portal, Kenya has been ranked as one of the developing countries facing severe food security problems. This is portrayed by a high proportion of the population (about 10 million) having no access to food in the right amounts and quality.

Despite the fact that Gucha Sub-County is endowed with both natural and human resources for agricultural production and economic development, the Sub-County has for several decades been languishing in food insecurity. Consequently, one of the limitations of improving food security is inadequate information on household food-resource handling procedure in the study area. The main research question for the study was what causes the paradox of food insecurity in a high potential rural environment? The specific objectives of the study were to analyze the influence of household's organization of agronomic activities on food security status among smallholder farming households; to examine the influence of harvesting, processing and storage procedures on household

food security; and to investigate how household food consumption patterns and food exchange processes influence food security. In this chapter, the extent to which the realization of the objectives was achieved; the summary of the key findings; and the conclusions and recommendations based on the findings have been logically derived.

7.2 Summary of the Findings

The first objective of the study was to analyze agronomic practices and food-resource handling procedures in Gucha Sub-County. Land is one of the main factors of production in any agricultural enterprise, and other factors being labour and capital. As a factor of production, whether one owns land or not, would determine the various agronomic activities practiced by the household. The study indicated that all the respondents owned land but in various forms and sizes. Of the respondents who owned land, majority (229, 52.1%) owned land between 1 and 3 acres. On the land ownership, there are those that had title deeds, others had inherited land and some especially women, owned through their husbands by entitlement as wives, while for the women respondents, land was mainly in their husbands names, but they owned by the virtue of being the wives. On meeting the land deficit, besides land ownership, several households were also engaged in land leasing to either boost their production and source of income. Twenty four (24%) percent of farmers leased land elsewhere especially from the neighboring Narok County to boost their farming activities. Besides, witchcraft practices provided impetus to some of the smallholder farmers to prefer leasing land away from home. Findings showed that majority (175, 58.4%) of the respondents used *jembe* (hoe) as a basic tool for tilling land.

Labour availability and arrangements were mainly decided and determined upon by the respective households. All of the respondents utilized their own household members as

the first source of labour with a few supplementing it by hiring. Thus, making household members to be the most reliable source of labour they depended. For households that used hired labour, whether partially (137, 36%) or fully (7, 2%), lacked enough household labour but were also able to pay for the hired labour either monetary or in kind. In summary, out of the total 144(38%) who used hired labour, 102(71%) used hired labour on crop production.

On the sources and types of maize seed, the findings pointed out that most 170(45%) of the farmers do not use hybrid seed. However 140 (37%) used both hybrid and local seed varieties for planting. The reason for not using hybrid was that, the hybrid seed was expensive for them to afford, while others relied on locally made seeds for planting. Majority of the respondents used artificial fertilizers when planting their maize. This is an indication that many smallholder farmers are now adapting fertilizer use despite the various attitudes and beliefs cited earlier in the study. The respondents who used both farmyard manure and fertilizer normally prepare their land and use manure during planting and then applied fertilizer for topdressing maize after the first weeding.

Respondents used various planting techniques. For instance, most 257(59%) of the respondents used traditional techniques, 86(23%) used modern techniques, while the remaining 44(18%) used both traditional and modern techniques. Respondents who used modern techniques during planting said that first they used lines with the help of a planting rope, dig holes, then used fertilizer and certified seeds before the holes were covered. Majority (321, 85%) of the respondents intercropped their crops in the farm and majority inter-cropped maize with maize and beans, while 75(23.3%) of respondents intercropped maize, banana and beans, whereas 54(14.3%) of the respondents

intercropped maize, millet, beans and bananas. Ideally, after the maize crops have germinated, there are several management practices that include weeding, provision of security, pruning and thinning, and application of inputs like fertilizer and guarding against pests.

Generally, the type of weeding and the persons to do weeding varied from one farm to another. The findings indicated that majority (349, 95.4%) of the respondents did weeding 1-2 times. Beyond weeding, the study also observed that 177(47%) of the respondents applied top dressing fertilizers to their maize crop. On sources of agronomic information, majority of the respondents acquired their agronomic information from informal sources that is family (92%) and friends/neighbors (82%) respectively. Besides, the respondents mostly sought information on new variety of hybrid seeds, use of fertilizers, treatment of crop diseases, new methods of farming and crop patterning.

The second objective of the study investigated how harvesting, processing, and storages practices influence household food security in Gucha Sub-county. One of the most crucial and significant factors for ensuring a successful agricultural food production among farmers, is food harvesting and storage processes, required to ensure harvested food does not go to waste or loss before consumed or sold. The study found out that before harvesting, all equipment such as granaries and transportation containers that come in contact with maize grains as it moves from the field to the homestead for storage were thoroughly cleaned prior to harvest to minimize mould and insect infestations and protect the purity of individual maize grains.

Majority (190, 50.5%) of the respondents harvested between 1-3 bags. Most 151 (75.5%) of the respondents did not harvest enough food to last up to the next season. Additionally,

majority (266, 71%) of the farmers were not satisfied with the grain harvest from their farms. For the respondents who did not harvest enough maize grains, bought supplementary foods from the market, however, again the amount of food bought dependent on the level of income. Majority (245, 65%) of the respondents indicated that food loss and waste was caused by infestation by pests in the field due to delayed harvesting and also during transportation to storage facilities without application of pesticides. Majority (330, 87.5%) of the respondents used foot/human head transporting maize to the homestead.

Overwhelmingly, 320(85%) respondents dried their grain on bare ground particularly, on grazing grounds. After drying maize grains, 80% of farmers in the study area shelled their maize grains through physical beating. Majority (195, 51.7%) experience shortfall in harvest due to poor soils. Moreover, majority (245, 65%) of food loss and waste was caused by infestation by pests in the field due to delayed harvesting. Majority (222, 58.9%) of the respondents used household labour. Majority (330, 87.5%) of the respondents use foot/human head transporting maize to the homestead and overwhelmingly, 320 (85%) respondents said that they dried their grain on bare ground particularly, on grazing grounds.

Food storage as a food-resource handling procedure is critical to farmers in minimizing losses and ensuring food security. In terms of grain storage facilities among respondents, the study found that 74% of the respondents used wooden granaries for storing maize cobs. When asked the amount of maize stored, out of 377 respondents, 51(25.1%) stored between 1 to 3 bags. Cumulatively, for the 64% of the respondents who stored maize grains, the study found out that within a month of storage, they had exhausted the stock

through consumption and also sale. This scenario is an indication that most respondents (76.5%) in Gucha Sub-County buy food, meaning that the social support systems do not give adequate support to other household members.

In terms of storage facilities, 170 (45%) of smallholder farmers stored their maize grains in the granary. Besides, the findings revealed that the maize available for consumption is also not fit for human consumption. The second highest grain loss occurred during drying process at 80 (21%). From the findings of the study, food loss during storage, vary considerably between knowledgeable farmers who were reported at 121 (28%). Lastly, the study indicated that most 140 (37%) of the grain loss occurred during transportation from the farm to homestead.

The third objective of the study was to examine the household food consumption patterns and exchange processes and food security status of rural households in Gucha Sub-County. From an anthropological understanding, culture in rural Gucha Sub-County, dictates how households consume and exchange food items. The findings revealed that an equal proportion of men and women (that is 50%) indicated *ugali* (prepared from maize flour) as their main food. Majority (271, 71.9%) of the respondents indicated that they took two meals a day. Majority 290(76.9%) of the respondents had taken maize/ugali within the last seven days. Rural farmers in the study area managed their lives by adopting various communal strategies such as food sharing and exchange.

In terms of food exchange patterns, majority (236, 62.6%) of the respondents indicated that the family had ever sold food harvested and another majority (300, 79.6%) of the respondents had bought grain. Most (68%) of the respondents do not sell their grains and other cereals to traders because they harvest very little for their consumption. Majority

278(73.7%) of the respondents had exchanged food items for other items other than food. However, majority (244, 64.7%) of the respondents indicated that the harvest were not proportionate with food items given in exchange since it is not easy to measure the exact quantity as required. Similarly, majority (263, 69.8%) of the respondents indicated that markets were not adequately stocked with maize grains that they needed. Majority (280, 74.3%) of the respondents pointed out that when seeking the market option, the food prices were not controlled by the government, hence, unreliable.

Overall, findings from the study further revealed farmers in the study area are smallholder and therefore, may not harvest enough for their households for consumption and exchange. Much of the grains and other cereals harvested by smallholder farmers in Gucha Sub-County were lost during post-harvest procedures. In socio-economic sense, food purchases are generally seen as more expensive alternatives. Besides, a household can leverage on its social networks to augment its livelihood and also as a coping mechanism when grappling with diverse food shocks. As a coping mechanism, the study found that majority (166, 63.3%) of the respondents reared indigenous animals such as goats, sheep and cows, which were sold to meet household food needs including clothing.

7.3 Conclusions

With regard to the specific objectives of the study, household food-resource handling procedures are the main contributors of food loss and waste along the production chain, which directly negate food security status of smallholder farmers. The study found that food-resources are lost at each level of the food production chain.

It was evident from the study that the main characteristics of agricultural production systems of rural farmers are simple, old technologies, low returns and high seasonal

labour fluctuations. The study found that farmers' food-resource handling processes and management techniques are determined by a number of interacting variables such as social cultural behavior, which have been under-researched by most studies. The study concludes that food loss and waste along the food production chain often result from inter-related causes ranging from poor technology, stressful environments, and to a larger extent irrational social cultural behavior of smallholder farmers. People's food-resource handling procedures are greatly influenced by their social behavior. Therefore, food-resources should be understood within the context of the social and cultural values in which they occur, and how they impact on the overall food security status of households.

At the institutional level, the importance and extent of post-harvest losses seem not to have been fully recognized, and if recognized, are not yet adequately acted upon. Effective food-resource handling in agronomic, pre-harvest, harvest and post-harvest management can contribute to conservation of scarce resources utilized in the production process. This can minimize the need to produce more food to cover the loss and wastage due to inappropriate post-harvest technologies and strategies.

As highlighted in chapters four, five and six, food losses are interlinked and complex, but the primary driver is food-resource handling procedures during agronomic practices. This means that in the study area, food loss arises from land preparation strategies to pre-harvesting techniques, and this is influenced by social and cultural conditions such as different productive and social roles that men and women play at different levels of agronomic practices in the value chain are often the underlying causes of food loss.

With regard to study assumptions, the findings show that smallholder farming households in Gucha Sub-County indulge in various food-resource handling practices in pursuit of

food security. This is pegged on the belief that individual households and communal institutions become more systematic and logically elaborate according to the general, analytical and calculable principles. This means that when smallholder farmers are confronted with several alternatives of a solution to a problem, they have to weigh all the available alternatives on the basis of costs and benefits of each alternative before making a decision. As a result, the decision made is assumed to be practical that it enables the smallholder farmers in the study area to choose the alternative that maximizes on benefits and minimizes costs. Therefore, means are reached by a systematic study of all relevant information and that the decision made is optimal and not necessarily the best. Consequently, findings in chapters four, five and six have proved hypothesis of the study, which stated that: "There is a relationship between household food-resource handling procedures and food security in Gucha Sub-County."

There are also a number of theoretical implications in regard to the findings and analysis in chapter five. From an anthropological view, smallholder farmers' culture, values, experiences and expectations in relation to social judgments influence food-resource handling processes. For instance, the decisions smallholder farmers make are optimal, but not necessarily the best, as long as farmers meet their livelihoods (both material and social). The critical problem is that households lack sufficient motivation, ability and opportunity to reduce food loss and waste, with problems specifically in lack of knowledge in planning and prioritizing. More significant in the study was the interplay between household consumption behavior and the social environment surrounding food loss and waste at this level.

The study observes that, to achieve household food security in the Gucha Sub-County and beyond, there is need to shift the dialogue from increasing farm production towards improving household food-resource handling practices along the food production chain with an emphasis on changing and influencing people's social behavior towards improved farm management practices. In Kenya, evidence from this study points to need of a policy shift and focus on household behaviour as a critical attribute in explaining food availability.

7.4 Recommendations

7.4.1 Recommendation for the Study

For smallholder farmers to attain food security, the study recommends that:

i. There is need for maize production stakeholders to focus on the whole food production chain right from agronomic practices to consumption and exchange with an aim of addressing food loss and waste.

ii. Smallholder farmers' awareness campaigns should be increased to provide knowledge and awareness on appropriate food type, food preparation, meal planning, leftovers usage and food discard behaviour. The findings provide evidence that once households are aware of the value of their losses, then there is commitment to handle food-resources better.

iii. At policy level, shift towards understanding household social cultural behavior in relation to food-resource handling procedures, and its influence on household food availability

7.4.2 Recommendation for Further Research

Arising from the study, the researcher wishes to observe that there is still potential for further research as an outcome of this study. With this regard, the researcher recommended that:

i. More research needs to be conducted on how indigenous knowledge or local knowledge influence household food security among smallholder farmers in rural Kenya.

ii. More research is needed on the relationship between agricultural extension officers and smallholder farmers in addressing food security.

iii. More research on participatory action in smallholder farming and its influence on household food security is needed.

iv. More research is needed on the relationship between socio-cultural factors and agronomic and pre-harvesting phases on food loss and waste, which is largely ignored by researchers and development agents.

REFERENCES

Abass, A.B., Ndunguru, G., Mamiro, P., Alenkhe, B., Mlingi, N., Bekunda, M. (2014). Post- Harvest Food Losses in a Maize-Based Farming System of Semi-arid Savannah Area of Tanzania. *J. Stored Prod. Res*. 57:49–57. doi:10.1016/j.jspr.2013.12.004.

Abedin, M., Rahman, M., Mia, M., Rahman, K. (2012). In-store Losses of Rice and Ways of Reducing such Losses at Farmers' Level: An Assessment in Selected Regions of Bangladesh. *J. Bangladesh Agric. Univ.*, 10, 133–144.

African Union (AU). (2014). Malabo Declaration on Accelerated Agricultural Growth and Transformation for Shared Prosperity and Improved Livelihoods, Doc.

Assembly/AU/2(XXIII).https://ofwlaw.files.wordpress.com/2014/07/au-malabo-declaration-june-2014.pdf.

AFDB. (2012). Highlights of the food security situation in Africa: *Quarterly Bulletin*, Issue 3

APHILIS. (2014). *In Post Harvest Loss: A Factor in Food Security*. Retrieved from http://www.aphlis.net/

Alavi, H. R., Tenas, A., Kopicki, R, Shepherd, A.W, Clarete, R. (2012). *Trusting Trade and The Private Sector for Food Security in Southeast Asia*; World Bank Publications: Washington, DC, USA.

Alwang, J. & Siegel, P., B. (1999). Labour shortages on small landholdings in Malawi: Implications for policy reforms. *World Dev.* 27: 1461–1474.

Ariga, J. M., Jayne, T. S., and Nyoro, J. K. (2006). Factors Driving the Growth in Fertilizer Application.

Aschemann-Witzel, J., de Hooge, I., Amani, P., Bech-Larsen, T. & Oostindjer, M. (2015). Consumer-related food waste: causes and potential for action. *Sustainability*, 7 (6): 6457-6477.

Ayieko, M.W. & Tschirley D. L. (2009). Enhancing Access and Utilization of Quality Seed for Improved Food Security in Kenya. Tegemeo Institute of Agricultural Policy and Development, Nairobi, Kenya.

Bala, B. K., Haque, M. A, Hossain, A, & Majumdar, S. (2010). Post Harvest Loss and Technical Efficiency of Rice, Wheat and Maize Production System: Assessment and Measures for Strengthening Food Security. Bangladesh Agricultural University; Mymensingh, Bangladesh.

Barasa, T. (2010). A Review of Kenya's Food Security and Nutrition Policy. Restech Workshop Proceedings, Kisumu 21st June 2010.

Barr, S. (2007). Factors influencing environmental attitudes and behaviors: A UK case study of household waste management. *Environ. Behav:* 39, 435–473.

BSR. (2011). Waste Not, Want Not: An Overview of Food Waste:

https://www.bsr.org/reports/BSR_Waste_Not_Want_Not_An_Overview_Food_Waste.

Botchway, F. (2011). Juju, Magic and Witchcraft in African Soccer: Myth or Reality? www.ghanaweb.com/Ghanahomepage.php-

Boxall, R. (2002). Damage and loss caused by the larger grain borer Prostephanus truncatus. *Integr. Pest Manag. Rev*. 7, 105–121.

Burns, C. (2004). *A review of the literature describing the link between poverty, Food Insecurity and Obesity with Specific Reference to Australia*. Victorian Health Promotion Foundation.

Buzby, J. C. & Hyman, J. (2012). Total and per capita value of food loss in the United States. *Food Policy*, 37 (5): 561-570.

Cappellini, B., & Parsons, E. (2012). Practising Thrift at Dinnertime: Mealtime Leftovers,

Sacrifice and Family Membership. *Sociol. Rev., 60*, 121–134.

Chinsinga, B. (2008). Exploring the Politics of Land Reforms in Malawi: A Case Study of the Community Based Rural Land Development Programme (CBRLDP); University of Manchester: Manchester, UK.

Damisa M. A. & Yohann, M. (2007). Role of rural women in Farm management Decision

Making Process: Ordered probit analysis. *World Journal of Agricultural Sciences*, 3(4): 543-6.

De Castro, J. M. (1997). Socio-cultural Determinants of Meal Size and Frequency. *British Journal of Nutrition* Apr; 77 Suppl 1:S39-54; discussion S54-5. Review.

De Groote, H. (2013). Effectiveness of Hermetic Systems in Controlling Maize Storage Pests in Kenya. J. *Stored Prod*. Res. 53:27–36.

De Irala-Estevez, J. (2000). A Systematic Review of Socioeconomic Differences in Food Habits in Europe: Consumption of Fruit and Vegetables. *European Journal of Clinical Nutrition* 54: 706-714.

Denscombe, M. (1998). *The Good Research Guide: For Small-scale Social Research Projects*. Buckingham: Open University Press.

Dibsdall L. A. (2003). Low-income Consumers' Attitudes and Behaviour towards Access, Availability and Motivation to Eat Fruit and Vegetables. *Public Health Nutrition* 6(2):159-68.

Dietz, T. (2013). Comparing the agricultural performance of Africa and Southeast Asia over the last fifty years. In: Berendsen, B., Dietz T., Schulte Nordholt H. & Van der Veen R (2013). Asian Tigers, African Lions. Comparing the Development Performance of Southeast Asia and Africa. African Dynamics, Vol.12 Leiden: Brill, 85-128.

Drewnowski, A. & Spencer S., E. (2004). *Poverty and obesity: the role of energy density and energy costs. American Journal of Clinical Nutrition*, 79:6 (16).

Drinkwater, M. & McEwan, M. (1992). Household Food Security and Environmental Sustainability in Farming Systems Research: Developing Sustainable Livelihoods. Paper presented to the Adaptive Planning Research Team Bi-annual Review Meeting, Mangu, Zambia, 13-16. April 1992.

Dunlap, R. E., van Liere, K. D., Mertig, A. G., Jones, R., E. (2000). Measuring endorsement of the new ecological paradigm: *A revised NEP scale*. *J. Soc.* 56: 425–442.

EAC. (2011). EAC *Food Security Action Plan* (2011–2015) Nairobi, Kenya: EAC Secretariat, Arusha, Tanzania.

Economic Report on Africa (ERA). (2009). *Developing Agriculture through Regionally Integrated Value Chains*, United Nations Economic Commission for Africa, Addis Ababa.

Evans, D. (2011). Blaming the consumer-Once again: The social and material contexts of Everyday. Food waste practices in some English households. *Crit. Public Health*, 21: 429-440.

FAO. (2009). *Crop prospects and food situation*. Rome, Italy

FAO. (2002). *The State of Food Insecurity in the World*. Rome, Italy

FAO. (2012). *The State of Food Security in the World*. Rome, Italy

FAO. (2015). *The State of Food Insecurity in the World*. Rome, Italy

FAO. (2014). *Food and Agriculture Organization of United Nations. Global Initiative on Food Losses and Waste Reduction*; FAO: Rome, Italy.

FAO. (2016). *Food and Agriculture Key to Achieving the 2030 Agenda for Sustainable Development*. Rome, Italy.

FAO. (2016). "*FAO and Messe Düsseldorf lead the SAVE FOOD-Global Initiative on Food Loss and Waste Reduction*. Rome, Italy.

FAO, WFP and IFAD. (2012). *The State of Food Insecurity in the World. Economic Growth Is Necessary but not Sufficient to Accelerate Reduction of Hunger and Malnutrition*. Rome, FAO.

FAO. (2017). *National Gender Profile of Agriculture and Rural Livelihoods–Zimbabwe:* Country Gender Assessment Series. Harare. Rome, Italy.

Feunekes, G. (1998). Food choice and fat intake of adolescents and adults: associations of intakes within social networks. *Preventive Medicine* 27: 645-656.

Foresight. (2011). *The Future of Food and Farming*. Final Project Report. London, The Government Office for Science.

Florkowski, W. J., Prussia, S. E., Shewfelt, R. L. & Brueckner, B. (2009). eds. *Postharvest Handling, A systems Approach*. 2nd ed. San Diego, USA, Elsevier, Academic Press.

Garnett, L. (2013). Sustainable Intensification in Agriculture: Premises and Policies, *Science* Vol. 341 (6141): 33-34.

Gladwin, C. H. (1980). A theory of Real-life Choice: Applications to Agricultural Decision. In P. F. Bartlett (Ed.), Agricultural Decision Making: Anthropological Contributions to Rural Development (45-85). New York: Academic Press.

Gladwin, H., & Murtaugh, M. (1980). The Attentive-pre-attentive Distinction in Agricultural Decision Making. In P. F. Bartlett (Ed.), Agricultural decision making: Anthropological contributions to rural development (115-135). New York: Academic Press.

Graham-Rowe, Ella, D. C. Jessop, & Sparks P. (2015). "Predicting Household Food Waste Reduction Using an Extended Theory of Planned Behavior." *Resources, Conservation and Recycling*, 101:194-202.

GoK. (2008). *Draft Sessional Paper of 2008 on Food Security: National Food Security and Nutrition Policy.* Nairobi: Government Printers.

GoK. (2010). *National Economic Survey*. Nairobi: Government Printers.

Gucha Sub-County Bureau of Statistics, (2014). Information centre.

GoK. (2008). Kenya Food Security and Nutrition Strategy, 2nd Draft, 2008. Government printer, Nairobi, Kenya.

GoK. (2009). National Food Security and Nutrition Survey. Government printer, Nairobi, Kenya.

GoK. (2010). The Constitution of Kenya, 2010. Government printer, Nairobi, Kenya.

Gustavsson, J., Cederberg, C., Sonesson, U., van Otterdijk, R., and Meybeck, A. (2011). *Global Food Losses and Food Waste*. Food and Agriculture Organization of the United Nations, Rome, Italy.

Guyomard, H, Darcy-Vrillon, B, Esnouf, C, Marin, M, Russel, M., & Guillou, M. (2012). *Eating*

Patterns and Food Systems: Critical Knowledge Requirements for Policy Design and Implementation. INRA, Paris; *Agriculture & Food Security:* 1:13 https://doi.org/10.1186/2048-7010-1-13.

Harrison, M, S, Coyne, T, Lee, A, Leonard, D. Lowson, S Groos, A, & Ashton, A. B. (2007).

The increasing cost of basic foods required to promote health in Queensland. *Med J Aust;* 186(1): 9-14.

Hell, K., Cardwell, K., Setamou, M., Poehling, H. M. (2000).The Influence of Storage Practices

on Aflatoxin Contamination in Maize in Four Agroecological Zones of Benin, *West Africa. J. Stored Prod. Res*., 36: 365–382.

HLPE. (2014). Food losses and waste in the context of sustainable food systems-A report by The High Level Panel of Experts on Food Security and Nutrition-June 2014. http://www.un.org/en/zerohunger/pdfs/HLPE_FLW_Report-8_EN.pdf

Hodges, R., J. (2011). Postharvest losses and waste in developed and less developed countries:

Opportunities to improve resource use. *J. Agric. Sci*, 149:37-45.

Hoddinott, J. (2012). *Agriculture, health, and nutrition: Toward conceptualizing the linkages. Reshaping Agriculture for Nutrition and Health*, ed. Washington, DC.: International Food Policy Research Institute.

Hunger J., D & Wheelen T., L. (2007). Essentials of strategic management (4th ed). Prentice Hall, New Dehli.

Haaij, S., Heselmans, M., Mangnus, E., Stravens, M., Tielens, J. (2017). *Farmers gain access to*

and control overseeds. Seed Special Winter. Stichting Vice Versa, Netherlands.

IFPRI. (2016). *2016 Global Food Policy Report*. Washington, DC: International Food Policy Research Institute.

IFPRI. (2017). *2017 Global Food Policy Report*. Washington, DC: International Food Policy Research Institute. https://doi.org.10.2499/9780896292529

IFT. (2008). Number of "Food-Insecure" People Increases Worldwide, Institute of Food *Technologists Weekly*.

ICIPE & IDRC. (2012). *Postharvest losses in Africa- analytical review and synthesis: report of Project inception workshop held at ICIPE*. Nairobi, Kenya: IDRC.

Inter-American Institute for Cooperation on Agriculture. (2013). Post-Harvest Losses in Latin America and the Caribbean: Challenges and Opportunities for Collaboration; IICA: Washington, DC, USA.

Irvine, D. (2013). "Hong Kong's mounting food waste problem." CNN. Accessible at: http://www.cnn.com/2013/01/21/world/asia/hong-kongfood-waste.

KARI. (2010). Policy Responses to food crisis in Kenya. Kenya Agricultural Research Institute. Nairobi, Kenya.

Kaminski, J., & Christiaensen, L. (2014). Post-harvest loss in sub-Saharan Africa-What do farmers say? *Glob. Food Secur, 3*, 149–158.

Kange, A. M., Cheruiyot, E. K., Ogendo, J. O., Arama, P. F., Ochola, S. O. (2014). Pre-and

Post Harvest factors affecting sorghum production among smallholder farming communities. *International Journal of Agronomy and Agricultural Research* 5(4): 40-47.

Krejcie, R.V. and Morgan, D. W (1970). Determining Sample Size for Research Activities. Educational and Psychological Measurement.

Kannan, E., Kumar, P., Vishnu, K., Abraham, H. (2013). Assessment of Pre and Post Harvest Losses of Rice and Red Gram in Karnataka. Agricultural Development and Rural Transformation Centre, Institute for Social and Economic Change; Banglore, India.

Kitinoja, L. (2013). Innovative small-scale postharvest technologies for reducing losses in horticultural crops. *Ethiop. J. Appl. Sci. Technol*: 1: 9–15.

Kumar, D & Kalita, P. (2017). Reducing Postharvest Losses during Storage of Grain Crops to Strengthen Food Security in Developing Countries *Foods* 2017, *6*(1): 8.

Lebersorger, S. & Schneider, F. (2011). Discussion on the Methodology for Determining Food

Waste in Household Waste Composition Studies. Waste Management, 31(9–10): 1924-1933

Lupton, D. (1996). *Food, The Body and The Self*. London: SAGE.

Lipinski, B., Hanson, C., Lomax, J., Kitinoja, L., Waite, R., and Searchinger, T. (2013).

Reducing Food Loss and Waste: Working Paper. Washington, DC: World Resources Institute.

Liu, J. G., Lundqvist, J., Weinberg, J., and Gustafsson, J. (2013). Food Losses and Waste in China and their implication for water and land. Environ. Sci. Technol. 47, 10137–10144. doi: 10.1021/es401426b

Liu, G. (2014). Food losses and food waste in China: a first estimate. OECD Food, Agriculture

and Fisheries Papers. No. 66. OECD Publishing (http://dx.doi.org/10.1787/5jz5sq5173lq-en).

Kader, A. A. (2002). Ed. Post-harvest Technology of Horticultural Crops. Oakland, USA,

University of California, Division of Agriculture and Natural Resources Publication.

Kader, A. A. & Rolle. R. S. (2004). *The Role of Post-harvest Management in Assuring the Quality and safety of horticultural produce*, FAO. Rome, Italy.

Kamoyo, K. Mkumbwa, S, Liversage, H, Baluwa, R. (2017). The Impact of Initial Security of Tenure on Smallholder Farmers' Household Income and Food Security: A Case Study of the Chiradzulu District in Malawi. Paper Prepared for Presentation at the "2017 World Bank Conference on Land and Poverty." The World Bank-Washington DC, March 20-24, 2017

Kareithi, A. (2011). "Magical Powerful Gor Mahia Spirit Lives Beyond the Grave" The Standard, Sunday 18th December, 2011.

Kingiri, M & Nderitu, J. (2014). Assessment of Extension and Advisory Methods and Approaches to Reach Rural Women–Examples From Kenya; MEAS Evaluation Series, University of Illinois Champgain

Lipinski, B. (2013). "Reducing Food Loss and Waste." Working Paper, Instalment of *Creating a Sustainable Food Future*. Washington, DC: World Resources Institute. Available online at http://www.worldresourcesreport.org.

Liu, G. (2013). Food security: Curb China's rising food wastage. *Nature 498(7453):* 170.

MacRae, G. (2016). Food Sovereignty and the Anthropology of Food: Ethnographic Approaches to Policy and Practice, *Anthropological Forum*, 26:3, 227-232.DOI: 10.1080/00664677.2016.1201456.

Majumder, S. Bala, B. Arshad, F.M. Haque, M. Hossain, M. (2016). Food Security Through

Increasing Technical Efficiency and Reducing Postharvest Losses of Rice Production Systems in Bangladesh. *Food Secur*. 8, 361–374.

Malinowski, B. (1922). *Argonauts of the Western Pacific: An Account of Native Enterprise and Adventure in the Archipelagos of Melanesian New Guinea*. London: Routledge and Kegan Paul.

Mintz, S. W., & Du Bois. C. M. (2002). "The Anthropology of Food and Eating." *Annual Review of Anthropology* 31: 99–119.

Morton, L.W., et al. (2008). Accessing food resources: Rural and urban patterns of giving and getting food. *Agric Hum Values*. 25: 107.

Murray, C. (2002). *Rural livelihoods: In the companion to development studies* (Edited by Desai, V and Potter, R.B.); Arnold Publishers, London and Oxford University Press Inc.

Musemwa, L. and Mushunje, A. (2012). Factors Affecting Yields of Field Crops and Land Utilisation Amongst Land Reform Beneficiaries of Mashonaland Central Province in Zimbabwe. Journal of Development and Agricultural Economics Vol. 4(4). 109-118, 26. Retrieved from http://www.academicjournals.org/JDAE

Muzangwa L, Nyari, P. Mnkeni S and Chiduza, C. (2017). Assessment of Conservation Agriculture Practices by Smallholder Farmers in the Eastern Cape Province of South Africa 1-17.

Mvumi, B., Chamboko, T., Mupindu, S., Chigovera, A. (2015). *Maize Food Analysis Cause and Solutions*. FAO, Rome, Italy.

Ntlokwana, B. (1999). Personal Communication. Senior Extension Officer, Kwa Zulu-Natal. Pietermaritzburg. Department of Agriculture and Environmental Affairs.

Neff, R. A, Spiker M.L, Truant P. L. (2015) Wasted Food: U.S. Consumers' Reported Awareness, Attitudes, and Behaviors. PLoS ONE 10(6): https://doi.org/10.1371/journal.pone. 0127881

Oerke, E., C. (2006): Crop losses to pests, *Journal of Agricultural Science*, 144(1): 31-43.

Oliveira A, Auad, A. M., Mendes, C & Frizzas M., R. (2014). Crop Losses and the Economic Impact of Insect Pests on Brazilian Agriculture C.M. Crop Protection.

Omamo, S., W. (2003). "Fertilizer Trade and Pricing in Uganda." *Agrekon*, 42(4): 310-324.

Onyancha, B., K. (2014). The Impact of Beliefs in Witchcraft and Magic on Attitudes towards Sustainable Agricultural Productivity in Gucha District, Kenya: The 8th Egerton University International Conference and Expo.

Pantenius, C. (1988). Storage Losses in Traditional Maize Granaries in Togo. *Int. J. Trop. Insect Sci. 9*, 725–735.

Pottier, J. (1990). *Anthropology of Food: The Social Dynamics of Food Security*. Cambridge, Polity Press.

Quested, T. E., Marsh, E., Sturrell, D., Parry, A., D. (2013). Spaghetti soup: the complex world of Food Waste Behaviours. Resour. *Conserv. Recycl.* 79, 43–51.

Riches, G. (1997). Hunger, Food Security and Welfare Policies: Issues and Debates in First World Societies. *Proceedings of Nutrition Society.* 56(1A): 63-74.

Rosegrant, M. (2014). Returns to Investment in Reducing Postharvest Food Losses and Increasing Agricultural Productivity Growth Post-2015 Consensus IFPIRI.

Rodenburg, J., Bourgeois, T.L., Grard, P., Carara, A., Irakiza, R., Makokha, D.W., Kabanyoro, R., Dzomeku, I., Chiconela, T., Malombe, I. (2016). Electronic support tools for identification and management of rice weeds in Africa for better-informed agricultural change agents. *Cah. Agric*, 25, 15006.

Rychetnik L., Webb K., Story L., Katz T. (2003). Food Security Options Paper: A Planning Framework and Menu of Options for Policy and Practice Interventions. In: NSW Department of Health, editor. Sydney: NSW Centre for Public Health Nutrition, The University of Sydney.

Salaria, N, (2012). Meaning of the Term Descriptive Survey Research Method. *International Journal of Transformations in Business Management;* 1(6):1-7.

Smale M, Cohen M. J. & Nagarajan L. (2009). Local Markets, Local Varieties: Rising Food Prices and Small Farmers' Access to Seed. Issue Brief. Washington DC: International Food Policy Research Institute.

Sorre, B. (2010). *Cash Crop Production, Food Security and Nutrition in Rural Households. Berlin*: Lap-Publishing House.

Tadele, Z. (2017). Raising Crop Productivity in Africa through Intensification review *Agronomy,* 7, 22; doi:10.3390/agronomy7010022

Tatlıdil, F.F., Dellal, I. & Bayramoğlu, Z. (2013). Food Losses and Waste in Turkey. Country Report Prepared. National Adaptation Plans (NAPs).

Teklu, D. (2013). Fish post-harvest technologies as a mean of food and nutrition security: *International Journal of Fishery Science and Aquaculture,* 1 (1), 024-027.

Thandi, P., Matwa, P., Bradley, H., and Hughes, G. (2006). Socio-cultural Factors Influencing Food Consumption Patterns in the Black African Population in an Urban Township in South Africa. *Kamla-Raj; Human Ecology,* Special Issue No. 14: 89-93.

USDA/ERS. (2010). Loss-adjusted Food Availability Data Series and Documentation.

Washington, DC: USDA. Available from: http://www.ers.usda.gov/ Data/Food Consumption/FoodGuideIndex.htm (verified 23 September 2017).

United States Department of Agriculture (USDA). (2013). "USDA and EPA Launch U.S. Food Waste Challenge." USDA Press Release Number 0112.13.

UNHCHR. (1998). All Human Rights for All: Fiftieth Anniversary of the Universal Declaration of Human Rights, Geneva, Switzerland,

van Vark, C. (2012). How to manage post-harvest loss In *Post Harvest Loss: A factor in food security*. The Guardian. Retrieved from http://www.guardian.co.uk/global-development-professionals-network/2012/dec/14/post-harvest-loss-food-security

Wilkinson, R. & Marmot, M. (2003). *Social determinants of health: The solid facts (2nd edition)* World Health Organisation: Europe.

WRAP. (2013). *Reducing Household Food Waste in the UK*. Information Sheet.

WRAP. (2014). Household Food and Drink Waste: A Product Focus, Project Code: CFP204. Available online:

http://www.wrap.org.uk/sites/files/wrap/Product-focused%20report%20v5_3.pdf (accessed on 27 February 2017).

Watson, M., & Meah, A. (2013). Food, waste and safety: Negotiating conflicting social anxieties into the practices of domestic provisioning. *Sociol. Rev.*, 60, 102–120.

WEMA. (2010). Reducing Maize Insecurity in Kenya: The WEMA Project Policy Brief. AART

WRI. (2015). Food Loss and waste Protocol, DRAFT as of March 20, 2015 FLW Protocol Accounting and Reporting Standard.

WRAP. (2016). Household Food and Drink Waste: A Product Focus, Project Code: CFP204.

Available online: http://www.wrap.org.uk/sites/files/wrap/Product-focused%20report%20v5_3.pdf (accessed on 27 February 2017).

Zorya S., Morgan N., Diaz Rios L., Hodges R., Bennett B., Stathers T., Mwebaze P., Lamb J. (2011). Missing Food: The Case of Postharvest Grain Losses in Sub-Saharan Africa. The international bank for reconstruction and development/the world bank: Washington, DC, USA: 2011.

Zhou, W. (2013). "Food Waste and Recycling in China: A Growing Trend?" Accessible at: http://www.worldwatch.org/food-waste-and-recyclingchina-growing-trend-1.

APPENDIX 1: SAMPLE SIZE DETERMINATION TABLE

N	N	N	n	N	n
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	102	1800	317
45	40	290	105	1900	320
50	44	300	109	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	198	3000	341
80	66	420	201	2500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	100000	384

Note: N = population size n = sample size

Source: Krejcie and Morgan (1970: 23)

APPENDIX 2: HOUSEHOLD QUESTIONNAIRE

Dear household member,

I am a PhD Student from Moi University carrying out a study on ***"Household Food-resource-Handling Procedures and Food Insecurity in Gucha Sub-county, Kisii County, Kenya".*** This research is purely academic and your contributions are highly appreciated. On behalf of your household, I kindly request you to answer the questions below. All the responses will be handled confidentially and for the purpose of this study only.

Thank you in advance

Mr. Oino Peter Gutwa

Tel. 0722-631-856

PART ONE: HOUSEHOLD DEMOGRAPHIC DATA *(Please circle or tick the appropriate answer)*

1. Household number? .....
2. Name of division……...Location……...Sub-location……
3. a). Sex of the household head 1. Male 2. Female

   b). Do men and women engage in similar roles and activities at the household level?

   1. Yes (name some of them) ……
   2. No (name some of the restricted roles):

For male only	For female only
…….	……..
…….	……..

   c). Do we have situations where some of these restricted roles have been performed by members of the opposite sex? 1. Yes 2. No

   d). If it happens in c above, what has been the reaction from those around the actors?

   1. Positive .....
   2. Negative ……...

   e). Between the male and female members of the household, who makes most of the household decisions on production, distribution and consumption of household resources and why?

   1. Male ……

2. Female ……
3. Both ……

f). Do social and cultural processes like rites of passage (including but not limited to circumcision, marriage and even death) influence household decision making?

1. Yes. How? ……
2. No. Why? ……

4. How old are you? …….. Years. 1. Don't know (D.K) 2. No Response (N.R)
5. Marital status? 1. Single 2. Married 3. Separated/divorced 4. Widowed 5. N.R
6. a). Your educational status? 1. Primary 2. Secondary 3. Tertiary 4. University 5. None

   b). Do you have any special skills, knowledge or professional training? 1. Yes 2. No

   c). If Yes in b above,

   i) Which skills/knowledge or professional training do you have?……

   ii) How did you acquire them? ……

   iii) Do you use them? 1. Yes (How?)…… 2. No (Why?)……..
7. If married, educational status of the spouse?

	Primary	Secondary	Tertiary	University	None
Wife 1	……1….	……2…	…3……	……4…	…5……
Wife 2	……1….	……2…	…3……	……4…	…5……
Wife 3	……1….	……2…	…3……	……4…	…5……

8. Which of the following employment categories best describe your occupation? (You can circle more that one option depending on your situation)

   1. Public/government 2. Private (NGOs) 3. Parastatals 4. Subsistence farming 5. Commercial farming 6. Self employed 7. Other (specify)……
9. a) Number of people in the household?……..

   b) Number of children in the household?

   1. Male…….. 2. Female…….

c) Number of children in school?

	Male	Female
Primary	…….	……
Secondary	…….	……
Training/tertiary	…….	……
University	…….	……
None	…….	……

d) Number of children employed? 1. Male …… 2. female ……

e) If children employed, does anyone of them assist the family financially?

1. Yes 2. No

f). Would you say your household has many dependants than producers?

1. Yes (why?)…….. 2. No

10. a) If female respondent, does the husband stay at home? 1. Yes 2. No

b) If No, where is he?……

11. Religious affiliation

a) Christian (specify denomination)

b) Muslim

c) Other____

PART TWO: HOUSEHOLD'S SOCIO-ECONOMIC AND AGRONOMIC ACTIVITIES DATA

12. a) How many plots (parcels) of land are owned by your household?……. plots.

b) What is the size of each in acres? 1. …..… 2. ……. 3. …….. 4. …….

c) Who owns each plot? 1. ……..… 2. ……..……. 3. ……..…. 4. ……..

13. a) Have you leased land from someone else? 1.Yes 2.No

b) [If yes in 11a] for what purpose?……

c) Has anyone else leased land from you? 1.Yes 2.No

d) [If yes in 11c] For what purpose? ……

14. Which technology do you use for the following activities

a) Ploughing

i. Jembe

ii. Oxen plough

iii. Tractor

iv. Other (Specify_____

b) Planting Maize

i. Manure

ii. Chemical fertilizers

iii. Other (Specify)_____

15. a) What crops did you plant this season?

Cash crops	**acreage (approximate)**	**reason why grown**
……	…….	…….
……	……..	…….
Food crops	**acreage (approximate)**	**reason why grown**
……	……..	…….
……	……..	…….

b) Which of these crops are inter-cropped?

1. ……

2. ……

3……..…….

c) What crops did you plant last season?

Cash crops	**acreage (approximate)**	**reason why grown**
……	……..	…….
……	……..	…….
Food crops	**acreage (approximate)**	**reason why grown**
……	……..	…….
……	……..	…….

d). Who provides labour on your farm?

i. Household members (why?)…….

ii. Hired labour (why?) …….

iii. Both household members and hired labour (why) ……

e). Have you ever sought causal labour:

i. On people's food crop farms?

ii. On people's cash crop farms?

iii. Both on people's food and cash crop farms?

iv. Elsewhere?

[specify]…….

f) Are you sought by other people to provide casual labour? 1. Yes

2. No

[If Yes]

i. On people's food crop farms?

ii. On people's cash crop farms?

iii. Both on people's food crop and sugar cane farms?

iv. Elsewhere?

[specify]……

g). In your own assessment, what percentage of the household labour time is spent on food

production processes? 1. Less than 25% 2. 25-50% 3. 50-75% 4. 75-100%

h). Do you think the available household labour is optimized for food production?

i. Yes

(why?)……

ii. No

(why?)……

16. a) Do you grow hybrid maize? 1.Yes 2. No

b) If No, why?.....

17. How many times do you normally weed the maize crop?……times.

18. Number of animal kept, if any

a) Indigenous

b) Exotic

c) Sheep/goats

19. Which system do you use to feed the animals?

a) Free range grazing

b) Zero grazing

c) Semi-zero grazing

d) Others…….

20. If (b) or (c) above, where do you source feeds for the animals?

a) Wholly purchased

b) Partly purchased and partly from own farm

c) Wholly from own farm

d) Other (specify)……

21. Where are the animals kept?

a) In the cattle boma (bueri)

b) In the house

c) Other……..

22. If (b) above, why?

a) Lack of space

b) Security reasons

c) Other (specify)……..

23. a). Which of the categories below best describe the average monthly income [in Kenya shillings] for you and your spouse?

1. Below 2000 2. 2001-4000 3. 4001-6000 4. 6001-8000 5. 8001-10000 6.10000-12000 7. Over 12000

b). Is this income adequate to meet your basic household needs like food supply?

1. Yes 2. No (how do you fill the gap?)……..

24. a) Have you ever sought casual labour,

i. On people's food crop farms?

ii. On people's cash crop farms?

iii. Both on people's food and cash crop farms?

iv. Elsewhere?

[Specify]…….

b) Are you sought by other people to provide casual labour? 1. Yes

2. No

[If Yes]

i. On people's food crop farms?
ii. On people's cash crop farms?
iii. Both on people's food crop and sugar cane farms?
iv. Elsewhere?
[Specify]……..

PART FOUR: MAIZE PRE-HARVESTING AND HARVESTING PROCEDURES

25. During the last harvest, which crops did you harvest last season?
26. Where do you get labour to help you in harvesting?
    i. Household labour
    ii. Community labour
    iii. Hire labour
    iv. Other (specify)…….
27. Which objects do you use for the following activities?
    a) Transportation of harvested food from the farm
        i. Traditional basket (egetonga)
        ii. Normal gunia
        iii. Cart
        iv. Other (specify)……..
28. Where did you store harvested crops?
    i. Granary
    ii. Big basket
    iii. Gunia
    iv. Irongo
    v. Other (specify)
29. How do you preserve harvested food items?
30. Measuring food like maize
    i. Gorogoro
    ii. Kasuku
    iii. Other (specify)…….
31. How much maize

Bags of maize

a) Did you harvest? …….

b) Store? …….

c) Sell? …….

d) Purchase? …….

e) Give away to relatives and friends? …….

32. During harvest, who decides that;

	Husband	Wife
a) Some food be sold	…….	…….
b) Some food be given away	…….	…….
c) Some food be stored	…….	…….

33. a) Do you normally harvest enough food to last until the next season? 1. Yes 2. No

b) If No, what are some of the factors that lead to shortfall in food production?

1.……

2.……

3 ……..

PART FOUR: HOUSEHOLD-FOOD CONSUMPTION

34. How many meals do you take on daily basis as a household?

1. One 2. Two 3. Three 4. More than three

35. 40. Can you recall the type of food you ate in the last 24 hours?

Food	Time	Amount
…….	……	……..
…….	……	……..

36. Within the last seven days, have you eaten any of the following foods? (Put Yes/No where appropriate).

Food type	**Yes/No**
Millet	……
Sorghum	……
Maize	……
Pineapple	……
Rice	……

Lemons	……
Bananas	……
Mangoes	……
Bread	……
Meat (cow, goat, sheep, pig)	..……..
Tubers cooked	……
Chicken	……
Sweet potatoes	……
Fish	……
Groundnuts dried	……
Other tubers smoked	……
Vegetables	……
Milk products	……
Tomatoes and onions	……
Beans	……
Carrots	……
Others [List them below]	
……	……

37. Housing status?

1. Roofing Grass ……, Iron sheet…….. (Mabati)…..Tiles……. Others [Specify]……

2. Wall Mud……..., Bricks……Blocks……, Others (specify)…….

3. Floor Mud……., Cemented……Tiled……., Others (Specify)…….

38. During the time of plenty what do you do with surplus food?

……

39. Sources of energy for cooking and lighting? ……

40. At times of crisis or food shortage where are foods being procured from?

41. What are the kinds of foods and ways of serving these for the different life stages e.g. for babies, pregnant women, visitors, elderly or the sick?

42. Who makes decisions around what is to be prepared and served at meal times?

43. What are your present methods of food preparations? Why?

44. What are your present approaches to food apportionment?
45. At times of crisis and food shortage what are the rituals of sourcing food?
46. During hunger season, do you have specific people you can go to for assistance?
    1. Yes (name two) …… 2.No
47. a) Are you satisfied with the grains from your land? 1. Yes 2.No
48. b) If No, why are you not?…….
49. When there is short fall in food production, how does the family obtain supplementary food? …… .
50. What problems does the family go through when there is less food to go round?
    a) Has the household consumed less preferred foods?
       1. Never 2. Rarely (once) 3. From time to time 4. Often (5 or more times)
    b) Have you reduced the quantity of food served to men in the household?
       1. Never 2. Rarely (once) 3. From time to time 4. Often (5 or more times)
    c) Have you reduced your own consumption of food?
       1. Never 2. Rarely (once) 3. From time to time 4. Often (5 or more times)
    d) Have you reduced the quantity of food served to children in this household in the last seven days?
       1. Never 2. Rarely (once) 3. From time to time 4. Often (5 or more times)
    e) Have members of this household skipped a meal in the last seven days?
       1. Never 2. Rarely (once) 3. From time to time 4. Often (5 or more times)
    f) Have members of this household skipped meals for a whole day?
       1. Never 2. Rarely (once) 3. From time to time 4. Often (5 or more times)
51. What do you think should be done to ensure there is enough food for all in this area?
52. a) Would you rate your family as?
    i. Rich
    ii. Not so rich but not poor

iii. Poor

b) Explain your rating ……

53. Would you say your household is?

a) Food secure? (Explain) ……

b) Food insecure? (Explain) ……

c) Does the answer in b above reflect the food production potential and resources that your household has to be food secure? 1. Yes 2. No

PART IV: FOOD EXCHANGE PROCEDURES

54. Does the family ever sell food harvested? 1. Yes 2.No

55. a) Does the family ever buy grain? 1. Yes 2.No

b) If yes, who decides that grains should be purchased?

1. Husband 2. Wife 3. Both

c) Who gives the money? 1. Husband 2. Wife 3. Both

56. a) Have you ever exchanged food items for other items other than food? 1 Yes 2. No

b) If Yes from (a) above, which items? …….

c) Are the items proportionate with food items given in exchange? 1. Yes 2. No.

57. a). In times of when the household does not have enough food resources, are the markets adequately stocked with food sources like grains that you need? 1. Yes 2. No

b). When seeking the market option, are the food prices controlled by the government?

1. Yes (how)……. 2. No

58. Have you ever had about credit facilities by the government to support food production in the County? 1. Yes (which one?)……. 2. No

59. Can one blame the government for the food deficit situation we find ourselves in within Kisii County?

1. Yes because…….
2. No because …….

60. There are several things that may require immediate support of the government in enhancing food security situation in Kisii County. Can you name any three priority ones?

i) ……

ii) ……

iii) ……

61. Given all that we have shared in this interaction, what recommendations will you give to enhance household food security in this area?

……

THANK YOU FOR RESPONDING TO THE QUESTIONNAIRE

Recorded by:……..

Date:……..

Checked by:……..

Date: ……

Comments:

……

<END>

APPENDIX 3: OBSERVATION GUIDE

1. Maize planting process
2. Types of food available in the household
3. Type of language used in maize consumption and sharing
4. Household food resource handling procedures within the household
5. Food consumption habits (general dietary patterns)
6. Division of roles
7. Population distribution
8. Non-verbal reactions
9. Storage facilities
10. Maize Transportation process
11. Maize cobs/grains processing

APPENDIX 4: FGD INTERVIEW GUIDE

Dear Participant,

I am a PhD Student from Moi University carrying out a study on ***"Household Food-resource-Handling Procedures and Food Insecurity in Gucha Sub-county, Kisii County, Kenya".*** This research is purely academic and your contributions are highly appreciated. I therefore, kindly request you to answer the questions below. All the responses will be handled confidentially and for the purpose of this study only.

Thank you in advance

Mr. Oino Peter Gutwa

Tel. 0722-631-856

Guiding Questions:

1. Which technology do you use for land preparation?
2. In your opinion what causes food loss and waste? How this can be mitigated?
3. How do you preserve harvested food items?
4. How does witchcraft lead to food losses and waste in the household
5. In your own opinion, are you satisfied with the way maize food-resources are handling at agronomic, pre-harvest, harvesting, consumption and exchange stages?
6. What are your present methods of food preparations? Why?
7. At times of crisis and food shortage what are the rituals of sourcing food?
8. Can one blame the government for the food deficit situation we find ourselves in within Kisii County?
9. In times of when the household does not have enough food resources, are the markets adequately stocked with food sources like grains that you need?

APPENDIX 5: NACOSTI RESEARCH AUTHORIZATION

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone: –254-20-2213471,
2241349, 310571, 2219420
Fax: +254-20-318245, 318249
Email: secretary@nacosti.go.ke
Website: www.nacosti.go.ke
When replying please quote

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

Ref: No.

Date:

4th February, 2015

NACOSTI/P/15/8347/4590

Peter Gutwa Oino
Moi University
P.O. Box 3900-30100
ELDORET.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Household food-resource handling procedures and food security in Gucha District, Kisii County, Kenya"*** I am pleased to inform you that you have been authorized to undertake research in **Kisii County** for a period ending **31st December, 2016.**

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

On completion of the research, you are required to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.

DR. M. K. RUGUTT, PhD, HSC.
DIRECTOR GENERAL/CEO

Copy to:

The County Commissioner
Kisii County.

The County Director of Education
Kisii County.

Authorized
DEPUTY COUNTY COMMISSIONER
KISII CENTRAL SUB-COUNTY

APPENDIX 6: RESEARCH AUTHORIZATION

REPUBLIC OF KENYA
MINISTRY OF EDUCATION SCIENCE AND TECHNOLOGY

Telegram: "EDUCATION"
Telephone: 058 – 30695
When replying please quote
E-mail: cdekisii@gmail.com

Ref: CDE/KSI/1

COUNTY DIRECTOR OF EDUCATION
KISII COUNTY
P.O. BOX 4499 - 40200
KISII.

DATE: 19th May, 2015.

STATE DEPARTMENT OF EDUCATION

Peter Gutwa Oino
Moi University
P.O. Box 3900 – 30100
ELDORET.

RE: RESEARCH AUTHORIZATION.

Following your Research Authorization vide your letter Ref. NACOSTI/P/15/8347/4590 to carry out research in Kisii County, this letter refers.

I am pleased to inform you that you have been granted authority to carry out your research in the County on ***"Household food-resource handling procedures and food security" in Gucha District, Kisii County,*** for a period ending 31st December, 2016.

Wish you a successful research.

COUNTY DIRECTOR OF EDUCATION
KISII COUNTY
P. O. Box 4499 - 40200, KISII
Date 19th May 2015.
Sign.....

RICHARD CHEPKAWAI
COUNTY DIRECTOR OF EDUCATION
KISII COUNTY.