MAIZE VALUE CHAIN ENHANCEMENT FOR FOOD SECURITY AND POVERTY REDUCTION IN BUNGOMA COUNTY, KENYA

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A thesis submitted in partial fulfillment for the award of the Degree of Doctor of Philosophy in Disaster Management and Sustainable Development of Masinde Muliro University of Science and Technology

JULY, 2018

DECLARATION AND CERTIFICATION

Declaration

I declare that this thesis is my original work prepared with no other than the indicated sources and support and that it has not been presented by anyone else in any institution for the award of PhD or any other award.

Signature……. Date: ……

Caroline Netia A. Kamau

CDS/H/06/13

CERTIFICATION

The undersigned certify that they have read and hereby recommend for acceptance of Masinde Muliro University of Science and Technology the thesis entitled **"Maize Value Chain Enhancement for Food Security and Poverty Reduction in Bungoma County, Kenya"**

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DEDICATION

This study is dedicated to my beloved children; Deirdre, Daisy and Dellilah and my husband Paul, whose support and encouragement were instrumental in my endeavours. I also fondly appreciate my late mum Regina Atsieno and my late dad David Awori who instilled in us their children, that education had no end.

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ABSTRACT

Food security exists when all people at all times have sufficient, safe, nutritious and preferable food to meet their dietary needs for an active and healthy life. Worldwide, about 815 million people are hungry with 75% of them found in rural areas. Approximately, 47% of Kenyans including Bungoma County, are not food secure. Conversely, poverty reduction is about improving the lives of the poor. Globally, 75% of the population is poor, while 42% in Kenya and 52.8% in Bungoma County are poor. Maize crop is the main source of food and livelihoods in Bungoma County. Despite the national and county governments' efforts, the challenges of achieving food security and poverty reduction have persistently impacted negatively on the county and country at large. The overall objective of this research was to examine maize value chain in Bungoma County with a view of enhancing food security and poverty reduction. Specifically, it sought to establish the level of development of maize value chain, determine the level of food security, examine factors influencing poverty reduction and evaluate strategies for enhancing maize value chain. The study employed cross-sectional survey, correlation and evaluation research designs. Multi-stage random sampling and purposive sampling were used to get a study sample size of 398 from the maize value chain players from Sirisia, Tongaren, Kabuchai, Webuye and Kanduyi sub counties. Data collection instruments included document analysis, questionnaires, focus group discussions, key informant interviews and observation check list. The questionnaires were pilot tested on 100 maize value chain actors. Data was analyzed and interpreted using descriptive and inferential statistics. The research established that the maize value chain development was at 25% and that only 37% of the community was food secure. The main factors influencing poverty reduction were low farm productivity and high rate of population growth. Further, the key strategies for enhancing maize value chain included reducing the cost of maize farm inputs, structuring maize marketing, capacity building of the maize value chain players, maize stakeholder collaboration and reduced cost of doing business. The study recommended that Bungoma County should enhance collaboration amongst maize value chain stakeholders and adoption of maize value chain development approach for sustainable food security and poverty reduction. It provided information for effective decision making by county policy makers for enhanced food security and poverty reduction. It also provided additional knowledge on value chain and agribusiness development and groundwork knowledge for further research.

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LIST OF ABBREVIATIONS AND ACRONYMS

ACDI	Agricultural Cooperative Development International
AEOs	Agricultural Extension Officers
AEZs	Agro-Ecological Zones
AFC	Agriculture Finance Corporation
ASDS	Agriculture Sector Development Strategy
BCAAR	Bungoma County Agriculture Annual Report
BCG	Bungoma County Government
BCIDP	Bungoma County Integrated Development Plan
CAN	Calcium Ammonium Nitrate fertilizer
CBS	Central Bureau of Statistics
CDA	County Director of Agriculture
CG	County Government
CGOB	County Government of Bungoma
CIMMYT	International Maize and Wheat Improvement Centre.
CREADIS	Community Research in Environment and Development Initiatives
CSPR	Civil Society for Poverty Reduction
DAP	Di-ammonium Phosphate fertilizer.
EAGC	Eastern Africa Grain Council
ETG	Export Trading Group
EUROSTAT	European Statistics Office
FAO	Food and Agriculture Organization
FFS	Farmers' Field School
FSP	Fertilizer Support Programme
GDP	Gross Domestic Product
GoK	Government of Kenya.
HCDA	Horticultural Crops Development Authority
HH	Household
IFAMA	International Food and Agribusiness Management Review
KARI	Kenya Agriculture Research Institution
KACE	Kenya Agriculture Commodity Exchange
KALRO	Kenya Agriculture and Livestock Research Organization
KAVES	Kenya Agriculture Value Chain Enterprises
KEPHIS	Kenya Plant Health Inspectorate Service
KENAFF	Kenya National Farmers Federation
KIs	Key Informants
MDGs	Millennium Development Goals
MOA	Ministry of Agriculture
MOALFCI	Ministry of Agriculture, Livestock, Fisheries, Cooperatives & Irrigation
MoTI	Ministry of Trade and Industry

MT	Metric Tonnes
MVC	Maize Value Chain
NACOSTI	National Council of Science and Technology and Innovation.
NAEP	National Agricultural Extension Policy
NALEP	National Agriculture and Livestock Extension Programme
NAIAAP	National Accelerated Agricultural Inputs Access Programme
NCPB	National Cereals and Produce Board
NOCO	Nzoia Out growers Company
NPK	Ratio of Nitrogen to Phosphorus to Potassium
PCPB	Pest Control Products Board
POP	Population
PRSP	Poverty Reduction Strategy Paper
PPP	Public-Private Partnership
PSDA	Private Sector Development in Agriculture
SCAO	Sub County Agriculture Officer
SD	Sustainable development
SDGs	Sustainable development Goals Millennium Development Goals
SDMHA	School of Disaster Management and Humanitarian Assistance
SH	Stake holders
SHOMAP	Small Holder Horticulture Market Access Programme
T&V	Training and Visit
USDA	United States Department of Agriculture
VC	Value Chain
WAEO	Ward Agriculture Extension Officer
WBCSD	World Business Council for Sustainable Development
WHO	World Health Organization

DEFINITIONS OF MAJOR OPERATIONAL TERMS

Absolute poverty: This is also known as destitution which refers to the deprivation of the basic human needs such as food, water, sanitation, clothing, shelter and health care, locally known as "Kumutambo"

Agribusiness: This denotes the collective agricultural business activities that are performed on maize produce from farm to fork as it covers the supply of farm inputs, the production and transformation of maize products and their distribution to final consumers.

Asset: This is anything considered valuable, important or useful, such as a skill, a quality. The most common here are land, children, wives, houses and house possessions.

Basic Needs for Survival: These are food, shelter, clean water, clothing, health services and education

Capacity: This is the resources, skills or ability, which can be physical or material, that one, community or institution has that can be used to combat or cope with life challenges like food insecurity.

Community: A group of people identified by geographical location, cultural heritage, language, beliefs or shared interests

Conceptual Framework: This is the framework that guides the study and provides a context for interpreting the study findings and explaining observations,

Coping strategies: Activities or measures to which people resort to obtain food, income and/or services for their living.

Chronic food insecurity: A long-term or persistent inability to meet minimum food requirements

Disaster: This is a calamitous event, especially, one that occurs suddenly and causes great loss of life, damage, or hardship. This could be floods, draught, hail storms or lightning

Disaster Management: It is a holistic approach to planning and managing disaster and its biophysical and socio-economic impacts. It is the process of analyzing activities and programs to mitigate and minimize negative effects of disasters.

Disaster Risk: This is the likelihood of a specific hazard occurring and its probable consequences for people and property

Disaster Risk Management (DRM): This refers to the systematic process of using administrative decisions, organization, operational skills and capacities to implement policies, strategies, and coping capacities of the communities to lessen the impacts of natural hazards

Disaster Risk Reduction (DRR): This refers to the diminution of either existing or anticipated damage caused by hazards

Enough food: Having enough food is when one or a household has sufficient quantities of food to eat to his/her/its fill or satisfaction. There is no much consideration for safety, nutrition and suitability for the food eaten.

Food access: This is the ability to get sufficient and nutritious food regularly through home production, food stocks, purchases, barter, gifts, borrowing or aid.

Food availability: This is the physical presence of the required, acceptable and adequate food in the vicinity or area of concern

Food insecurity: This is the lack, limited or uncertain availability, access and utilization of acceptable, sufficient and nutritious foods

Food security: This means that all people have enough, appropriate, safe and nutritious food to eat at all times to sustain a healthy and active life.

Food Secure: To be food secure is when one or a household has enough of the suitable, safe, nutritious and acceptable food to eat at all times for a healthy and active life

Food utilization: This is the effective preparation and consumption of food. It also refers to the biological capacity of individuals to absorb and utilize nutrients in the food that they eat.

Gender: The socially constructed roles and responsibilities assigned to men, youth and women in a given culture, location and the societal structures that support it.

Hazard: This is anything that is likely to cause harm, damage or destruction to humans, other organisms, or the environment. It could be biological, chemical, mechanical, environmental or physical

Household: All persons living under one roof or occupying a separate housing unit. They could have one or a separate cooking facility but they must be related by blood or law so as to constitute a family.

Infrastructure: This includes road networks, marketing facilities, storage facilities and communication facilities

Livelihoods: These are activities, resources or means of earning a living. The means by which people live or survive

Livelihood strategies: This is how to use the available resources, assets, capabilities and skills to earn a living. How to obtain the income necessary for family like security, healthy life, shelter, and education

Malnutrition: A state of nutrition (under or over nutrition) in which there is deficiencies in nutrients like proteins, energy, vitamins or others causing measurable adverse effects on body health and functioning.

Poverty: This is a general scarcity or dearth, or the state of lacking basic requirements of life like food, money, good housing, education or land.

Poverty reduction: It is the process of providing the poor (those deprived of the necessities for life) with the means or measures to meet basic needs for survival. It is what one does to better his or her living status

Sustainable Development (SD): It is understood as the balancing of economic growth, social development and environment protection for the present and future generations. That is economic and social development should not degrade or destruct the environment but help protect and conserve it.

Theoretical framework: This refers to the model of how the relationships among several factors that are identified as important to the study problem are theorized or made to make logical sense. It is the rationale or base by which the research is conducted.

Value Chain: It is the full range and sequence of related business activities and the actors from sourcing and provision of specific farm inputs for production,

transformation, marketing up to final consumption of maize and maize products

Vulnerability: Vulnerability is the potential to suffer harm or loss. It is also referred to as the degree to which people, property, resources, systems or culture are likely to suffer or get hurt when exposed.

CHAPTER ONE

INTRODUCTION

1.1. Background Information

This chapter gives a glance at the current global and local food security and poverty reduction situation, introduces the relevance of value chain approach to food security and incomes, and looks at the current status of the maize crop in Bungoma County. It also discusses the statement of the problem, research objectives, research questions, justification and scope of the study.

According to the world food situation statistics, 815 million people in the world are food insecure, meaning that they are undernourished or are not able to acquire enough food to meet the daily minimum dietary energy requirements (FAO, 2014 and WFP, 2016). Moreover, 75% of the hungry are found in the less developed countries, especially in the rural areas (FAO, 2010). This high percentage needs to be brought down if the Millennium Development Goals (MDGs) and Sustainable development Goals (SDGs) are to be achieved (Anzoátegui, 2015 and FAO, 2010). Further, when it comes to global food security and poverty reduction, maize crop is one of the leading cereal crops relied upon for human food, income, industrial raw material and animal feed (CBS, 2006) and hence its production and productivity must be enhanced and sustained

Agriculture remains the mainstay of Kenya's economic development with maize crop being of central interest in achieving food security and poverty reduction in the country

(GoK, 2010, GoK, 2011 and ASDS, 2012). However, food security and poverty reduction have stubbornly remained major challenges for the Kenyan Government as 47% of its rural population is not food secure (ASDS, 2012 and Kenya Vision, 2030). Consequently, Bungoma County like most other counties in Kenya depends mainly on agriculture for its sources of livelihoods. It suffers from chronic and sometimes severe food insecurity and high level of well spread poverty which makes about 53% of her population poor (KARI & UON Research Report, 2013). Further, according to The Kenya Economic Survey Report (2014), Bungoma County had a poverty gap of 3.79 making it the fourth poorest county in Kenya after Kakamega and Mandera (4.69), Turkana (4.13), and Nairobi (3.94) based on poverty indices respectively.

Bungoma County highly depends on the maize crop for her food and livelihoods as the crop covers 95% of the land under food crop production, especially, in Tongaren, Kimilili, Mt. Elgon, Webuye and Kanduyi sub counties (BCIDP, 2013). It is one of the four counties which together produce 45% of the maize produced in Kenya with the other three counties being Narok, Uasin Gishu and Trans Nzoia (Valk, 2014). Maize is the crop that determines food security and incomes not only in Bungoma County but for three quarters of Kenya's population (KNBS, 2014; BCIDP, 2013 & ASDS, 2012).

Therefore, focusing on food security in Bungoma County is synonymous with focusing on maize. According to KARI (2014), land under maize farming in the county has been on an upward trend over the last five to 6 years, increasing at an annual average rate of about 9.7% in the County. However, maize productivity is low averaging at about 15

bags per acre against the County's optimal level of 35 bags of 90 kgs per acre (KARI, 2014). This means that although the acreage under maize farming or production has been increasing, the yield or volumes of maize produce a farmer gets from one acre of land is much lower than what is optimally expected. Consequently, what is produced is not sufficient leading to a deficit in food requirement. This has led to the County to rely on maize imports from neighbouring counties like Trans Nzoia, Uasin Gishu and countries like Uganda which worsens the food accessibility issues (BCIDP, 2013). Hence, achieving food security and poverty reduction have remained elusive calling for an approach that could effectively stimulate and sustain farm productivity, food accessibility and utilization for all the people in the County at all times (CBS, 2011).

According to Gloy (2005) and IFC (2013), agribusiness and value chain approach have great potential for enhancing land productivity and increased incomes which can motivate increased food production and consumption and hence enhance food security and reduce poverty. This is through increased inclusive growth, mitigation of prices and weather shocks, reduced post-harvest handling wastes, and increased business opportunities (Anderson & Fedder, 2004 and Deschamps-Laporte, 2013). Nonetheless, value chain approach for agribusiness development demands continuous pursuit of new technologies and research so that collective and inclusive agricultural efficiency is enhanced by reducing wasted resources, saving time, and improving output (Guidi, 2011). These translate into increased farm income, food availability, consumer purchasing power and improved food utilization and hence, an improved food security and standard of living (IFC, 2013).

Further, the release of farm manpower from farming into off-the-farm jobs through agribusiness has the basis for economic growth and development due to increased worker productivity, which in turn spurs creativity, more products and improved living (USAID, 2010 and Guidi, 2011). Moreover, conventional agricultural approaches focus on intensive-type of farming where there is the application of high-input systems that offer an increased yield. In contrast, agricultural value chain approach considers a set of activities, services, and products that lead to a product or service that reaches the final consumer thus promoting sustainable agriculture, food security and poverty reduction (Shepherd, 2004 and Miller, 2006). Further, many studies have been carried out on food security and poverty in Kenya and the results have shown that lack of sufficient and nutritious food go hand in hand with poor living standards (Wabwoba *et al*., 2015). Moreover, many approaches like the NAEP, T&V, NALEP and FFS that have been employed towards enhancing food security and poverty reduction, have mainly focused on increasing crop production and productivity (Wabwoba, 2012 and Nyoro, 2000). Further, high reliance on maize crop as the main source of food has made achieving adequate food and reduced poverty across Kenya and subsequently in Bungoma County elusive (Simiyu, 2014 and Wabwoba *et al*., 2015). Nonetheless, since maize is the staple food and source of livelihoods for the people of Bungoma County (USAID-KAVES, 2015), this study sought to examine the maize value chain with a view of enhancing food security and poverty reduction and evaluate strategies used for enhancing maize value chain in Bungoma County. The study established that the people of Bungoma County were poor and not food secure. Consequently, the study concluded that there is need for collaboration between maize value chain players and

adoption of agricultural value chain approach in order to enhance food security and poverty reduction

1.2. Statement of the problem

Bungoma County generally, has a good climate and arable soils that are favorable for production of not only maize but also most crops and livestock across the County (KARI, 2013). However, according to KNBS (2010) and Wabwoba *et al.* (2015), the county suffers from chronic and sometimes severe food insecurity and high level of wide spread poverty (52.6%). This poverty is experienced across the county, especially, amongst the smallholder farmers whose main crop is maize (BCIDP, 2013 and Simiyu, 2014). The farmers experience low farm productivity, low farm incomes, high inaccessibility to food market and high incidences of malnutrition, escalating into the prevailing state of poverty (KAR1, 2013, BAAR, 2014 and Morike *et.al*, 2011).

Maize being the main crop for her population, Bungoma County like the rest of Kenya has used various agricultural extension approaches like NAEP, T&V, NALEP, and FFS since 1982, to help enhance food security and poverty reduction (Mattie, 2003 and KARI & UON Research Report, 2013). After the establishment of devolved governments in Kenya (GoK 2010), the County introduced new strategies like provision of free seed and fertilizer and mobile soil testing laboratories to help enhance farm productivity (BCIDP, 2013 and Wabwoba *et al*., 2015). However, all these approaches have been mainly towards increasing agricultural production and productivity using conventional agricultural methods like crop husbandry and good

agricultural practices (GAP), with little focus on agribusiness (Muyanga & Jayne, 2006 and GoK, 2014). Consequently, the little focus on agribusiness as a vehicle for enhancing food security and poverty reduction in Bungoma County has led to persistent food insecurity and with low incomes (Simiyu, 2014). Therefore, in order to motivate the maize farmers and other actors involved in maize and related activities to effectively participate in the maize crop activities so as to achieve food security and poverty reduction, an alternative approach needs to be employed. According to Anderson & Fedder (2004) and Deschamps-Laporte (2013), value chain is the alternative approach that emphasizes strategies that develop agricultural innovation systems, pluralism of service providers, demand-driven and innovative public-private partnerships and hence likely to help achieve food security and poverty reduction in Bungoma County.

Although value chain approach is sensitive to resource scarcity, business environment and climate change, as a model of agribusiness, it has the potential to enhance food security and create opportunities for raising incomes for the world's poor as revealed by IFC (2013), Neves & Pinto (2012) and JADEE (2010). This is proven by the half or more of GDP and 60 to 80 percent of total employment created by the agricultural business sector, especially, in low-income countries (WBG, 2012 and Neves & Pinto 2012). Therefore, the value chain approach has embedded benefits like sharing information, increased productivity, reduced business costs and enhanced profits compared to other alternative approaches to food and poverty reduction (Guidi, 2011 & IFC, 2013). This is why this study adopted the approach to examine the maize value

chain in Bungoma County with a view of enhancing food security and poverty reduction

1.3. Research objectives

1.3.1. Overall Objective

The overall objective of the study was to examine maize value chain in Bungoma County with a view of enhancing food security and poverty reduction.

1.3.2. Research Specific Objectives

The specific objectives that the study sought to achieve included;

(i) To establish the level of development of maize value chain in Bungoma County

(ii) To determine the level of food security in Bungoma County

(iii) To examine factors influencing poverty reduction in Bungoma County

(iv) To evaluate strategies for enhancing maize value chain in Bungoma County

1.4. Research Questions

(i) What is the level of the maize value chain development in Bungoma County?

(ii) What is the level of food security in Bungoma County?

(iii) What are the key factors influencing poverty reduction in Bungoma County?

(iv) What strategies can enhance maize value chain in Bungoma County?

1.5. Justification

As already stated, maize is the main staple food and the main source of livelihoods with advantageous conditions for its production in Bungoma County (USAID-KAVES,

2015). Moreover, the national and county governments had expended efforts through various agricultural strategies and projects to enhance food security and poverty reduction in the County (Wabwoba *et al*., 2015, Chenge, 2014, KARI. 2013, CGB, 2013 and Simiyu, 2014). Yet the challenges of food security and poverty reduction had persisted in the county and country at large. Therefore, there was need for a holistic approach in scrutinizing and addressing the daunting problems of food insecurity and poverty in Bungoma County.

Studying the requirements for a competitive maize value chain in Bungoma County offers policy makers at different levels an alternative extension approach and information that promise increased incomes, land productivity, food production and consumption through increased inclusive and holistic growth (USAID, 2010; Guidi, 2011 & & IFC, 2013). The study provided reliable and timely information for decision making on what needed to be done at each given level of the maize value chain so that food security and poverty reduction activities are sustained. The study also provided information for the value chain players, the community and other agriculture stakeholders so that they may equitably participate to enhance maize productivity. The recommendations from the study will guide the Bungoma County Government, policy makers and other development planners in addressing different issues that affect food security and poverty reduction at different levels of the value chain. For the academic sector, the study findings served to add to existing body of knowledge by other researchers on agribusiness and value chain concept and helped to fill knowledge gaps for further research in similar issues.

1.6. Scope of the Study

The focus of the study consisted of maze value chain players in Bungoma County. These were the maize input suppliers, producers, transporters, processors, traders, supporters, and enablers of the maize value chain in Bungoma County. The chain supporters or service providers were mainly institutions like KALRO, KEPHIS, NCPB, Banks, AFC and extension service providers. The chain enablers included the MoALFCI, MoTI and local Government. For effective study delimitation in consideration for County representation, the study respondents were drawn from five sub counties Sirisia, Tongaren, Kabuchai, Webuye and Kanduyi (BCIDP, 2013).

CHAPTER TWO

LITERATURE REVIEW

2.1. Introduction

This chapter reviewed related literature organized according to the study objectives. The review was on the concept of value chain approach, analysis of maize value chain in Bungoma County, factors influencing food security, factors influencing poverty reduction and maize value chain development strategies for enhancing food security and poverty reduction. In addition, the relationships between disaster risk management and food security, and poverty reductions as well as the conceptual framework were reviewed.

2.2. Value Chain

2.2.1. The Concept of Value Chain

The concept of value chain is based on business management where it is centred on the process view of organizations and sees a manufacturing (or service) organization as a system, made up of subsystems each with inputs, transformation processes and outputs (Porter, 1985 and Kaplinsky & Morris, 2001). Further, Value-Links (2013) and Kaplinsky (2000) clarify that the inputs, transformation processes, and outputs in the value chain involve the acquisition and consumption of resources. These include money, labour, materials, equipment, buildings, land, administration and management. In addition, according to Value-Links (2013), the value chain activities convert inputs into outputs and add value to the products at each stage. However, how the value chain activities are carried out and resources used determines costs and affects profits (ACDI,

2006). However, like the sustainable development concept, value chain is a holistic, systemic and three dimensional concept whose implementation is influenced by its social, economic, environmental and institutional factors (World Bank, 2010). Therefore, as summarized by McCormick and Schmitz (2001), the concept of value chain is about recognizing the fact that in order for a product to reach the table of a consumer, it must have been designed, produced, marketed and distributed. In addition, in a value chain, the flow of inputs, raw materials, knowledge and expertise are controlled by social, economic, environmental and institutional factors.

From the above literature review it is evident that agricultural enterprises are value chains that need to be well designed before going to the farm to produce a crop. In relation to this study, there needs to be a good design of what technologies to use for maize production, where and how the maize produced should be distributed, stored and marketed sustainably for it to be effectively profitable and be consumed.

2.2.2. What is Value Chain

Value chain describes the full range of activities that a business and workers do to bring a product from its conception to its end use and beyond (WBCSD, 2011). It describes the main activities such as research and design of the product, production and processing, marketing, distribution and support to the final consumer (ILO, 2015). These main or key activities of a given value chain are also called primary activities and are performed by the value chain actors who do the real implementation and they include producers, traders, processors and transporters (Value-Links, 2013). Moreover,

these main activities form stages that are linked by a range of sub activities forming a chain in which value is added to the product as it moves from stage to stage (Kaplinsky & Morris, 2001). Furthermore, there is a range of other sub activities or shadow activities along the primary activities that provide supportive services like financing, training and infrastructure that help strengthen the chain. These shadow activities are also called secondary activities and are provided by service providers. Additionally, the primary and secondary activities are enabled by regulatory activities that regulate, direct and govern the value chain (IDRC, 2011). Figure 2.1 is a diagram representing a value chain with its primary, secondary and enabling activities

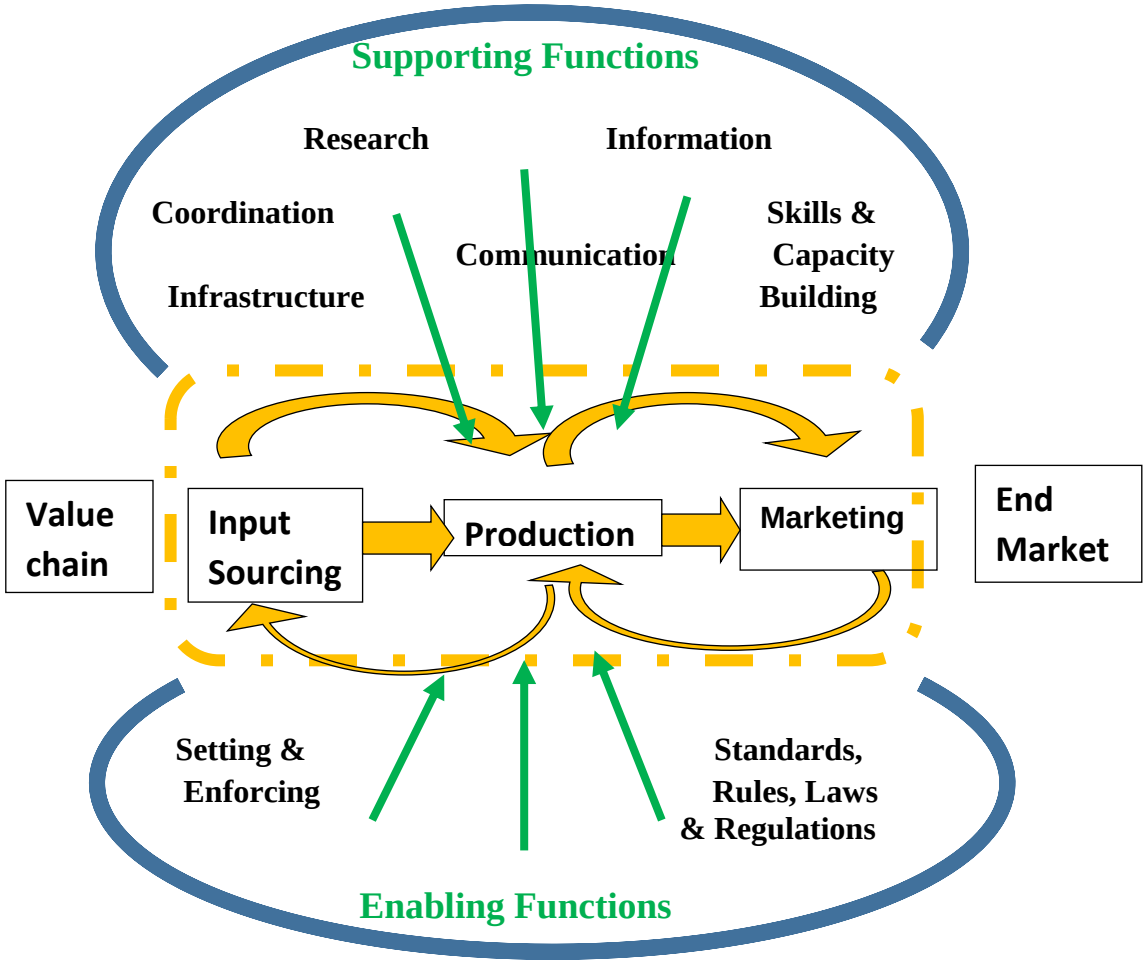

Figure 2.1: Basic Value Chain with its primary, secondary &enabling activities

(Source: ILO, 2015)

Figure 2.1 illustrates how embedded and systemic a value chain is. It shows that the primary activities move products from before production, at the centre of the value chain to the end market while the environment is influenced by relevant supporting functions that include information, training, finance and inputs. It also shows that the enabling functions include setting and enforcing of laws, standards, rules and regulations. This diagnostic process is to help understand that value chains and market systems are complex and hence inclusive participation and consultation are vital in order to arrive at the real underlying constraints and related market opportunities (Herr, 2007).

In relation to this study, this piece of the reviewed literature means that maize value chain like all other value chains is embedded and systemic. It consists of primary, secondary and enabling functions like research, information, training, input supplying and financing. Therefore in order for the maize value chain to enhance food security and poverty reduction, there must be inclusive participation and consultation between the maize value chain players. In this study, the level of participation and collaboration between the maize value chain players was established by examining the relationships between the functions of the present maize value chain service providers, agricultural projects in Bungoma County and the maize value chain enabling services by the County Government in relation to the primary maize value chain activities.

2.2.3. Value chain Analysis

Value chain analysis is the process by which to identify the primary, secondary and enabling activities that add value to the chain's final product and to examine these activities to reduce costs or increase gains (Grant, 2010). It looks at every step from the acquisition of raw materials, through production and distribution of the product, to the eventual end-use upto down to disposing of the packaging of the product after use (Reddy, 2013 and Mitchell *et al*., 2009). Therefore, a value chain can be said to be a business production system where actors at each level increase gains and outcomes thus creating employment and reducing poverty. According to Grant (2010) and Reddy (2013), a value chain has primary and support value creating activities that need to be analysed for any given value chain's competitiveness or profitability. These activities that make up or establish a given value chain can be contained within a single business or divided among different firms, within a single geographical location or located in different places (ILO, 2015). Figure 2.2 shows a summary of activities in a general value chain.

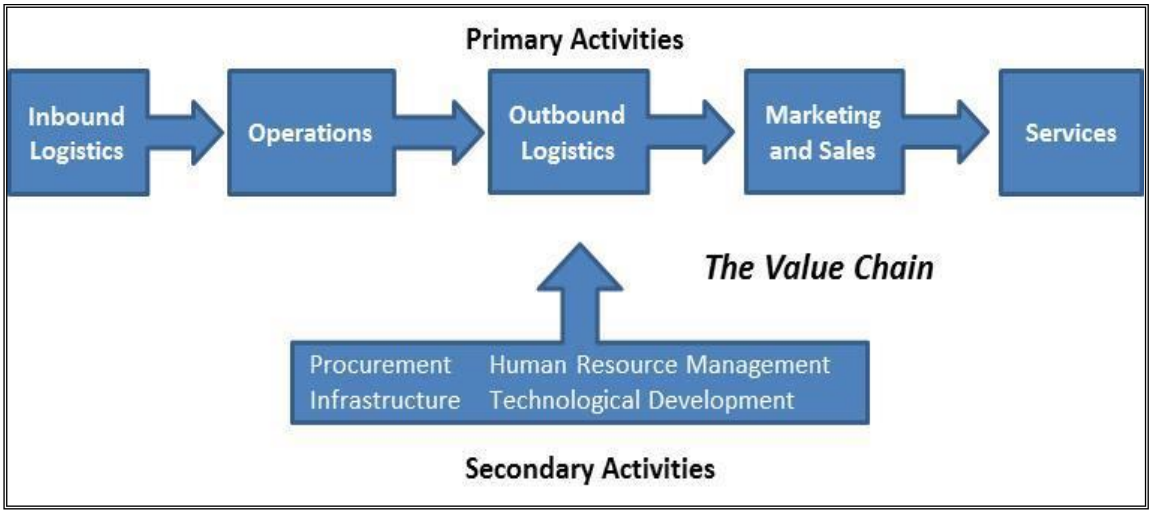

Figure 2.2: Summary of Activities in a General Value Chain Analysis
(Source: IDRC, 2011)

Figure 2.2 shows the summary of primary and secondary activities for a general value chain that are explained as follows;

(i) Inbound Activities: These include sourcing, receiving, arranging, storing and issuing the inbound inputs and raw materials and they involve relationships with suppliers

(ii) Production and Processing Activities: These are concerned with managing the process that converts or transforms inputs or raw materials into outputs in the form of goods and/or services.

(iii) Outbound Activities: These are the process related to the storage and movement of the final product and the related information flows from the end of the production line to the end user

(iv) Marketing, distribution and Sales Activities: These are the activities that involve the selling of a product or service and processes for creating, communicating, delivering, and exchanging offerings that have value for customers, clients, partners, and society at large. They also inform buyers about products and services to induce buyers to purchase them, and facilitate their purchase,

(v) Service Activities: These include all the activities required to keep the product or service working effectively for the buyer after it is sold and delivered.

Figure 2.2 also shows support or secondary activities that are explained as follows;

Infrastructure Activities: These consist of activities such as accounting, legal, finance, control, public relations, quality assurance and general management. They serve the business's needs and tie its various parts together.

Technological Development Activities: These pertain to the equipment, hardware, software, procedures and technical knowledge brought to bear in the firm's transformation of inputs into outputs.

(i) Human Resources Management Activities: These consist of all activities involved in recruiting, hiring, training, developing, compensating and (if necessary) dismissing or laying off personnel.

(ii) Procurement Activities: These are related to the acquisition of goods, services or works from an outside external source

From the literature in the above subsection, maize value chain could be made to be a business production system where actors at each level increase gains and outcomes thus creating employment and reducing poverty as well as increasing food security. In order to identify the primary, secondary and enabling activities that add value to the chain's final product for the value chain's competitiveness or profitability, this study examined the key maize value chain activity levels in Bungoma County. These included maize inputs supplying, maize farming or production, storing and marketing.

2.2.4. Value Chain Mapping

During value chain analysis, value chain mapping is also done whereby the key value chain actors or players are identified so that it is clear who and how many are doing which activities, where are the given activities being done in the value chain, what are the market channels and how is the product reaching the markets (Mitchell *et al*.,

2009). Value-Links (2013) also adds that the value chain map is a static snap shot of the value chain structure that also portrays support markets for providing critical support services to the chain players and functions as shown in Figure 2.3.

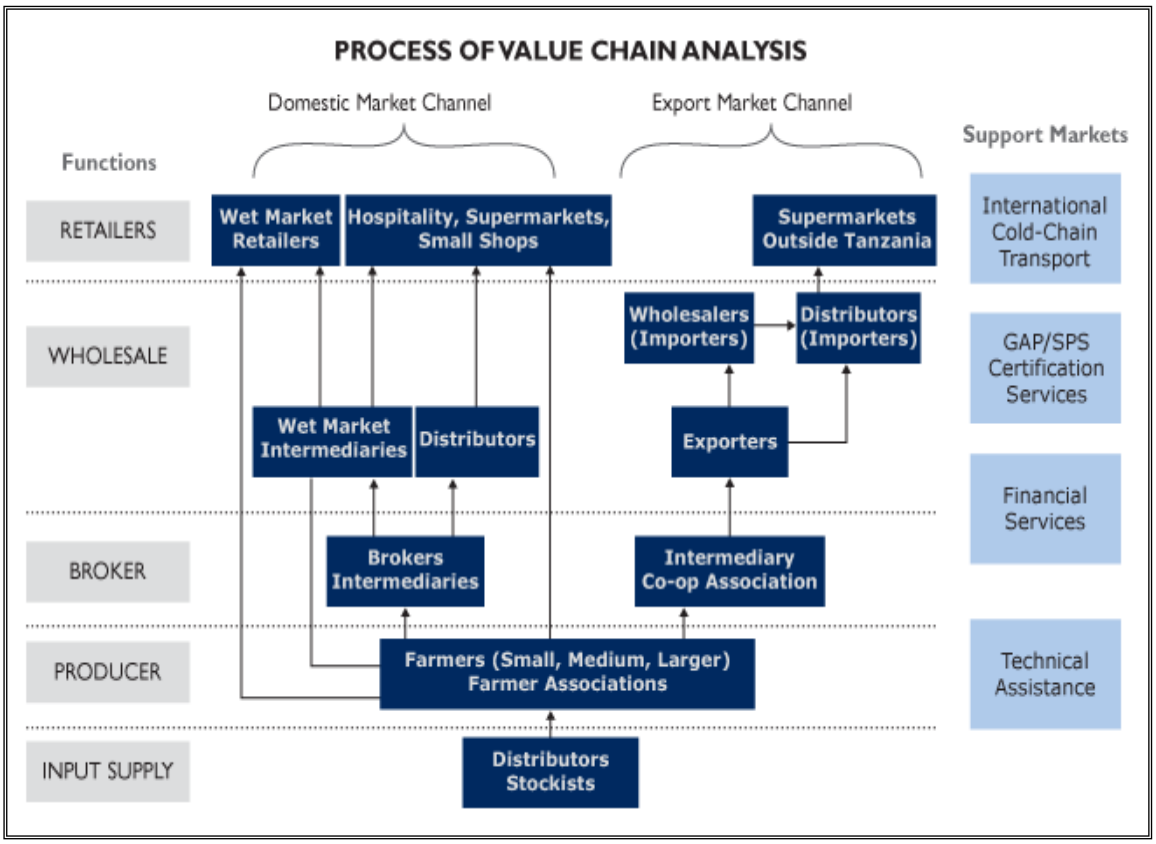

Figure 2.3: A Basic Agricultural Value Chain Map

(Source: Microlinks, 2015)

Figure 2.3 represents quantitative value chain analysis which involves mapping of value-added distribution along the chain, measuring of profitability, productivity and production capacity. There is also benchmarking of the value chain against its competitors (Microlinks, 2015). Quantitative value chain analysis is effective at revealing inefficiencies that can be addressed to increase competitiveness of the value chain (World Bank, 2010). This is in addition to qualitative value chain analysis which

aims for the value chain players to understand the chain's trends, incentives and relationships.

This study mapped the maize value chain in Bungoma County to identify the key value chain actors or players to know who and how many are doing which activities and where, and to establish what market channels were used for the maize products to the consumers so as to address food security and poverty reduction. This was done mainly by reviewing and analysing County Governments' relevant annual reports, interviews and field visits and observations.

2.2.5. Value chain Development

Value chain development is defined as an improvement of cooperation between stakeholders and players of a particular value chain and the coordination of their activities at different levels of the value chain (Herr, 2007). Its objective is to achieve the economic growth that reduces poverty by focusing on access to markets, inputs, technology, and a whole range of services for the small and very small businesses of the poor. It also focuses on the performance of industries in which large numbers of the poor participate, as workers and entrepreneurs (Microlinks, 2015). Therefore, the ultimate goal of value chain development is to increase the competitiveness of the value chain through increasing value creation, profits, efficiency of the value chain on the (international) market (World Bank, 2010). In achieving value chain development, FIAS (2007), asserts that there are five triggers that are employed as a methodological framework to help identify opportunities and constraints. They make the value chain more competitive and integrate it more effectively into other value chains and markets.

According to FIAS (2007), in order for a value chain to attain the desired development it must possess the five business drivers as shown in Figure 2.4.

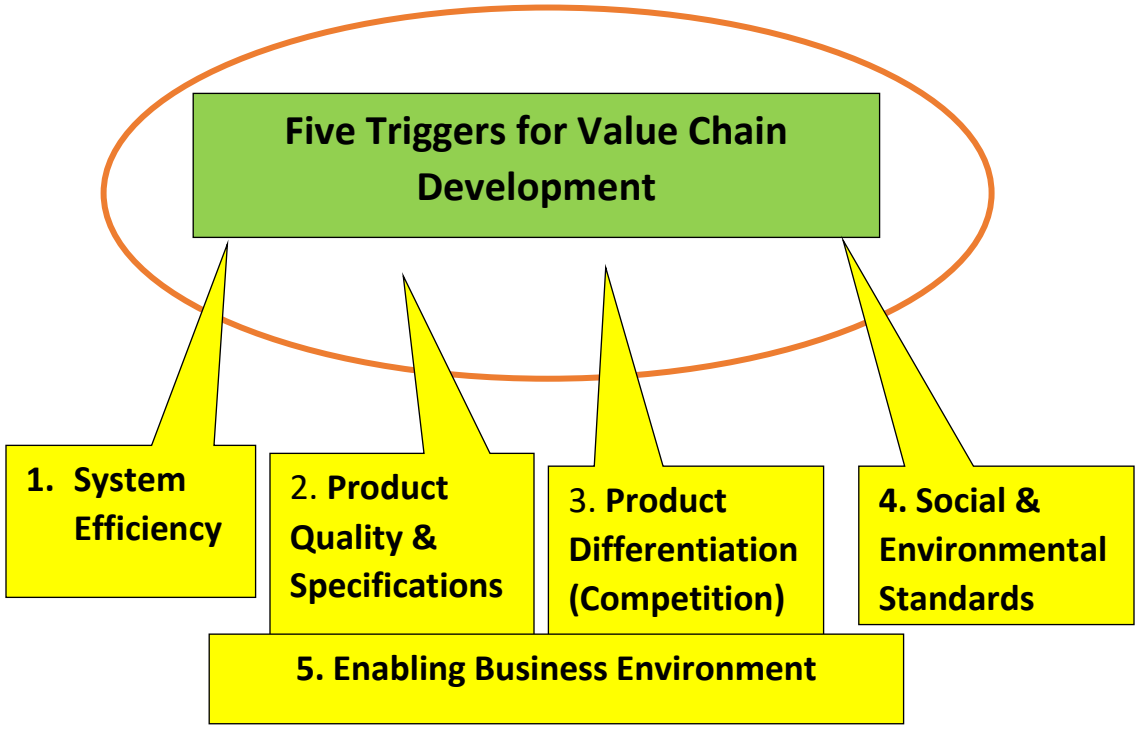

Figure 2.4: Five Triggers for Value Chain Development

(Source: Kaplinsky and Readman, 2004)

Figure 2.4 shows that a value chain must first have an operating system that is efficient so as to produce products that are quality and to the customers desired specifications. Secondly, the products should be at affordable cost and on time besides having the skills and competence required to produce products that are differentiated or specialized so as to cope with competition in the market. Additionally, the products released to the market should be acceptable to the society and the wastes from use of the products and resources used in producing the products should not be environment degrading. Finally, for a value chain to develop effectively there needs to be an

enabling business environment that facilitates the growth of each stage of the value chain.

According to the literature reviewed in the above subsection, if maize value chain in Bungoma County was developed, it would help achieve the economic growth that reduces poverty by focusing not only on improved primary chain activities but also the performance of maize industries in which large numbers of the poor participate, as workers and entrepreneurs. Besides examining the maize inputs supplying, production and trading, the study also looked into maize milling and maize value addition to try and establish the level of development for the maize value chain in the County.

2.2.6. Measuring Value Chain Development

According to Value-Links (2006), World Bank (2010) and Microlinks (2015), it is essential to measure value chain development so as to assess its efficiency and competitiveness and this can be done through various ways which include; (i) mapping value-added distribution which involves the recording and analyzing the gross output values that are added at different stages in the chain, beginning at raw material and ending with the final product sold to the consume. (ii) measuring the profitability of each activity or stage along the value chain to establish its competitiveness, (iii) measuring the productivity of each activity and resources to help measure the efficiency of the inputs employed in the production process which is frequently expressed as a ratio of output over input, (iv) measuring the value of wastage along the value chain which is normally measured as the value of a resource that never makes it

to the final consumer, (v) value chain benchmarking which involves comparing the performance of a firm, value chain or link in the value chain to its competitors, (vi) value chain agility which is the level of flexibility or the responsiveness. This is how fast to smoothly and cost-efficiently respond to unexpected changes in supply or demand that could be external or internal disruptions and recover promptly from shocks such as natural disasters, customer preferences and epidemics. This study measured the level of maize Value Chain Development by measuring the profitability of the key activities through their Gross Margins along the maize value chain to establish its competitiveness and the productivity of the inputs used in the activity to help measure the efficiency of the inputs employed.

2.2.7. Value chain Upgrading

Value chain upgrading means acquiring the technological, institutional and market capabilities that allow value chains to improve their competitiveness and move into higher-value activities thus increasing their trade or business (Mitchel *et al*. 2009). Herr (2000) adds that the process of value chain upgrading could be categorized into seven different upgrading strategies as follows;

Horizontal coordination - This is the process of greater intra-nodal organization like in the production and processing nodes, whereby the value chain actors at the same level or node could be coordinated with others to allow for the chain to achieve economies of scale in supplies and production and to reduce transaction costs;

Vertical coordination - This is the move away from one-off spot transactions towards longer- term inter-nodal relations, whereby a processor and a buyer or trader could

contract to improve their relationship in order to achieve greater certainty and increased revenues;

Functional upgrading - This refers to changing the mix of functions performed by either increasing number or changing the activities performed by actors in the value chain;

Process upgrading - This involves improving value chain efficiency by either introducing new technologies, changing management increasing output volumes or reducing costs for a unit of output;

Product upgrading – This is about improving the quality and standards of the product so as to attract more customers and better prices;

Inter-chain upgrading - This is the use of skills and experience developed in one value chain to productively engage with another value chain that is more profitable;

Upgrading' of the enabling environment – This is about improving the business environment in which the value chain operates through improving the support services, institutions, legal and policy frameworks necessary for increased competitiveness.

From the literature review in the above subsection, it is evident that in order for the maize value chain in Bungoma County to effectively enhance food security and poverty reduction, it has to improve its competitiveness and move into higher-value activities thus increasing its trade or business. Therefore, these mentioned value chain upgrading strategies need to be incorporated.

2.2.8. Value Chain Approach

It is a business methodology in which, according to Porter (1985) and Rowe, *et al*. (1994), businesses and organizations coordinate and monitor their systems, subsystems and activities such that inputs are acquired, processed and transformed into value added outputs. These are the products that are then distributed to the market or points of consumption. It is further described as a participatory business development methodology that encourages partnership arrangements between the business or the value chain primary actors, secondary players and the value chain enablers, (private and public stakeholders). Through the partnerships or collaboration, the value chain activities are implemented with aim of achieving high efficiency in the use of resources and value chain competitiveness (Value-Links, 2013 and Reddy, 2013). Therefore, for effective implementation of value chain activities, the chain's primary actors, supporters and enablers/ policy makers must understand how the value chains function. They need to understand the chain's features, principles, requirements and goals (GVCI, 2006).

Therefore, in relation to this study, according to USAID (2014), the maize value chain players need to be capacity built to understand how the value chains function. This is essential if that the value chain development strategies, incentives or interventions that enhance and contribute to pro-poor and sustainable agri-business development are to deliver successful value chain development and hence food security and poverty reduction.

2.2.9. Value Chain Approach and Agriculture

Agriculture is defined as farming or growing of crops and keeping of livestock for food, raw materials and incomes (FAO, 2010 and GOK, 2012). Successively, agricultural value chain refers to the whole range of goods, activities, services and actors necessary for agricultural inputs to move into the farm for production of farm products and distribution of the farm products from the farm to the final customer or consumer (Webber & Labaste, 2009). Through value chain approach, farmers are linked to consumers' needs as they work closely with suppliers, processors and traders to produce the specific goods consumers demand (ACDI, 2006). It is important to note that for effective application of value chain approach in agriculture, agricultural value chains need to be carefully selected, analyzed and mapped. This is necessary in order to enable all including the poor small producers to participate and profit equitably from a competitive marketing system of maize thus increasing economic growth and creating wealth and reducing poverty (Kaplinsky, 2000). Therefore, as aptly put by Trienekens (2011), incorporating value chain into agriculture means empowering the farmers to have better control over production, trade and distribution in order to guarantee the quality of their value added products in order to perform in a cost-effective and competitive way. Furthermore, according to Pacini *et al*. (2003), conventional agriculture is the intensive-type of farming, whereby there is rapid technological innovation and large capital investments through extensive use of pesticides, fertilizers, external energy inputs and high labor inefficiency. This differs considerably in approach from agricultural value chain which considers a set of agricultural activities, services, and products that lead to a product or services that reaches the final consumer.

Regionally, most African populations are small holder farmers and peasants and the conventional extension approaches used, where the scientists develop agricultural technologies and extension workers pass them to farmers for adoption, have left almost 80% of the farmers food insecure and poor (Reij & Waters-Bayer, 2001).This is because these approaches that include general agriculture extension, training and visit (T&V) and farmers' field schools (FFS), are costly with poor information packaging and insensitive to farmers' needs (Belay & Abebaw, 2004). However, especially in "less developed" countries, value chain as an extension approach faces numerous agricultural development issues and myths that impede effective participation of value chain actors in enhancing food security and poverty reduction. These include culture and traditional agricultural practices, politics, infrastructure deficits, high rate of population growth, climate change, water, inappropriate technologies and innovations. Other issues include environmental degradation, land tenure regimes and policies, inadequate agricultural specialization, inadequate public private sector partnerships, and inadequate and ineffective agricultural commercialization and innovation (World Bank, 2010; IFAD, 2012; Guidi, 2011 & Hazel, 2011).

In Kenya, the idea of agricultural value chains development is becoming popular as it promises more equitable participation and organization of the agricultural sector but with little consensus and limited knowledge on the best methodologies for chains analysis and development (IFAD, 2011). Nevertheless, specifically, in Bungoma County, the extent to which the very poor, youth and other vulnerable populations directly and indirectly participate and benefit from value chain approach has the

following challenges or barriers; lack of time or social exclusion that make them unlikely to participate if not specifically considered, inadequate required assets for market engagement, ignorance, unlikely trickle-down effect for Intra and inter-household resource transfers, inequitable balancing of resources between small numbers of the vulnerable and less vulnerable, ineffective governance and a non-enabling business environment (IFAD, 2012). Therefore, based on this literature review, maize value chain being an agricultural value chain requires careful analysis and mapping in order to enable all including the poor small maize producers and traders to participate and profit equitably.

2.2.10. Value Chain and Agribusiness

Value chain is the model for agribusiness which is the corporate arm of agriculture. It describes agricultural enterprises whose activities individually and collectively include research and development of new agricultural resources and methods, ownership and management of agricultural production facilities (Neves & Pinto 2012). The facilities are such as farmlands and livestock facilities, manufacture or distribution of agricultural supplies and equipment like machinery, feeds, seeds, agrochemicals and fertilizers. These need to be incorporated into various value chains for production, processing and distribution of agricultural products (Davis & Goldberg, 1950).

Further, according to FAO (2009) and IFC (2013), agribusiness is a concept characterized by raw materials that are mostly perishable, variable in quality and not regularly available. It also continuously pursues new technologies with the purpose of

boosting agricultural efficiency, productivity and competitiveness by reducing wasted resources, saving time, improving output and increasing profits (JADEE, 2010). Moreover, global agribusiness embraces value chain approach in depicting industrialization and commercialization of food and farming. This is whereby farmers get a bigger share of the money spent on food by consumers as the food products move from the farm to different markets in different forms and levels across the globe and get sold at higher prices (Norberg-Hodge *et al.*, 2002).

Regionally, Africa still holds about 60% of the world's arable land with numerous agribusiness opportunities which require the application of value chain approach in order to tap the agricultural opportunities for sustainable food security and wealth creation (Watson, 2013). Consequently, in Kenya, the government is being advised by the ministry of agriculture to invest in value chain approach for agribusiness development so that the agricultural sector can be transformed into an innovative, commercially oriented, competitive and modern industry. This is supported by ASDS (2008) and Kenya Vision 2030 (2008) reports that agree that agribusiness development can effectively enhance food security and poverty reduction, especially in the rural counties like Bungoma.

Therefore, like value chain, agribusiness is a multi-dimensional systemic concept that inter-relates all business stages, activities, services and players in the agricultural development and hence by employing value chain approach agribusiness can strongly enhance maize productivity, food security and wealth creation (Jamandre, 2010).

Agricultural business (Agribusiness) sector has various resources that include money, labour, materials, equipment, buildings, land, administration and management. while the agricultural value chain players/actors are input suppliers, farmer/producers, transporters, processors, traders, buyers, service providers or chain supporters and chain enablers that could be harnessed and coordinated through value chain approach for increased agricultural productivity and creation of wealth (ASDS, 2008 and FAO, 2017).

Following the forgoing literature review, it has been demonstrated that value chain approach is an effective business extension approach like any other agriculture extension approach. It has the function of transferring scientific research information, new knowledge and skills to farmers and stakeholder through education if well applied (FAO, 2000). This is supported by SFSA (2014) and Muyanga & Jayne (2006) who agreed that extension approaches are methods designed to educate farmers and agriculture stakeholders. They carry useful and practical agricultural information, knowledge, technologies and skills for enhancing agricultural productivity and development. However, the players and stakeholders of a given agricultural value chain need to understand the workings of value chain approach before a value chain like the maize vale chain can increase maize productivity and incomes at each stage of the chain (Christoplos, 2010).

Therefore, this subsection of the literature review informs that in order to effectively achieve food security and improved living standards in Bungoma County, the maize

value chain and its activities need to essentially be transformed into agribusinesses. This requires that the players of the maize value chain have the understanding of value chain approach and the capacity to effectively participate in the chain's development.

2.3. Maize Value Chain

2.3.1. Overview

Globally, maize is a cereal crop that is widely grown in the whole world for livestock feed, industrial raw materials, biofuel and human consumption having have originated from Mexico where maize is defined as that which sustains life (Pingali, 2001). According to FAO (2015), maize grows in a wide range of agro-ecological zones with rainfall requirements being between 500 mm and 2500mm and it is the third most largely planted crop after wheat and rice with main producers being USA, China and Brazil respectively. However, 72% of the total maize grown is consumed in Africa where maize is the staple food, especially, in sub Saharan Africa (WFP, 2005). Nonetheless, Brittell *et al*., (2012) reported that of late the maize production has been unstable on decline due to low use of fertilizers, improved seeds that are too expensive for farmers to afford, scarcity of land, and poor climatic conditions.

In Kenya, maize is the main food crop contributing 3% of the country's GDP. However, due to the high population growth as noted by many like Pingali (2001), WFP (2000) and Langyintuo (2005), Kenya is one of the top importers of maize as it is not producing enough to feed her population unlike in the 90s when Kenya was exporting maize. It is mainly rain fed, cultivated in almost all parts of the country by 97% of the total small scale farmers who produce about 70% total maize output.

Further, maize constitutes about 80% of the food needs for the Kenyan people, especially amongst the farmers and the urban poor households which makes maize production, supply, distribution and consumption a notional food security and poverty reduction issue (USAID, 2010). Therefore, as the Kenyan population and economy grow, maize production, supply and marketing must grow at higher rates if food security and poverty reduction are to be achieved (FAO, 2012 and KARI, 2014)

In Bungoma County, maize is the staple food for the people of Bungoma as 97% her population prefers it and depends on it for food (USAID-KAVES 2015 & BCIDP, 2013). Further, according to Simiyu, (2014) and Wabwoba (2014), it is produced mainly by 86% of the County's population who do small scale farming on average land of average of 2-5 acres where they grow maize for both subsistence and cash. Moreover, upto 80 percent of all the maize produced is consumed within the producing households (BCG, 2015).

Notwithstanding the paramount importance of maize in food security and income amongst the people of Bungoma County and the whole country at large, its productivity has been declining, looking at the past four decades, leading to food security problems (Ariga *et al.,* 2006). Further, although maize value chain plays a key role in the economy of Bungoma County and Kenya as a whole, the value chain is fragmented and poorly coordinated and hence not developed (Herr, 2007). This is affirmed by the study done by USAID-KAVES (2015), who reported that the maize value chain in Bungoma County had inefficient connections between producers, traders

and consumers with poor and unreliable information systems. This is evidenced by most marketed maize going through brokers, small aggregation centres and assembling traders who sell to local and urban markets and millers, and presence of many small posho mills that process maize grain into low-cost and low-quality flour that is consumed by majority of the local people.

As evidenced by the reviewed literature, globally, and especially in Bungoma County, maize is a very valued cereal crop. In this study, the uses and importance of the maize crop were assessed in relation to their contribution to food security and poverty reduction in the county.

2.3.2 Maize Value Chain as a Business Model

According to Porter (1985) and IFAD (2003), value chain enhances market efficiency and cost effectiveness through employing cost drivers that include; economies of scale, learning, capacity utilization, linkages among activities, interrelationships among business units. There is also a high of degree of vertical integration, timing of market entry, firm's policy of cost or differentiation, geographic location, institutional factors (regulation, union activity, taxes, etc.), product differentiation and innovative technologies. This enables or facilitates all value chain players, including the poor, to equitably and effectively participate in a competitive market system thus enhancing wealth creation and reducing poverty (Kaplinsky, 2015).

Nonetheless, Kaplinsky (2015), further asserts that, for maize value chain as a business model to deliver, it is critical that the maize value chain players and those who have a stake in the activities that are performed along the chain as the maize food products move from production, through marketing to consumption, understand their roles. According to Sahoo (2010) and IFAD (2003), these players and their roles are summarized as follows; (i) Micro - actors – these are the maize farm inputs suppliers, maize producers or farmers, maize transporters, maize millers or processors, maize traders and maize food product consumers. They directly handle and add value to the maize produce as it moves along the chain; (ii) Meso – actors - these are the supporters of the maize value chain. They could be private or public institutions who provide services like value chain financing, insurance, technical capacity building, linkages, and advocacy, that are required to effective performance of the chain; (iii) Macro - actors - these are mainly government and or government institutions. Their role is to facilitate, regulate and enable the chain to achieve its goals through development and enforcement of effective policies and laws. They also ensure that there is basic infrastructure. In this study, while examining the maize value chain for enhancing food security and poverty reduction, the roles of the Micro, Meso and Macro maize value chain actors were assessed.

2.3.3. Maize Value Chain Analysis

From the literature review on value chain above (section 2.2) maize value chain describes the full range of activities that are necessary to transform maize seed into maize produce and move it through value adding activities like processing and

marketing upto the final consumer of the maize products and the waste after consumption (WBCSD, 2011) & ILO, 2015). The literature review in this section USAID (2011), also covered the maize value chain analysis in Bungoma County which included the chain's key actors, activities, interactions, constraints and opportunities at all stages of the chain, from inputs acquisition, through processing and marketing to consumption. These are highlighted subsequently.

2.3.3.1. Inputs Supply for Maize Value Chain

According to Kang'ethe (2011), the primary inputs required for maize production, post-harvest management, storage and marketing include fertilizers, seed, ploughing equipment, weeding equipment, post –harvest equipment, agro-chemical and storage facilities/equipment. The fertilizers required in the production of maize are normally planting and top-dressing fertilizers for enhancing maize yield or productivity, the postharvest and storage equipment, facilities and technologies are for reducing or preventing the post-harvest losses and lengthening the shelf life of the maize product while the transporting and marketing equipment, facilities and technologies are for the safe delivery of the maize products to their destination and to attract customers (Brittell *et al*., 2012). Bungoma County, like the rest of Kenya, relies on Kenya Agriculture and Livestock Research Organization (KALRO) and KEPHIS for research and technologies used in the maize value chain and the regulation, certification and control of maize seed production, supply and distribution in Kenya respectively. Fertilizers and seed are the most important in the production stage of the maize value chain but other inputs like mechanical tillage and planting equipment, fertilizer application equipment,

pesticides, herbicides, threshers, dryers, labour, maize stores and management skills are also imperative for maize value chain development (Smale *et al*., 2013). In addition, USAID-KAVES, (2015) also affirms that it is essential that there is timely availability of the right inputs for the given agro ecological zone for effective development of the maize value chain. However, the same author also critiqued that most of the maize small scale farmers found prices of fertilizers; research recommended maize seed and other technologies unaffordable and hence inaccessible to them.

In the maize value chain, inputs suppliers are the producers and suppliers of the inputs used in the implementation of the maize value chain activities. These include technology developers like researchers or research institutions like KARI in Kenya, manufacturers of fertilizers like Arthi River Mines, maize seed companies, and manufacturers of farm equipment none of which are found in Bungoma (Chenge, 2015 and Simiyu, 2014).

In the maize value chain there is the agro-dealers, also known as the stockists, who stock and dispense maize value chain inputs to the other maize value chain actors like the producers. They should be located in reachable distances, easily accessible and well stocked with affordable inputs (Mathenge et al., 2012 & Brittell *et al*., 2012). In Bungoma County, BCIDP (2013) reported that coverage by agro dealers possess a challenge as they are mainly found in urban towns. This is because in the remote areas where most farmers are found, the demand for fertilizers and other inputs is low and physical infrastructure is poor leading to poor business returns. The literature reviewed

in the above subsection asserts that maize farm inputs should always be easily accessible, reliable, affordable and with timely availability. In this study, the status of the maize value chain inputs supply in relation to food security and poverty reduction was assessed.

2.3.3.2. Producers/Farmers

In the maize value chain, according to Brittell *et al*., (2012), USAID-KAVES (2015) and Kirimi *et al*., (2011), producers are the farmers of maize who are categorized into three groups as small scale or level I farmers, medium scale or level II farmers and large scale or Level III farmers as explained in the following in the next paragraphs;

Small scale farmers or smallholder farmers who are those that cultivate less than 10 acres of land largely for subsistence, are food insecure and are net buyers of maize. They make about 97% of the total farmers, especially, in developing countries and they operate in low-inputs and low yields systems. They also have limited access to important services such as extension, finance, warehousing and drying services. They account for about 1% of the total maize marketed but produce about 70% percent of the total maize produce output in small per capita volumes. Moreover, smallholder maize sales go largely through brokers, who collect at low prices immediately after harvest and bulk for onward sale to large wholesalers and maize millers. The small scale farmers sale their maize immediately after harvest to meet their immediate cash demands, such as household requirements, school fees and health and also because many of them also lack storage facilities that would enable them to store for potentially

higher prices during the off-seasons. The small scale farmers mainly use family labour in their farm activities.

Medium-scale farmers produce for home consumption as well as surplus for sale and they cultivate between 10 to 25 acres of maize and account for about 10% of total maize output. They sell about 46 percent of their maize produce and use a combination of both family and hired labor. Further, they also source their inputs mainly from agro dealers and they are generally able to access financial services, warehousing facilities and can negotiate better prices for their maize depending on the volumes offered.

Large-scale farmers cultivate 25 acres and above for commercial purposes and are heavy users of commercial inputs such as fertilizer, improved seeds, chemicals and machinery. They rely more on hired labor and farm mechanization and their produce account for about 20% of the total maize production and with the economies of scale they minimize cost of production by bulk purchasing from wholesalers and distributors. Moreover, they easily access financial services, warehousing facilities and sell 99% of their maize produce at high prices as they are able to negotiate direct sales to large millers and wholesale buyers due to their large volumes. According to various studies like those of USAID-KAVES (2015), Simiyu (2014) and Chenge (2014), and the report by BCIDP (2013), majority (97%) of the farmers or maize producers in Bungoma County fall under the category of small scale farmers exhibiting all the respective characteristics. In this study, the status of maize producers in the maize value chain in Bungoma County was assessed I relation to their contribution to food security and poverty reduction.

2.3.3.3. Traders in Maize Value Chain

Maize trading or marketing, especially in "less developed" countries is unstructured and unorganized involving producers, small maize aggregators, wholesalers, brokers, retailers and transporters and hence very complicated (USAID-KAVES, 2015). Kirimi *et al*. (2011) describe the situation as where wholesalers buy maize from assemblers and directly from farmers for resale in deficit areas, to larger market centers and to millers while primary and secondary traders buy maize from large wholesalers and assemblers and sell it to smaller scale retailers and final consumers. The Bungoma County situation, according to USAID-KAVES (2015), is such that brokers dominate the maize trade whereby they act as primary and secondary traders who buy maize from farmers and wholesalers and sell to retailers, wholesalers, millers and warehouses while transporters own transport vehicles that are hired to carry maize from one place to another. Further, maize wholesalers operate mainly in the urban centers in the maize growing areas and are the primary market channels for the village level while brokers also sometimes act as agents of wholesalers and millers. In addition, due to a lack of suitable storage facilities and working capital for small village traders and assemblers, they sell quickly for quick cash turnover, usually at low prices without much concern for maize produce quality and standards.

According to USAID-KAVES (2015) and Kirimi *et al*. (2011), maize produce storage and warehousing are key to maize trading. Moreover, formal and informal warehouses provide services that include drying, bagging, fumigation, cleaning, storage, and linking with buyers at a cost. Warehousing receipts system provides receipts that are

used as collateral to get credit from several participating banks or other financial services (Brittell *et al*., 2012). Most farmers in the County lack modern and appropriate technologies for post-harvest management and storage. In addition, they are mainly small-scale farmers and so can only participate in the warehousing receipts system through group aggregation to attain the minimum volumes and standards required (USAID-KAVES, 2015 & BCIDP, 2013).

Furthermore, Kaplinsky and Morris (2001) assert that maize gains more value and trades better if it is milled. Processing of maize can be done through dry or wet milling thus milling of maize for maize meal is the primary source of value addition component of maize value chain. This is mainly done by enterprises that range in scale from micro millers to large scale millers. Brittell *et al.* (2012) adds that the products of dry milling are flour and fine meal flaking grits for making breakfast cereals while wet milling produces maize syrup, maize starch, high fructose syrup and maize oil. Other maize processed products include cooking oil and animal feed. Further, Brittell *et al.*, (2012), explains that maize millers are capital intensive and most use roller-milling technology that produces a more refined meal and they must be prepared to acquire maize from wholesalers, stores, warehouses, imports and large scale farmers to ensure that the mills are not under used. Most of the milling firms have a business line that deals with distribution of their products while others contract distributors to move most of their products linking the millers and the supermarkets and retail shops. Further, large scale millers of maize build large stocks and imports to cushion them whenever there is shortage while small-scale millers have limited capital and cannot build

sufficient stocks to cushion themselves during the off-season. In Bungoma County, maize processing mainly comprises of few medium scale millers like Hongera Millers in Webuye town and thousands of posho millers in the villages and urban centres that produce un-sifted flour using hammer mills with capacities of 10-50 bags per hour mainly for local consumers (USAID-KAVES, 2015).

Similarly, Kirimi *et al.* (2011), adds that the level at which one engages in maize trading determines the efficiency and profitability of the agribusiness activity. Maize retailers are the final maize chain end traders who sell maize products to the consumers in small quantities. Maize products that are retailed are mainly flour and grains which are accessed by most of consumers from roadside kiosks; market stalls, small shops and supermarkets, or directly from small scale milling enterprises and posho mills WBCSD, (2011). The retailers are either supplied with the maize products by distributors at their point of operation or they either collect at wholesale points or source from farmers. Due to the significant vertical integration within the maize marketing chain and the low profit margins involved, BCIDP, (2013) confirms that the retailers in the Bungoma County also include small scale wholesalers and assemblers who also get involved in maize retailing to consumers.

According to Brittell *et al*., (2012) and USAID-KAVES (2015), the high number of interconnected actors, activities and multiple potential entry points that include input suppliers, village traders, extension service providers, and rural brokers make maize

value chain analysis very complex. Figure 2.5 highlights and summarizes the maize value chain analysis process.

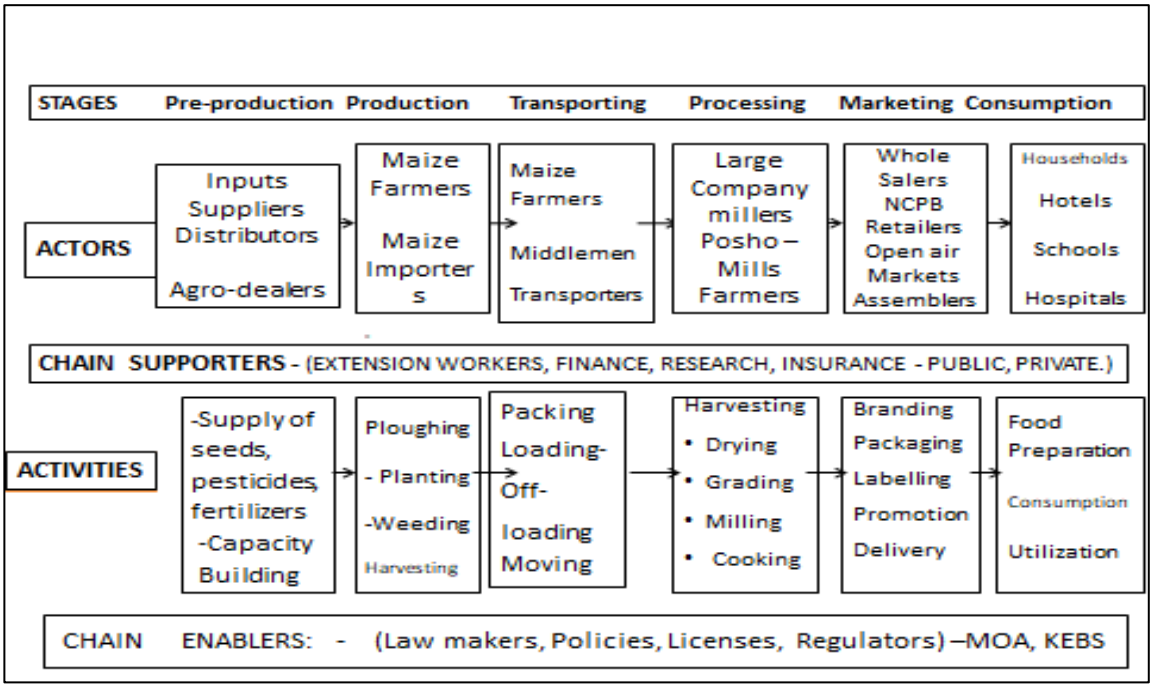

Figure 2.5: Maize Value Chain Analysis
(Source: USAID-KAVES, 2015)

Figure 2.5 illustrates the stages, actors, supporters and enablers of the maize value chain which are involved in acquiring farm inputs required for maize production, transporting maize produce from the farm to various market destinations, processing and maize trading to reach the consumers. Value chain analysis is to help identify challenges faced at different segments of the value chain and opportunities to help solve the challenges and enhance the value chain's upgrading and development (Kaplinsky and Morris, 2001).

The foregoing literature review in subsection 2.3.3 on maize value chain analysis revealed that maize value chain could help achieve food security and poverty reduction. Nevertheless, the maize value chain needed to demonstrate or have effective maize

marketing system, maize storage and warehousing facilities, maize processing industries and profitable level of maize trading. In this study the type of maize marketing system was analysed, maize storage, warehousing and processing facilities were assessed and the level of maize trading in the County was assessed

2.3.4. Maize Value Chain Mapping

After analyzing the maize value chain , it needs to be mapped in order to know who are the actors carrying out which activity and where they are located, what are the maize marketing channels and how customers access the maize products (Mitchell *et al*., 2009). Figure 2.6 illustrates how the maize produced moves from the farmers to the consumers in Bungoma County.

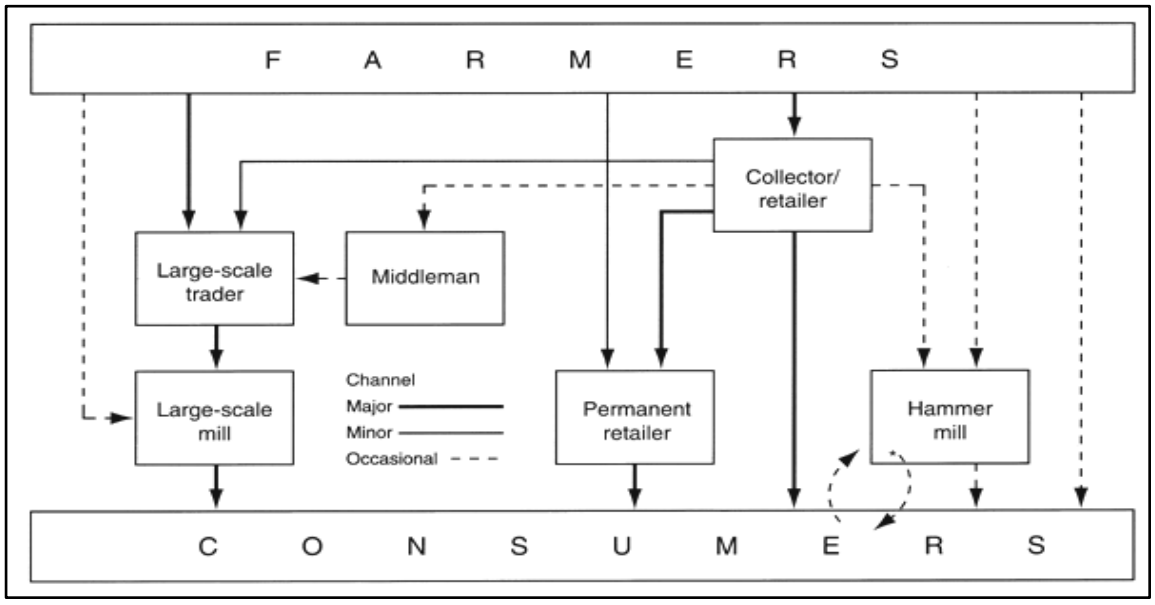

Figure 2.6: Maize Value Chain Map in Bungoma County
(Source: USAID-KAVES, 2015)

After farm inputs like farm equipment, maize seed, fertilizers and pesticides are dispensed to the farmers through the agro dealers to prepare land, plant, manage and

produce maize grain, the maize product must reach the consumers (Kaplinsky and Morris, 2001). Figure 2.6 shows a map showing the various maize marketing and distribution channels by which maize produce reaches the end users at different levels at the marketing stage in the maize value chain. However, it is notably not showing that maize is also imported into the County in order to help meet the high demand for food not met by local production confirming study findings by Wabwoba (2014), Simiyu (2014) and Chenge (2014). Therefore, from the foregoing literature review, it is evident that if maize value chain is to be enhanced in Bungoma County, it is important that the maize value chain (MVC) players who are the input suppliers, agro dealers, producers, transporters, processors, traders and enablers, fully understand what value chain is and how to apply the value chain approach.

2.4. Level of Food Security in Bungoma County

This section reviewed literature on food security and factors making maize value chain not to achieve food security in Bungoma County despite the efforts being put in place (USAID-KAVES, 2015).

2.4.1. Food Security

According to Franzkowiak *et al.*, (2014), food security is a wide and complex issue that is global, regional and local as it consists of many issues like nutrition, land productivity, income, food production systems and biodiversity. Due to its many perspectives, food security also has many definitions which identify the processes and outcomes of food security and are useful for formulating policies and deciding on

actions that lead to desired outcomes (FAO, 2007 and WHO, 2003). According to WHO (2000), people are food secure when they have enough to eat at all times to be healthy and active, and do not have to fear that the situation will change in the future. Simply put, food security is basically when a family has enough food for all of the people in the household at all times.

On the other hand, according to USDA (2006), food insecurity is part of a continuum that includes hunger (food deprivation), malnutrition (deficiencies, imbalances, or excesses of nutrients), and famine. Long-term lack of food security eventually becomes hunger, defined as an individual-level physiological condition that may result from food insecurity, and on a population level, extreme lack of food security becomes famine. The United Nations rarely declares famine status, even in cases of long-term food insecurity, since its definition of famine is quite specific – famine is declared only when at least 20 percent of households in an area face extreme food shortages with a limited ability to cope; acute malnutrition rates exceed 30 percent; and the death rate exceeds two persons per day per 10,000 persons. This is supported by FAO, IFAD and WFP (2015) by stating that one having malnutrition does not necessarily mean that one is food insecure as malnutrition can also be caused by poor health, poor care or an unhealthy environment.

Many studies as per Pingali (2001) and WFP (2000), have established that maize is globally widely grown for food for human consumption, with some used for livestock feed, industrial raw materials and biofuel in different countries. It is one of the world's

leading cereal crops cultivated over an area of about 142 million hectares (Simiyu, 2014). Infact, according to Pingali (2001), in Mexico where maize originated, maize is what sustains human life. Further, USAID (2010) asserts that maize is the second most important food crop in Africa after cassava and it is critical for food security as it used for human and animal consumption.

Furthermore, when it comes to Kenya, Pingali (2001), WFP (2000) and Langyintuo (2005), agree that maize is the main food crop as it constitutes about 80% of the food needs for both urban and rural households of the Kenyan people providing roughly a third of the caloric intake (Kirimi *et al*., 2011). Finally, in Bungoma County, many study reports including USAID-KAVES (2015), BCIDP (2013), Simiyu, (2014) and Wabwoba (2012) declare that maize is the main staple food for 97% of the population and the crop is grown by the farmers who are 86% small scale. Therefore, maize production, supply, distribution and consumption are key to food security, especially in Bungoma County and hence the words maize and food can be used interchangeably (USAID, 2010 and Kirimi *et al*., 2011).

According to (USDA, 2006), food security consists of food availability, accessibility, utilization and stability of food production systems. Therefore, since addressing food is synonymous to addressing maize in Bungoma County (USAID, 2010 and Kirimi *et al*., 2011), then examining food security would mean looking into maize availability, accessibility, utilization and stability of maize production systems or factors affecting maize value chain for food security. Consequently, maize availability, accessibility and

utilization are indicators that can be used to measure food security at all levels from global, national, household to individual (UNICEF, 2009 and Ramiro, 2009).

Figure 2.7 helps to explain the concept of food security in a simplified form as per the main source being maize.

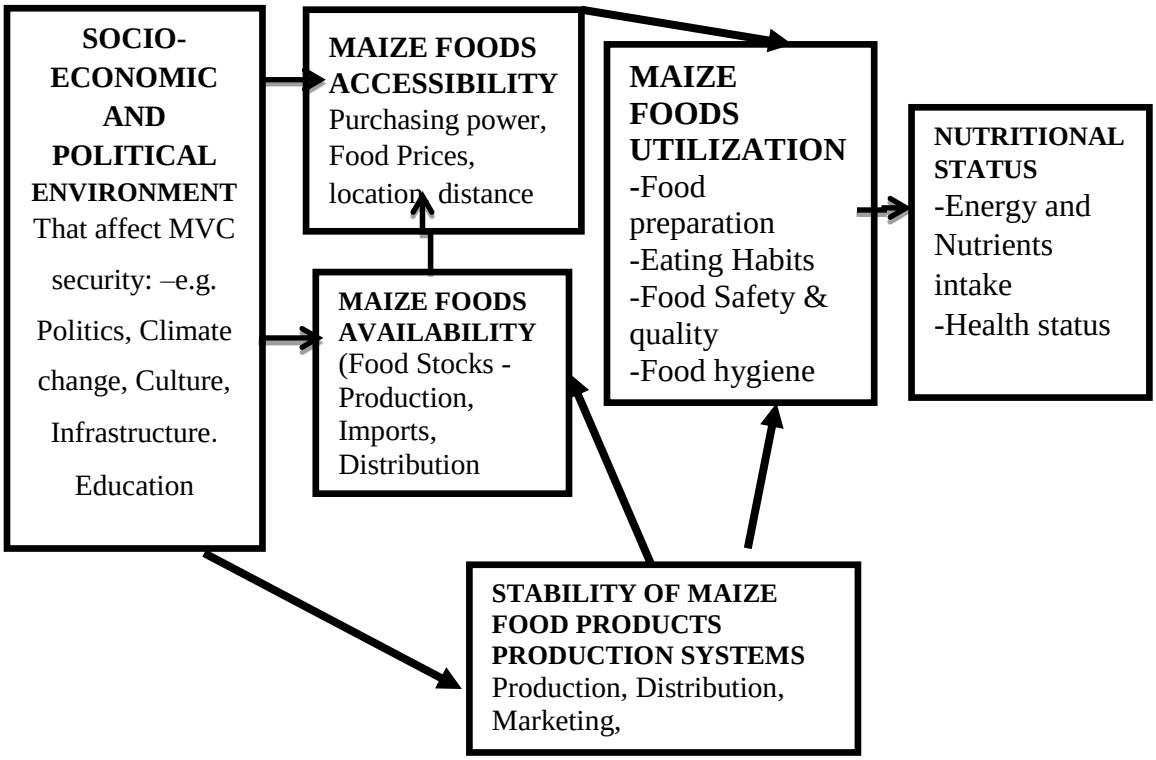

Figure 2.7: A Simplified Concept of Maize Value Chain and Food Security

(Source: Researcher, 2016).

Figure 2.7 illustrates how complex is the concept of food security as it entails very many intrinsic issues. The concept is summarized thus: There must be stable systems for maize food products to be produced, processed, distributed and marketed along the maize value chain. The maize food products must also be made available to the people in stocks or store where they are accessed through purchases or exchanges and utilized in the most appropriate way so as to obtain the required nutrients for nutrition.

According to Ramiro (2009), Mwololo (2012) and UNICEF (2009), food security could be measured by use of indicators of the food security pillars- availability, accessibility, utilization and stability of food production systems. In the case of maize and maize value chain, stocks or stores of maize food products from production, imports, household incomes, purchasing power, nutrients intake and nutrition status of the people are indicators that could be measured to reflect food security (Wabwoba *et al*., 2015). Further, Food crop (maize) production and consumption estimates and their stores and balance sheet can be used to measure only food availability while in the households nutrition status of individual members could be measured by using BMI (Body Mass Index) and MUAC (Mid-Upper Arm Circumference) to indicate the food security status of given households and hence of the community (Blumberg *et al*, 2009; Flodin et al., 2000 and IFRC, 2009). However, in studies like this of maize value chain, it would be easier to use food stores and stocks, household incomes and purchasing power and maize crop production and consumption trends and projections to measure food security (USAID-KAVES, 2015).

As already established, food security has many definitions but going by FAO (2007), food security exists when all people at all times have physical or economic access to sufficient safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. It is where; all people are able, by themselves, to obtain the food they need for an active and healthy life, and where social safety nets ensure that those who lack resources still get enough to eat. It is achieved when none of its four components is uncertain or insecure (USDA, 2006) and the maize food value chain

players understand in detail and address factors influencing the four pillars or components of food security along the value chain (Devereux and Maxwell, 2001).

Nevertheless, the world's food situation is that 75 % of the people are not food secure while 75% of the world's poor live in rural areas where most depend on agriculture for their livelihoods and are mostly vulnerable to the effects of climate change. Ironically, this rural population is the farmers who are to feed the world (World Bank, 2010). In the year 2016, (WFP, 2016), amongst many scholars, it is reported that 815 million people in the world are not food secure, meaning that they are undernourished or are not able to acquire enough food to meet their daily minimum dietary energy requirements, over a period of one year and by 2050 (IFC, 2014). Further, according to Anzoátegui (2015) and FAO (2010), there will be two billion more people in the world demanding a 70 percent increase in global food production and this is a percentage that must be brought down if the MDGs and SDGs are to be achieved

Regionally, Africa's food security is a worsening predicament with hunger claiming lives of one out of six children each year (One acre fund, 2010). According to FAO, (2010) and FAO (2014), the self-defeating question as to why is Africa food insecure while 75% of sub- Saharan Africans are farmers should be answered. For example, Kenya has a total population of over 40million (Kenyan Census, 2009) with agriculture being the mainstay of its economy. This is because agriculture directly contributes about 27% and 47% indirectly to Kenya's Gross Domestic Product (GDP) while 6% of the Nation's foreign exchange comes from agricultural exports (Kenya SRA, 2004). 75% of Kenyan population is largely rural of whom 80% depend on smallholder

subsistence agriculture for livelihood (SRSP, 2001). However, Kenya suffers from a chronic challenge to achieve food security as 47% of her population, especially in the rural areas, is still not food secure (ASDS, 2012 and Kenya Vision, 2030).

Consecutively, Bungoma County like most of Kenyan counties depends on agriculture for her economic development (BCIDP, 2013). Maize crop, mostly produced and marketed by small scale maize value chain actors, is the main crop for food and livelihoods ((BCIDP, 2013, Simiyu, 2014 and USAID-KAVES, 2015). Conversely, Bungoma County suffers from chronic and sometimes severe food insecurity reaching to the level of 67% (BCIDP, 2013, KARI, 2013 and Wabwoba *et al*., 2015). Therefore, it is apparent that achieving food security is of major concern not only in Bungoma County but also in Kenya and the whole world. In the examining of maize value chain for enhancing food security and poverty reduction in Bungoma County, this study also sought to establish the level of food security in the County.

2.4.2. Factors affecting maize availability and maize accessibility

From the literature reviewed, in Bungoma County maize availability means food availability which basically means having sufficient food that is available to ensure that everyone is adequately fed. In the maize value chain, maize or food availability is addressed at the production and storage levels of the chain where it is determined by the physical quantities of maize that are produced, supplied, distributed and stored (USAID-KAVES 2015). It is the net amount remaining after production, stocks and imports have been summed and exports deducted for maize in the food balance sheet

USAID, (2009). Adequacy is assessed through comparison of availability with the estimated consumption requirement for each food item which takes into account the importance of international trade and domestic production in assuring that a country's food supply is sufficient (Ramiro, 2009). The same approach can also be used to determine the adequacy of a household's food supply, with domestic markets playing the balancing role. High market prices for maize food products are usually a reflection of inadequate availability; persistently high prices force poor people to reduce consumption below the minimum food required for a healthy and active life, and may lead to food riots and social unrest. Specifically, according to Olwande *et al*., (2009), (Kang'ethe, 2004) and Wanyama *et al*., (2009), maize availability in Bungoma County and Kenya as a whole, is determined by factors of production like available land, rain reliability, crop technology used, agriculture extension services availability, cost and availability of maize farm inputs, farm capital, farmer education level, infrastructure and farm management skills.

Food accessibility is the second pillar of food security after food availability. According to FAO (2997), it is a measure of the ability to secure entitlements, which are defined as the set of resources (including legal, political, economic and social) that an individual requires for obtaining access to food. The concept of food security is much more than just production of maize and maize food products at county, national and global levels. It expands to include households' and individuals' access to maize and other food products (USAID, 2009). Further, Mwololo (2012) clarifies that the mere presence of an adequate maize supply does not ensure that a person can obtain

and consume food – that person must first have access to the maize through his/her entitlements (legal, physical, social and economic). In Bungoma County, The entitlements that determine people's access to food are exhibited or displayed through ways like maize allocation mechanisms, maize affordability and their cultural and personal preferences for maize food products (BCIDP, 2013 and KARI, 2013). In the maize value chain, the food access entitlements that make the people's access to food to be accelerated by their income, purchasing power, farm and off-farm activities, maize prizes and their physical distances from markets are addressed at the marketing stages of the chain (USAID-KAVES, 2015). In this subsection, literature review highlighted that there are many factors influencing maize availability and food accessibility and hence food security. In this study, effective proposals and suggestions on how to solve or mitigate these challenges so as to enhance maize value chain and food security.

2.4.3. Factors affecting maize utilization

Food utilization on the other hand is indicated by food consumption patterns, dietary intake and nutritional status will indicate food security status (UNICEF, 2009). It refers to the nutritional benefits that one gets from the food eaten which refers to the biological capacity of individuals to absorb and utilize nutrients in the food that they eat as well as the type and form of the food eaten (IFC, 2013). This effectively depends on how food is prepared and consumed besides the available food being safe, nutritious, sufficient and acceptable.

On the other hand, according to UNICEF (2009), food utilization is important at the household level and critical at the individual level as it is indicated by food consumption patterns, dietary intake and nutritional status. It brings together both the quality of the food and other complementary factors such as safe water that underpin good nutritional outcomes. This is further explained in Makali (2012), that food utilization also ensures that the nutritional outcomes of every individual in the household are adequate by considering the use of food and how a person is able to secure essential nutrients from the food consumed. In this case where maize is the main source of food, maize utilization is addressed at the maize processing, value addition and consumption stages of the maize value chain (USAID-KAVES, 2015). Consequently, nutritionally maize contains approximately 72% starch, 10% protein, and 4% fat, supplying an energy density of 365 Kcal/100 g (WHO, 2014). Therefore, maize utilization must look out to ensure that the nutritional value of the diet that includes its composition, methods of preparation, social values, type, methods of serving and as well as the quality and safety of its supply are observed to avoid issues like body wasting, stunting, underweight, and malnutrition (IFRC, 2009).

Moreover, while considering food utilization, sub-nutrition which is synonymously known as hunger that results from food intake that is continuously insufficient to meet dietary energy requirements must be looked into (IFRC, 2009 and USDA, 2006). KVAES (2015), BCIDP (2013), KARI (2013), Simiyu (2014) and Chenges (2014) all concur that sub-nutrition is of paramount importance when it comes to Bungoma County where maize is the main staple food and its supply has been on decline trend in

the last few years. Moreover, an adult person in the county eats at least 1.5 bags of 90kgs in a year in the form of maize flour for Ugali, porridge and grain for Githeri (cooked maize and beans mixture) while the Kenya national estimated maize uptake is at 88kgs per person per year (Kirimi *et al*. 2011). This means that if Bungoma County does not increase its maize production and productivity, her people risk encountering hunger whose measurement is typically indirect and based on food balance sheets and national income distribution and consumer expenditure data (USAID, 2009).

The literature reviewed in the above subsection outlined that the average intake rate for maize per person in Bungoma County is estimated to be 135kgs against the national rate requirement per capita of 88kgs annually yet the County is still not food secure. This could mainly be due to over reliance on maize for food as guided by culture leaving little room for diversification of other acceptable sources of food. This study sought to establish the level at which the people of Bungoma County relied on Maize for food.

2.4.4. Factors affecting stability of maize production systems

Finally the fourth pillar of food security is the stability of maize food production systems. This is determined by the temporal availability and access to food which includes food production, storage, processing, distribution, marketing processes and in-built mechanisms that protect the global food system from instability (WHO, 2003). The increases in the frequency and magnitude of food emergencies for which neither the global food system nor affected local food systems are adequately prepared,

increase food system instability and hence food insecurity which calls for disaster management of food security risks.

According to KNBS (2014) and Kenya Economic Survey 2014, maize production and productivity in Kenya, which is largely concentrated in Rift Valley ,Western and Nyanza regions, have been increasing and erratically declining respectively in the recent years. In Bungoma County, maize crop productivity has been declining for more than a decade and now the average yield in the region was at 8-13 90kg bags per acre (Simiyu, 2014). The key factors in maize production and supply that influence maize value chain in the county include;

Small Farm holdings which cover 97% of the maize farmers who are small scale resource poor farmers owning an average of 2.5 acres. The small land sizes and poor farmer status do not facilitate for land mechanization and effective adoption of research recommended technologies which mainly results into low productivity and subsistence consumption (Chenge, 2014 & Simiyu, 2014). This leads to unsustainable performance of the maize value chain (Msuya, 2008). Most farmers are challenged by the high costs of maize production which includes costs of land preparation, fertilizers, maize seed, planting, harvesting, shelling, transport and storage. These costs, especially for farm machinery, labour and maize farm inputs are very high for the small scale farmers who are the majority maize producers. This results into poor and untimely land preparation and farm management leading to low maize yield and low maize supply for sustaining the maize value chain (Wekesa *et al*., 2003).

Agricultural extension service approaches employed highly determine the capacity of the maize value chain actors to exhaustively exploit the available resources for increased productivity and adoption of the available innovations and technologies (Nin *et al.*, 2003). According to Mapila (2011) and FAO (2010), the desired innovations and researched technologies can only effectively reach the target end users through an effective agricultural extension service approach. This is because effective access of the services will enhance the reception and adoption of the recommended agricultural technologies for related maize value chain activities. The activities encompass maize production, processing, distribution, preparation and consumption of the maize food products. However, the conventional agricultural extension approaches that Kenya, including Bungoma County, has been employing are costly with poor information packaging and insensitive to farmers' needs and focusing on farm production and productivity (Belay & Abebaw, 2004). These have left almost 80% of the farmers food insecure and poor (Reij & Waters-Bayer, 2001). These approaches include the national government extension system, progressive or model farmer approach, integrated agricultural rural development approach, commodity-based systems, farm management, training and visit (T&V). Others not to be left out include attachment of officers to organizations, farmers' field schools (FFS) and National Agricultural and Livestock (NALEP) (Muyanga & Jayne, 2006). All these approaches are fairly centralized and government-controlled mainly focusing on agricultural production. Their success is mainly measured in the adoption rate of recommendations, numbers of farmers actively participating and increases in national agricultural production (FAO, 2000). Their lack in holistic focus or non-use of value chain approach to food security

generally renders them incapable of meeting evolving challenges and demands for food security and poverty reduction (SFSA, 2014, Anderson & Fedder, 2004 and Jean-Philippe Deschamps-Laporte, 2013).

Environmental degradation which includes desertification, deforestation, environmental depletion and environmental pollution enhances environmental vulnerability or lack of capacity for the environment to effectively support the ecosystems. This leads to reduced amount of arable land, land productivity, production of maize food products and consumption of maize food products thus making the maize value chain unproductive. Further, according to USAID-KAVES (2015), climatic variability and climate change are a major factor in maize production in Kenya where maize is predominantly a rain fed crop. Thus the maize crop is highly vulnerable to droughts, floods and storms (hail stones) which can cause upto 90% crop loss or failure. While climate change is good and bad for food production, its pace of change can exacerbate localized problems such as flooding and droughts (FAO, 2007). Nonetheless, food production produces significant quantities of Green House Gases. Further, modern, conventional agricultural practices aimed at increasing yields include intensive application of oil-based farm inputs and irrigation systems which require large inputs of energy and therefore environmentally unsustainable (FAO, 2010). Moreover, according to UNEP (2009), unchecked modern food production techniques are likely to cause serious degradation to the environment. This is mainly through soil erosion, loss of fertility and reduced biodiversity thus acting as a catalyst to human-induced climate change. Therefore, it is of global concern that meeting the

food security challenge must be achieved sustainably that is by use of environment friendly technologies and farm practices across the agricultural value chains.

Maize crop faces pests and diseases of which some are becoming resistant to insecticides and fungicides. These include viral and fungal diseases like Maize Chlorotic Mottle Virus (MCMV), Maize Lethal Necrosis Disease (MLND), striga and Fall Army Worm (FAW) and other species of armyworms in Kenya and Liberia (FCI, 2017). According to Kamau *et al*., (2013), these emerging pests and diseases may consume large quantities of crops once they are grown. They may also prevent the maize crop from growing at all and cause devastating results to maize production either by consuming or destroying large quantities of the maize produce. In addition, the increased temperature due to climate change, also adds to increased activity by the insects and vectors of diseases thus worsening the maize value chain sustainability and food security situation;

Poverty is also a factor that affects the maize value chain. FAO (2010) reveals that poverty is unmistakably a driving factor in the lack of resources to purchase inputs for producing maize food products or purchase adequate food. It plays the major role in food insecurity, especially, in developing countries where about 1.6 billion people live on less than one dollar a day. USAID (2009) affirms that generally, if there is too little food in the household, it is the result of inadequate purchasing power driven by poverty rather than of market failure. Moreover, at the national level, if a country does not

produce all the food it consumes then it must import food and a number of countries, in the developing world, are too poor to purchase food on the international market (FAO, 2010). These result into a structural food deficit and international food aid must make up the shortfall. Additionally, at the local and household levels, the maize value chain market distribution system needs to be adequate to ensure that food is available and affordable at all market places.

As regards Post-Harvest Losses, Barros (2013) asserts that there are inadequate appropriate agricultural technologies in post-harvest management for increasing maize produce handling efficiency, productivity, and profits. Appropriate technologies in maize value chain or agribusiness development (shelling, processing, storage and transport), promises increased productivity, food security and incomes. It is expected that the technologies would help prevent, the estimated 35% - 37% of maize harvested going to waste and financial loss before it is marketed or consumed (KNBS, 2014 and (FAO, 2014).

High rate of population growth is also factor in the development of maize value chain as the world's population is predicted to hit 10 billion by 2050 and with it food demand is predicted to increase substantially (FAO, 2012). This is more so in the sub Saharan Africa whereby the birth rate is at about 85,000 people per day while death rate is at 35,000 people per day meaning that the population in this region is growing at 50,000 persons per day (Smil, 2000). However, only 25% of this population is food secure (FAO, 2007). This simply calls for more food to be produced, especially in developing

rural countries and counties like Bungoma County. This is because this is where, although it seems that population grows exponentially, maize food product grows only arithmetically, while food distribution is either political or logistical, continuing to be a problem to feed the continuously increasing population thus becoming a compounding issue of food security

Underdeveloped infrastructure affects the maize value chain in that maize food product or produce losses increase further after harvesting during transportation, storage and marketing of people's culture influenced type, form and place to receive their food (UNEP, 2009). Credit availability to small scale farmers is necessary for an efficient and sustainable production system for a productive and profitable maize value chain to enhance food security, especially in the African developing countries (Nweke, 2001). For this to happen, there need to an effective financing system to the small scale farmers so that they may timely and adequately acquire the required farm inputs like technologies, machinery, fertilizers and seed (Odoh, *et al*., 2009). Agricultural farm credits from relevant financial institutions that are affordable and accessible to the small scale farmers are recognized as one of the prerequisites for attaining sufficiency in farm production and sustained agricultural value chains (Omonona *et al*., 2008 and Odoh, *et al*., 2009). However, the available farm credit market demands different forms of collateral like land title deeds, social group registration certificates, house hold goods, livestock and vehicles from the small scale maize farmers before giving out credit. This discourages and alienates the farmers thus affecting the efficiency of the maize value chain and food security (Odoh, *et al.*, 2009).

According to FAO (2007), there are other various factors that may look insignificant but they do affect the performance of the maize value chain and food security status of some people in the community. These include food preferences, gender, health, social status, education and age. This means that the food eaten may not always be sufficient or nutritious to support the required daily active and health life thus making the concerned people vulnerable to food insecurity (UNICEF, 2009). Enablers in the maize value chain for food security must be able to facilitate the chain to identify and remove all major constraints to achieving competitiveness in the value chain (USAID-KAVES, 2015). They also ensure that there are equitable returns for the maize value chain actors within the local and export maize foods distribution systems by shifting focus from agricultural production to consumer demand, marketing and the coordination of product flows (NAMDEVCO, 2014).

Moreover, it works to ensure that the four components of food security (Availability, accessibility, utilization and system stability) are achieved through inclusive and effective production, distribution, processing, marketing and consumption of nutritious, safe and sufficient food at all times (USAID, 2010). However, various political and other government policies and decisions contribute to food insecurity worldwide. These include substituting commodity or cash farm produce for food produce (e.g., growing sugarcane instead of maize) and heavy exportation of food crops at the expense of food security of the exporting country (FAO, 2007). It is necessary that the government and policy makers make laws, regulations and decisions that create an enabling environment that facilitate profitable flow of maize food products from

production to consumers and ordering information from the consumers on preferences, quality and quantity to producers and traders (FAO, 2017). Diagrammatically, Figure 2.8 portrays how value chain approach facilitates the flow of food products from production source to consumers and ordering information from consumer.

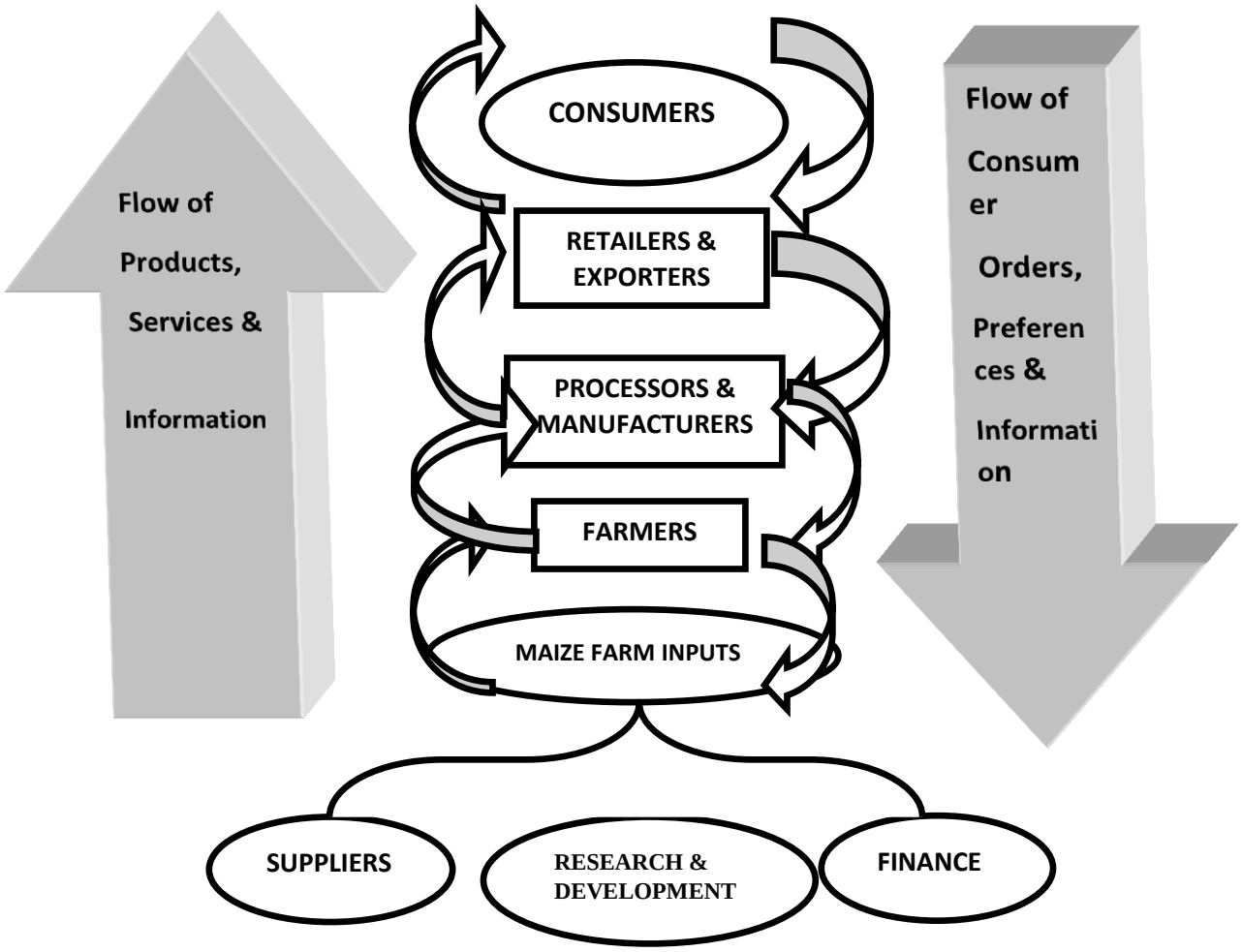

Figure 2.8: Flow of Maize Products and Information (Source- NAMDEVCO, 2014)

Figure 2.8 shows that an enabling business environment facilitates effective movement of maize food products to the consumers and market information from the consumers within the maize value chain. According to FAO (2017), these movements of food

products and their market information facilitate food availability, accessibility and utilization.

The literature reviewed in the above subsection revealed numerous aspects like small farm holdings, inefficient agricultural extension services, inaccessible maize farm inputs, maize pests and diseases, limited access to affordable farm credits and many others as factors affecting stability of maize production systems. In this study, the key factors affecting maize production system and suggestions for their mitigation were established.

2.5. Consequences of food insecurity

Food insecurity is a situation where people lack secure physical, social, and economic access to sufficient amounts of safe and nutritious food at all times for a healthy and active life (UNDP, 2010 and IFPRI, 2002). FAO (2001), states that, on an individual level, food insecurity, especially over time, causes physical, social, and psychological problems in both children and adults which include paradoxically, obesity, especially in women and girls. Globally, chronic food insecurity (undernourishment and malnutrition) causes underweight, wasting, and stunted growth in children and higher hospitalization rates and generally poor health in infants and toddlers. Food insecurity can also lead to political instability and conflict (FAO, 2010).For example, the population of a country can (sometimes violently) protest its lack of food or rising food costs Thus, for any Nation, household or individual, it is simply essential that there is

equate and nutritious food at all times. This study sought to establish what copying strategies to food insecurity were practiced in the County.

2.6. Disaster Risk Management and Food Security:

As evidenced from the foregoing literature review on food security, USDA (2006) and WFP (2006), agree that there are many complex issues that influence food security and can cause famine resulting into hunger disasters at different levels of global, national, household and individual if not managed. According to WFP (2015) and Haddad (2004), a disaster is a calamitous event, especially, one that occurs suddenly and causes great loss of life, damage, or hardship, while disaster management is a holistic approach to planning and managing disaster and its biophysical and socio-economic impacts. Subsequently, disaster risk management (DRM) could be referred to as the systematic process of using administrative decisions, organization, operational skills and capacities to implement policies, strategies, and coping capacities of the communities to lessen the impacts of natural hazards (IISDR, 2010). Therefore, food insecurity or famine is disaster risk which is a likelihood of people dying as a specific hazard consequence and this requires strategies to be applied.

Natural disasters caused by natural hazards like droughts, floods, storms and break outs of diseases and pests are major causes of hunger and famine as they affect the economic and physical availability, access, nutrition and stability of food supplies – the four pillars of food security (WFP, 2015). In Kenya, especially, in Bungoma County, the most common natural hazards include drought, hail storms, lightning and maize

pests and disease out breaks. When they occur, they cause loss of crops, farm production assets and even homes which may take several seasons to recover (Ali-Olubandwa *et. al*, 2014; BICDP, 2013 & ERA, 2015).

This means that for any sustainable development and food security to be achieved disaster risk reduction measures (DRR) like climate smart technologies, maize crop insurance, inclusive and holistic agriculture development strategies and community capacity building should be put in place (WFP, 2015). Further, hazards may also be political, economic or social/human in nature like ethnic conflicts, wars, poor infrastructure and poor health that can cause serious food insecurity disasters or vulnerability to food insecurity (Haddad, 2004). Figure 2.9 represents a simplified relationship between hazards and food insecurity.

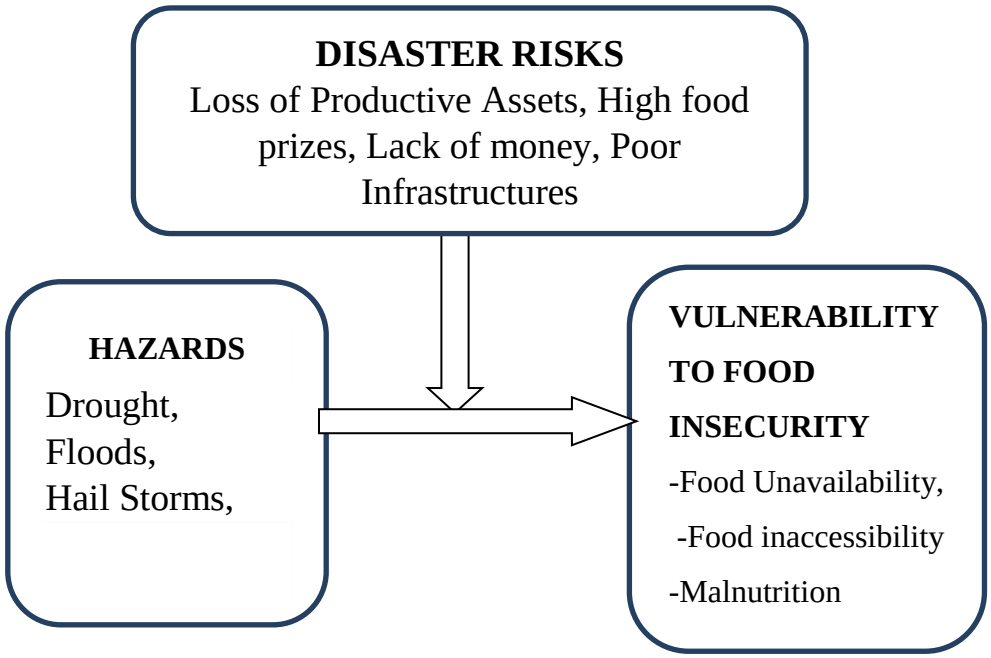

Figure 2.9: Relationship between Hazards, Risks and Food Insecurity

(Source: Haddad, 2004)

Figure 2.9 shows that disaster risk management is required in order to mitigate or alleviate the disasters or risks which are the effects of hazards when they occur so that vulnerability to food insecurity is prevented or minimized.

From the foregoing literature review, it is evident that every government must have in place disaster risk management strategies (DRMS) and disaster risk reduction measures (DRRM) to prevent or cope with extreme hunger or food insecurity and poverty. This study sought to establish what strategies were in place for disaster risk management and reduction to help cope with causes of food insecurity (hazards) like floods, droughts, storms, maize pests and maize diseases.

2.7. Factors Influencing Maize Value Chain for Poverty Reduction

2.7.1 Poverty and Poverty reduction

According to the Encyclopedia Britannica (2014), World Bank (2008) and U.S. Census Bureau (2014), poverty is a complex issue which is subjective and hence has various definitions, valuations and causes. It is usually measured as either absolute or relative after considering space, universality, method in which and how it is measured and the social, cultural and historical backgrounds of the affected people. Synonyms for poverty include; privation, neediness, destitution, indigence, pauperism, penury, meagerness, inadequacy, sparseness, shortage, paucity, scarcity and dearth. Additionally, absolute poverty is a condition characterized by severe deprivation of basic human needs, including food, safe drinking water, sanitation facilities, health, shelter, education and information. It is said to exist when people lack the means to satisfy their basic or survival needs.

World Bank (2011) states that, globally, poverty stands at 44-46 per cent, which is an improvement from 56 per cent in 2000. However, studies have established that the number of people living in extreme poverty remains unacceptably high with 17 percent of the poor people found in the developing world and living at or below $1.25 a day (FAO, 2008). Regionally, over 80 percent of the extremely poor live in South Asia (399 million) and Sub-Saharan Africa (415 million), mainly due to persistent food insecurity and climate change effects. While in Kenya, poverty rate is up to 57% of the population with poverty line at $1.46 per day in urban areas and $0.68 in rural areas. In Bungoma County, where the majority (90%) of the population, depend on the maize value chain for income and livelihoods, which is highly influenced by rain fed maize food production, high cost of maize farm inputs, unemployment, Child Labor and HIV amongst others, poverty is reported to be at 53% (FAO, 2008 and Wabwoba *et al*., 2015).

On the other hand, poverty reduction is also a multifaceted issue which is the process of employing those measures that improve the living standard of the poor, or are intended to enable the poor to create wealth for themselves after availing or meeting their necessities of life (Kaplinsky and Morris, (2001). It is about improving the poor people's economic and social capacities through efforts like employment, education and pro-poor economic growth (Cannon, 2003). Consequently, in order to alleviate or eradicate poverty, Bungoma County, like most other counties in Kenya, which have high poverty level, high population growth rate and low level of education, must have a plan for poverty reduction and disaster risk reduction (Prowse, 2003). This study

sought to establish what poverty indicators, causes of poverty and poverty reduction measures (PRM) were in place in Bungoma County.

2.7.2. Measuring Poverty Level

According to Thorbecke (2009), poverty being a complex systemic and subjective issue, its measurement is equally controversial as its measuring methodology depends on the purpose for which the information is sought and the data requirements. However, in general, for any poverty measurement, poverty dimension(s) and poverty threshold for each dimension must be defined as the threshold services to identify the poor and differentiate them from the non-poor. Moreover, in measuring poverty the indicators to be measured to assess people's conditions must be identified whether it is monetary or non-monetary, inputs or output (World Bank, 2008). Further, according to GUIO (2005), in measuring poverty, there are three main approaches used which include objective poverty, subjective poverty and multi-dimensional deprivation;

Objective poverty approach focuses on analysis of both absolute and relative poverty whereby absolute poverty is defined as a situation in which the individual's basic needs in goods and services like food, housing and clothes are not met. Relative poverty locates the phenomenon of poverty in the society from the perspective of inequality where a person is in a clearly disadvantaged situation. This could either be financially or socially. On the other hand, subjective poverty approach focuses on information on the opinion of the individuals or households and their situation in analysing and measuring poverty. It provides for understanding the subjective view of the

respondents on their financial situation as opposed to the objective focus that only uses observable and measurable variables. Whereas, multi-dimensional deprivation also called severe poverty approach, is closely linked to social exclusion and deprivation or the lack of access to certain goods and services considered necessary for society and poverty here is measured with non-monetary variables and deprivation indicators.

However, according to EUROSTAT (2002), most poverty measures are monetary and input based, with income and expenditure measures as the most obvious indicators for measure. The most common procedure when choosing which variable to use is to turn to those variables that represent an individual's income or expenditure. Both income and expenditure present advantages and disadvantages when it comes to using them as monetary variables for measuring poverty. Annual income, which in theory seems to be the best option, reflects a household's economic capacity, but it only provides a partial view. As well as income, households have other wealth indicators like goods and assets which also form part of their total wealth and influence the standard of living that households can support.

Income based measures of poverty can be further distinguished depending on whether they are based on absolute or relative thresholds. Absolute thresholds are expressed in the form of the cost of a basket of goods and services required to assure minimum living conditions and relative thresholds are expressed as a proportion of the income level (Thorbecke, 2008). On the other hand non-monetary measures of poverty are the other approaches to the measurement of poverty that are based on direct measures of

people's access to the types of goods and activities necessary for a decent standard of living. They do not use income as an indirect measure of the resources available to satisfy consumption.

Given information on a welfare measure such as per capita income, consumption and a poverty line, then various indicators and formula can be used to measure the poverty level. The following are some of the available methods of measuring poverty as given by Ravallion *et al*., (2001); (i) the headcount index ($P_0 = n/N$- where n is the number of poor and N is the total population or sample. It measures the proportion of the population that is poor. It is popular because it is easy to understand and measure but it does not indicate how poor the poor are. (ii)The poverty gap index (P^1) which measures the extent to which individuals fall below the poverty line (the poverty gaps). The sum of these poverty gaps gives the minimum cost of eliminating poverty. The measure does not reflect changes in inequality among the poor. (iii)The squared poverty gap ("poverty severity") index (P^2) averages the squares of the poverty gaps relative to the poverty line. (iv)The Sen-Shorrocks-Thon index which allows one to decompose poverty into three components and to ask: Are they poor? Are the poor poorer? And is there higher inequality among the poor? (v) The time taken to exit which measures the average time it would take for a poor person to get out of poverty. Given an assumption about the economic growth rate; it may be obtained as the Watts Index divided by the growth rate of income (or expenditure) of the poor. Literature reviewed from the above subsection highlighted the three main approaches used in

measuring poverty. This study chose to use the subjective poverty approach measuring monetary indicators to establish the level of poverty in Bungoma County.

2.8. Poverty Reduction and Disaster Risk Reduction

Poverty, rapid population growth and ignorance are some of the key factors that exacerbate disaster risk. Therefore, poor people are at higher risk of falling victims of disasters, especially natural disasters, due to their higher vulnerabilities (GTZ, 2005). On the other hand, in most cases natural disasters also worsen poverty as a destructive event results in malnutrition, homelessness and epidemics which result into hardship and desperation in the aftermath of disasters. Further, since vulnerability can cause or enhance poverty, it is very easy for the poor to remain poor or become poorer due to the devastating effects of disasters that the poor cannot recover from or take long to recover (Prowse, 2003).

According to Holloway (2003), disaster risk management (DRM) is about having in place sustained initiatives that minimize the likelihood of disastrous occurrences by reducing either the intensity of external threats (hazards) to poverty or the vulnerability of those at risk. In this case, in Bungoma County where the small scale farmers, who are generally poor, are the drivers of the maize value chain on which the economy of the county relies, measures aimed at reducing disaster risks and mitigating the extent of disasters must be put in place (GTZ, 2002). This would involve promoting strategies and measures to enhance the maize value chain upgrading so as to increase its productivity and profitability for increased incomes and economic empowerment for

the people (Mitchel *et al*., 2009 and Herr, 2000). Thus, since disaster risks occur when hazards meet vulnerability, the increased incomes from an upgraded maize value chain will reduce peoples' vulnerability to poverty and hence prevent or reduce disasters like deaths (Cannon, 2003 & Trommershäuser and Kausch, 2004). On the other hand, factors like low income, climate change and illiteracy are risks to poverty reduction as they make the poor more vulnerable.

Value chain approach is especially important in increasing farm incomes and reducing poverty for small holder maize value chain actors and vulnerable groups. These include the female, disadvantaged ethnic groups and people prone to diseases, because they often have the least commercial relationships, least access to learning, and generally reap the least benefits from their economic activities (Guidi, 2011 and USAID, 2010). Therefore, the application of value chain approach to the development of maize value chain addresses the systemic constraints of pro-poor growth industries, which helps to enable communities to sustainably increase incomes, accumulate -assets and permanently escapes poverty.

Climate effects like erratic rains, droughts, floods and hail stones are a big threat to the maize value chain for poverty reduction as they cause reduced maize yield, productivity and incomes due to reduced amounts of maize products for sale. Droughts are known to cause upto 100% maize crop failure plunging the poor small scale maize farmers back into poverty after investing their meager resources into the

costly maize farm inputs and land preparation (KARI, 2013, CGB, 2013, BSR, 2009 and Kenya Economic Review, 2014).

According to Alene *et al. (*2000) and Agrekon (2006), the role of education in maize farm management, technology adoption and resource allocation decision making by maize value chain players cannot be overestimated. However, the small scale maize farmers found in developing countries are of low level education and sometimes illiterate. This denies them the capacity to think critically and use information sources efficiently which is very costly as they either lose money or opportunities to make money hence remain poor or become poorer (Najafi, 2003 and WFP, 2009). On the other hand, producers with more education are more aware of sources of information and more efficient in evaluating and interpreting information about innovations, technologies and opportunities to earn or increase income. Therefore, they hence have a more improved living standard than those with less education (Simiyu, 2014). Education is vital for the coordination, harmonization and incorporation of methodologies and technologies for the upgrading of the maize value chain for increased incomes for the value chain players. The maize value chain actors need education for effective analysis the market situations so that they can capture opportunities for improved competitiveness and hence increase incomes for its players and reduce poverty (Chenge, 2014). From the foregoing literature in the above subsection, key factors affecting poverty reduction and disaster risk reduction were outlined. This study sought to establish the factors influencing poverty reduction and what measures were in place for poverty reduction and disaster risk reduction.

2.9. Value Chain Approach for food security and poverty reduction

According to IFPRI (2002), poverty and insufficient food supply go hand in hand as people must have money, income or other resources to enable them access food. Value chain approach is a method of examining farming problems in a more comprehensive setting which reveals numerous potential benefits. These include reduced drudgery for laborers; the release of workers for nonagricultural endeavors; a better quality of food and fibers; a greater variety of products; improved nutrition; and increased mobility of people (Shepherd, 2004). The release of farm manpower from farming into off-the-farm jobs has the basis for the country's economic growth and development due to increased worker productivity, which in turn spurs creativity, more products and improved living (Davis & Goldberg, 1995 & Ricketts *et al.*, 1999). Moreover, agribusiness demands continuous pursuit of new technologies and research so that agricultural efficiency is enhanced by reducing wasted resources, saving time, and improving output (Beierlein *et al.*, 1995). All these translate into increased income, food availability, consumer purchasing power and improved food utilization and hence, an improved standard of living (Davis & Goldberg, 1995).

Moreover, since Africa still hosts 75% of the world’s poor whose livelihoods are found in the agricultural sector, it means that agriculture remains fundamental to the region’s economic growth, food security, poverty alleviation and environmental sustainability (Webber & Labaste, 2010). Consequently, value chain perspective, which is pro-poor and provides the means for understanding relationships between chain players for increasing efficiency, productivity and value, would be the approach to enhance

agriculture's productivity and poverty reduction in Africa (ADB, 2005). Therefore, value chain approach, which if effectively employed in the development of maize crop in Bungoma County, would enhance food security and poverty alleviation to a large extent.

2.10. Challenges faced in the maize value chain for food security and poverty reduction

Ninety percent of the population of Bungoma County is made of vulnerable and poor populations who are generally disadvantaged or marginalized based on their economic, environmental, social, or cultural characteristics (FAO, 2012). These people tend to be more isolated from the mainstream economy, have far fewer assets, and suffer from more disadvantageous (or exploitative) relationships with the private sector. They also have limited capacity to make informed choices in engaging with mainstream markets and allocating scarce resources in investment decisions. Further, according to Guidi (2011) and Lustig (2012), there are other issues preventing the poor and other socially and economically disadvantaged from effectively participating in the market maize value chain. These factors include farming attitude, existing land tenure regime, limited other non-agricultural income and employment sources, inadequate access to critical and basic socio-economic infrastructure like communication networks, credit facilities and insurance (Audsley *et al*., 2010). However, although all of these factors of diversity and vulnerability tend to reduce the role of the poor small scale farmers in maize value chain development, the county depends on them for the maize food crop production as they make 97% of farmers in the county (USAID-KAVES, 2015).

Therefore, through value chain approach which is a pro-poor or pro-vulnerable approach, these challenges faced in efforts to achieve food security and poverty reduction can be examined holistically and sustainable solutions developed through effective maize value chain analysis (Albu, 2008 and FAO, 2012).

2.11. Strategies for enhancing Maize Value Chain

According to Guidi (2011), Audsley *et al*. (2010), ISDR (2004) and Porter (1985), the concept of value chain and value chain approach implies that the agricultural value chains development strategies must significantly contribute to sustainable food security and poverty reduction. These strategies include: (a). Capacity building of the value chain players – The maize value chain players need to be facilitated to combine their strengths and available resources to individuals, households, businesses and communities to help understand and effectively participated in the development of the chain; (b). Transaction costs reduction-The different private and public actors participating in an agri-business development endeavour share the goal of reducing transaction costs as a way to bring about efficient allocation, shared economic benefits, and competitiveness of the value chain on either local or export target markets; (c). Entrepreneurship of smallholders – The endogenous and exogenous drivers can stimulate entrepreneurship among micro value chain actors across the chains' activities. Their participation in an organized manner and the associated institutional arrangements can display their entrepreneurial qualities; (d). Public goods delivery along the value chain must be recognized - A diverse array of public goods are interlinked with proper agricultural markets, some of which are non-commodity

outputs of social and ecological value, some are basic infrastructures such as energy, roads, telecommunications and water supply, and some are services necessary for pro-poor agricultural market growth; (e). Technological dimension and sustainability-Farming techniques, technology and know-how implemented by smallholders in their farms. These include those technics implemented during harvesting, post-harvest and commercialization phases are conducive to both environmental stewardship and fair labour and social standards. These strategies which include transaction costs reduction, entrepreneurship of small holder value chain players, public goods delivery and technological dimension and sustainability must be recognized and developed for effective development of the maize value chain.

As noted earlier on, achieving food security and poverty reduction on national, household and individual levels have remained elusive for the Kenya Government for many years (Kenya Economic Review, 2014, GOK, 2012). In its efforts towards the challenges of food security and poverty reduction, the Government has employed strategies, policies, programmes and projects like ERS, SRA, Vision 2030, ASDS, ABDS NMK, NAAIAP, , SHEP UP, THVC but food security and poverty reduction being complex and holistic issues still remain glaringly to be tackled (GOK, 2010). It is the poor, weak, marginalized and minority who are mainly vulnerable to poverty and lack of food security, strategies for enhancing value chain, which is a pro-poor development approach, would be the best strategies towards addressing the challenges of food security (Kirimi *et al*., 2011 and FAO, 2017).

2.12. Methodological Approaches relevant to current study

On studies done on agricultural value chains, (Bitsch, 2000b and Sterns *et al*., 2001), indicate that the prevailing agricultural economics epistemology of positivistic knowledge is inappropriate for the study of agribusiness which in contrast to the traditional arenas of agricultural economics studies, should be designed to be:

(i) Theory generating, developing, qualifying and correcting instead of theory disconfirming

(ii) Capable of examining phenomena that are not readily quantifiable, stable nor distinguishable

(iii) Describing and interpreting new or not well-researched issues,

(iv) Evaluating, policy advising, and action researching and directing research at future issues.

Moreover, given that food security and poverty reduction are complex and heterogeneous issues, each with its own distinct characteristics, relating to maize value chain development for its redress in Bungoma County; it requires the understanding of the broader issues that are involved in the value chain concept (Kaplinsky & Morris, 2004). This means that approaches used in value chain studies are diverse and subjective. However, a value chain study must address the following outline; (i)The point of entry for value chain analysis, (ii) Value chain mapping, (iii) Product segments, (iv) How producers access final markets, (v) Benchmarking production efficiency, (vi) Governance of the value chain, (vii)Upgrading in the value chain and (viii) Distributional issues

These assertions were confirmed by many researchers like USAID-KAVES (2015) who carried out a study on maize value chain analysis in Bungoma through field surveys, focus group discussions (FGDs), and key informant interviews to update outdated information, validate secondary sources, and primary data collection for specific information. The findings were that maize is the main staple for the people of Bungoma; it is mainly cultivated by small scale farmers who make 97% of the farmers and are net buyers of food. Similarly, Wilson *et al*., (2015) carried out the same study in Tanzania and found that maize value chain in Tanzania was not coordinated and it is dominated by heavy presence of the government actions, donor interventions and a few large-scale operators and brokers. They used a consultant who carried out a field survey and a workshop was used to validate the study report. Further, another study on maize value chain analysis was done in Uganda by UG-ICG (2003), to establish what the vertical and horizontal chain linkages were and the methodology used was the analysis of strengths, weaknesses, opportunities and threats (SWOT). The findings were that the maize value chain in the country was well inter linked for the maize supply chain but not for the other segments of the chain.

From the literature reviewed on relevant study methodologies, the researcher used SWOT, surveys, consultancy or evaluation research designs and interviews, key informants (KIs), focus group discussions and observations as methods of data collection in the study on maize value chain. Further, the main data collection tools used were questionnaires, checklists and guidelines, obtaining respondents for interviews by various sampling strategies.

Consequently, based on the reviewed reports of former relevant studies, the study designs used in this study were cross-sectional survey, descriptive & inferential statistics and evaluation research designs. They facilitated to ensure that the study was robust, comprehensive and well-developed through collection of data by use of many methods Baggett (2003) and Patton (2001). Similarly, the study used observation, interviews, key informants and focus group discussion methods by use of questionnaires, checklists and guidelines with respondents obtained for interviews by various sampling strategies to collect data. These research designs, methods and sampling strategies helped collect data and analyse it to establish the level of maize value chain development, examine factors that influence the maize value chain for food security, examine key factors that influence the maize value chain for poverty reduction and evaluate strategies for enhancing maize value chain.

2.13. Theories Relevant to Current Study

A theory is a model, system, philosophy or a viewpoint. This study was based on Michael Porter's Value Chain Model (Porter, 1994), which is a set of interrelated value adding generic activities common to a wide range of businesses including agricultural businesses (agribusiness). The idea of the value chain is based on the business process view of organizations, the idea of seeing a manufacturing (or service) organization as a system, made up of subsystems each with inputs, transformation processes and outputs. Inputs, transformation processes, and outputs involve the acquisition and consumption of resources – money, labour, materials, equipment, buildings, land, administration and management. How value chain activities are carried out determines costs and affects

profits (Value-Links, 2013). However, the model is very general therefore must be toned down and details customized to each value chain, especially for agricultural value chains (USAID-KAVES, 2015).

Value chain is a complex and holistic approach to business competitiveness which is pro-poor and inclusive and therefore, can be used to address food security and poverty reduction, thus applying the concept of sustainable development (Redclift, 1987 and FAO, 2007). The concept, according to FAO (2017), states that development is the improvement of quality of life that results from economic growth, which is defined as the increase in productive capacity that leads to added quantities in goods and services like food, clothes, medical services and shelter. However, development should reflect the levels of standards of living due to the increased availability of goods and services which is also relative, as it should reflect on what a given society considers valuable. Thus sustainable development (SD) has many definitions. According to Redclift and Pearce (1990), sustainable development is the science of managing the environment and its resources, in balance with economic growth, while IISD (2002) defines sustainable development as environmental, economic and social well-being for today and tomorrow, and most define SD as simply the balancing of economic growth with social development and environment protection. However, the landmark definition which is widely quoted is the one from Our Common Future which states thus “SD is the Development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WECD, 1987). It considers ecology, economic, socio-cultural, human rights, social justice, technological and political

systems and all factors both natural and human operating at all levels, grassroots, regional, national and international.

The concept of SD contains within it two key concepts; First the concept of needs, in particular, the essential needs of the world's poor, to which overriding priority should be given. Secondly, the idea of limitations imposed by the state of technology and social organization on the ability of the environment to meet present and future needs. Therefore, in addressing the maize value chain for food security and poverty reduction, we are addressing economic development as we improve the value chain's productivity, profitability and improved incomes for improved living standards. We are also addressing the social component when people's food security and living standards improve. However, most of the time in concentrating on the economic and social development, the environment component is forgotten when we need to conserve and protect the environment for providing the land, soil, air and climate that are needed for the economic and social developments (FAO, 2017). Further, sustainable development requires that we see the world as a system—a system that connects space–that is, what happens in one part of the world e.g. Pollution, affects the other parts of the world. A system that connects time in that the decisions made by our fore fathers about how to farm the land for maize production continue to affect agricultural practice today whereby soil fertility has declined and land is degraded leading to low maize yields (KARI, 2014 and FAO, 2015). To summarize all these, Figure 2.10 depicts how intertwined and systemic is the concept of sustainable development.

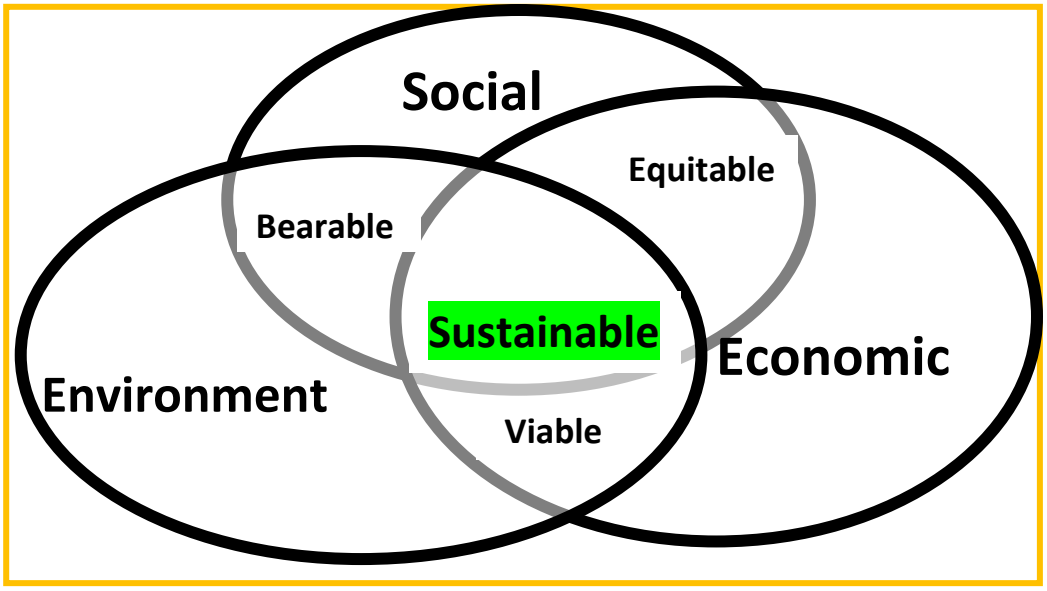

Figure 2.10: Interrelationship between Economic, Social and Environmental Needs (Source: WECD, 1987)

Figure 2.10 illustrates that the concept of sustainable development must be applied in developing strategies for upgrading and developing maize value chain for sustainable food security and poverty reduction. This also means that developing maize value chain must endeavour to balance the needs for economic growth, social capital and environmental protection in the community.

2.14. Conceptual Framework

According to Sekaran (2000), Robson (2011) and Nalzaro (2012), the conceptual framework or the logical structure of meaning of the relationships among the factors that were identified as important to this study was based on the specific objectives of the study. The conceptual framework model or diagram illustrates the independent, intervening and dependent variables and their relationships in the study. It also provided a context for interpreting the study findings, explaining observations, and

encouraging theory development that is useful to practice (Camp, 2001 and Elliott, 2005). Thus, Figure 2.11 represents the conceptual framework model in this study.

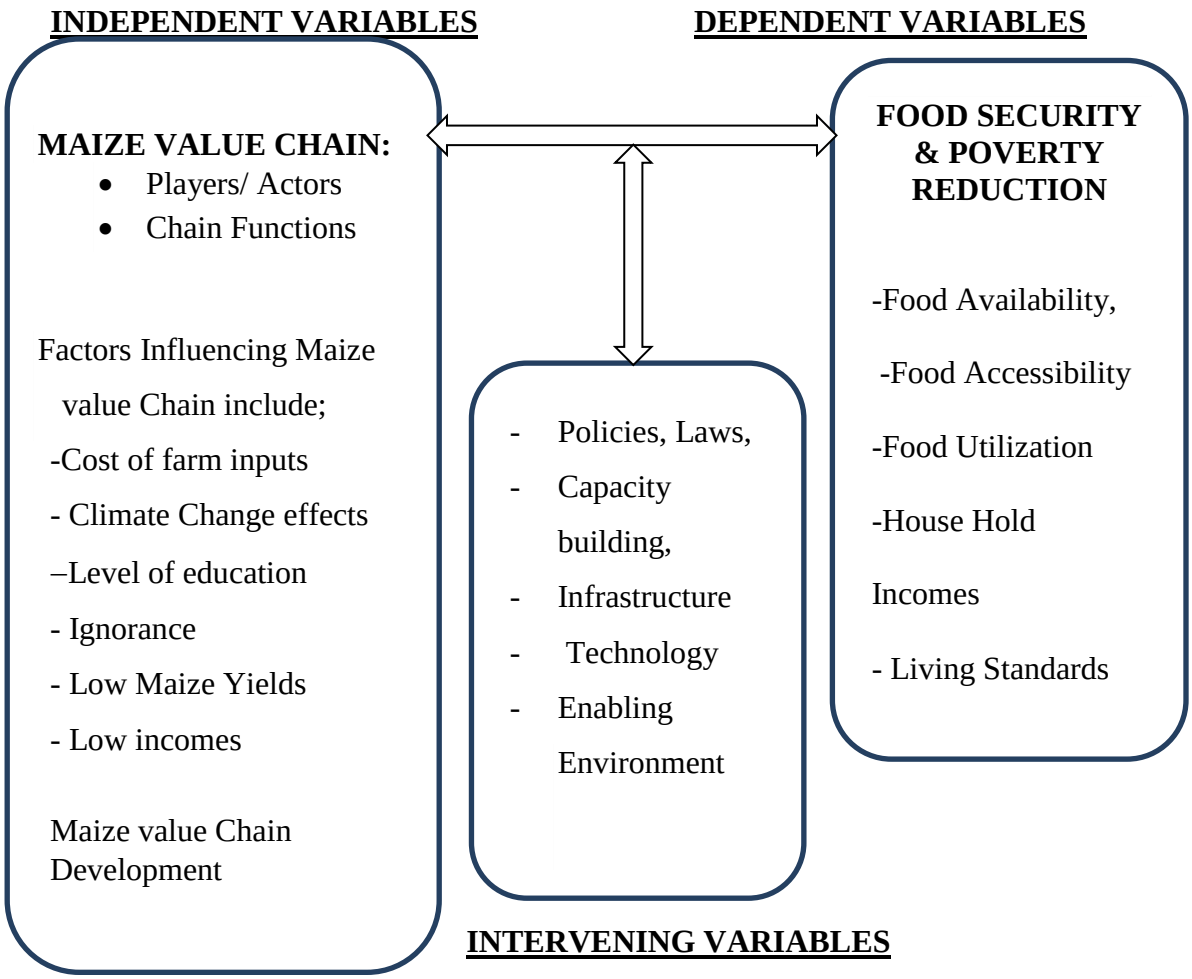

Figure 2.11: Study Conceptual Framework Model

(Source: Researcher, 2015)

In Figure 2.11, the independent variables were placed on the left side (not in any order of importance) and the dependent variables were placed on the right hand connected with an arrow implying direct relationship. Figure 2.11shows that food security and poverty reduction are dependent variables that are functions or depend on various independent factors or variables that include maize value chain players and functions.

They also depend on the cost of maize farm inputs, climate Change effects, Level of education of the maize value chain players, low maize yields, low incomes, management skills of the maize value actors and business environment. The framework also shows some of the indicators to assess food security like food availability, accessibility and utilization and those that can help measure poverty reduction like standard of living and income level.

Discussing the conceptual framework must include firstly the maize value chain players or actors to carry out the chain functions and activities so as to move the maize food products from point of production through marketing processes to the consumers for consumption and disposal of the waste. Secondly, the cost of maize farm inputs should be affordable so that maize productivity is high for farmers to produce more maize food products to adequately feed the households and have surplus for market. Thirdly, climate change effects like floods and droughts should be managed to avoid risks of total maize crop failures and food shortages as well as low maize yields and low incomes that lead to low purchasing power and hence poor access to the food products. Fourthly, the level of education of the maize value chain players determines the levels of information, adoption of maize crop technologies and decision making. Lastly, management skills of the maize value actors should be to the standards required for an effectively running maize value chain and the business environment should be business friendly and facilitative for the maize value chain functions.

The conceptual framework also shows the intervening variables which include policies, Laws and regulations for guiding, regulating and directing the maize value chain players and functions, available management skills managing the performance of the maize value chain, infrastructure and technologies for facilitating the development of the chain. The dependent variables which are food security and poverty reduction will be achieved depending on how the intervening variables impact or affect the independent variables.

In order to achieve the specific objectives of attaining a high and sustained maize value chain development level, high and sustained food security level, low and sustained poverty level and effective and sustained maize value chain enhancing strategies, the intervening variables needed to address the factors or challenges under the independent variables. Achieving this would lead to the overall outcome of an enhanced maize value chain that can sustain a high food security level and a high level of living standard

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. Introduction

This chapter discusses the study site, target population, research designs and data collection methods used in the study. It also describes how the study sample was obtained and highlights how data was collected, analysed and presented. The other sections discussed include data tools' reliability and validity, assumptions, limitations and ethical consideration. The research designs employed defined the research questions, variables, and the data collection methods that helped obtain information relevant to the research problem. They also helped to specify the type of evidence needed to accurately describe and assess meaning related to observable phenomenon (De Vaus, 2001 & Trichin, 2006).

3.2. Study Area

The study was carried out in Bungoma County which is found in the western region of Kenya. It is located on the southern slopes of Mt. Elgon and borders Uganda to the northwest, Trans-Nzoia County to the northeast, Kakamega County to the east and southeast, and Busia County to the west and southwest (Figure 3.1). The county lies between latitude $0^0 28^1$ and $1^0 30^1$ North and longitude $34^0 20^1$ and $35^0 15^1$East (GoK, 2012). According to BCIDP (2013), Bungoma County has 3,032.4 Km^2 of land out of which 2,880.7 Km^2 or 94.9 per cent is arable with an estimated population density of over 2,000 people per square kilometer making it untenable and uneconomical. The County's absolute poverty level is estimated at 53% with a total of 784,718 people

living in poverty (KNBS, 2010). The rural poor are 53% totaling to 715,033 people. These statistics, except the food poor, are above the national level of 47% (KNBS, 2007). Figure 3.1 shows the study site.

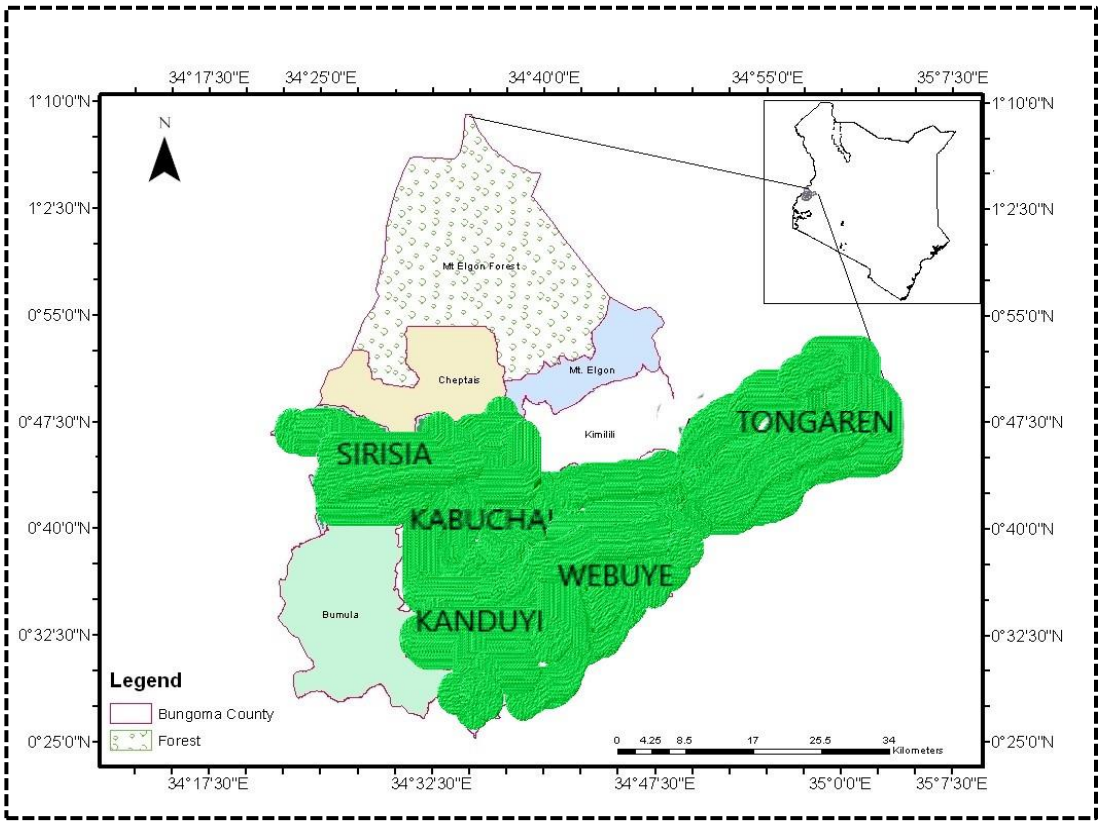

Figure 3.1: Map of Bungoma County

(Source: BCIDP, 2013)

Figure 3.1 shows the map of Bungoma County with her sub counties. The study was undertaken in five sub counties of Bungoma County in Kenya. These were Sirisia, Tongaren, Kanduyi, Webuye and Kabuchai sub counties. The five sub counties were purposively chosen for the study because of various specific reasons; Sirisia represented areas of low agricultural potential area (AEZ-LM3 and LM4), Tongaren represented medium to high agricultural potential areas (AEZs -UM3 and UM4). Similarly, Kanduyi was purposively sampled for housing the county headquarters to

provide most of the maize value chain service providers and enablers, Webuye was chosen for housing the maize millers in the county and Kabuchai for being the host of maize traders (BCIDP, 2013).

The County is divided into ten administrative sub-counties namely Kanduyi, Tongaren, Kimilili, Kabuchai, Sirisia, Webuye East, Webuye West, Bumula, Mt. Elgon and Cheptais (CGB 2013). These sub-counties are further divided into 21 divisions, 81 locations and 179 subs-locations. Further, the County has nine constituencies formed and named to reflect their respective sub counties. They are Sirisia, Bumula, Kanduyi, Webuye East, Webuye West, Kabuchai, Sirisia, Tongaren and Mt. Elgon (Cheptais is in Mt. Elgon Constituency) Figure 3.1 indicates the administrative boundaries of Bungoma County (BCIDP, 2013 and KARI, 2013).

3.2.1. Physical and topographic features of Bungoma County

The major physical features include; the extinct volcanic Mt Elgon, Mt. Elgon forest reserve, national park, mountain vegetation. The other physiographic features include hills (Chetambe, Sang'alo and Kabuchai), rivers, waterfalls such as Nabuyole and Teremi. Mt. Elgon and Sang'alo hill have attractive caves. The altitude of the County ranges from over 4,321m (Mt. Elgon) to 1200m above sea level. Mount Elgon is a 4,321m high extinct volcano, Kenya's second-highest mountain (after Mount Kenya). The County has only one gazetted forest, the Mt. Elgon forest reserves which measures 618.2Km^2, and one National park, which measures 50.683 Km^2. It is the source of major rivers including the Nile, Nzoia, Kuywa, Sosio, Kibisi and Sio-Malaba/Malakisi.

3.2.2. Physical Infrastructure and Utilities

According to the Kenya National Highways Authority (KENHA), Bungoma County has 67 km of class "A" roads and 154 km of class "C" roads. The Eldoret –Webuye - Malaba and Webuye- Kiminini - Kitale are the only class "A" roads traversing through the County. While land is a natural resource which is scarce in supply and in demand according to KIHBS (2005/06), the County has 2,880.78 Km^2 of arable land mainly for crop farming and livestock production. The county land uses include: Agriculture, forestry, mining, construction of human settlements, business, social and public amenities. Land is also used as collateral to obtain credit as well as for aesthetic purposes. The average holding size in the County for small scale farm sizes is 2.5 acres, while for large scale farms is 10 acres. This implies that land sizes are declining due to fragmentation of land into uneconomical units/parcels.

The county has eight level 3 hospitals, 12 private hospitals, 6 nursing homes and over 140 private clinics and 3 mission hospitals. The doctor to population ratio is 1: 64,000 while the nurse to population ratio is 1:13,333. The average distance to the nearest health facility is 1.5 km. According to KIHBS 2006/2007, 8.6 per cent of the communities reside within a distance of 0-1 km of a health facility, 49.1per cent within 1.1-4.9 km of a health facility and 48.4 per cent within 5 km and more.

According to Kenya National Human Development Report (KHDR) 2009, the National literacy rate is 71.4 per cent. The Kenya Integrated Household and Budget Survey (KIHBS) 2005/06 shows that 80.5 per cent of the population in the county aged 15

and above can read and write, while 14.4per cent cannot read and write. The county has 1000 primary schools (699 public and 301 private). On average, every primary classroom holds about 56 pupils per class, which is a high number for effective teacher pupil contact. The county has 260 secondary schools (252 public and 8 private). The secondary school gross enrolment rate is 78 per cent while net enrolment is 63.4 per cent against a national enrolment rate of 70.5 per cent. The county has one public university (Kibabii University), three university campuses (Masinde Muliro, Moi and Nairobi Universities), two science and technology institutes (Sangallo and Kisiwa institutes), two medical technical college (Webuye and Bungoma MTC), one public Teacher Training Diploma College (Kibabii), 12 private teacher training colleges, seventy youth polytechnics and twenty private accredited colleges.

3.2.3. Source of Livelihoods

According to Kenya Census (2009) and BICDP (2013), Rain –fed agriculture is the mainstay of the local communities with the County having a total area of 3, 593 KM^2 with 201,655 ha under food crops while that under non-food crops is 86,423 ha. The annual rainfall in the county is in the range of 400-1800 mm while the annual temperature varies from 0 to 32^0C. The main ecological zones include upper highlands (UH), lower highlands (LH), upper midlands (UM) and lower midlands (LM). Thus the county has a high potential for production of most agricultural produce. The main crops grown include maize, beans, finger millet, sweet potatoes, bananas, Irish potatoes and assorted vegetables. Sugar cane, cotton, palm oil, coffee, sunflower and tobacco are grown as cash crops in the county. The main livestock breeds in the county include; cattle, shoats, camels, donkeys, pigs, chicken, bees and fisheries.

Bungoma County is one of the leading producers of maize and beans in the country contributing a large percentage of the country's maize and beans annually. It is the fourth producer of maize and beans after Trans Nzoia, Uasin Gishu and Nakuru counties in the country (GOK, 2011). This is evidenced by the presence of a Silo and conventional stores owned by the National Cereals and Produce Board (NCPB) with storage capacity of 830,000 metric tons. The county has various tourist attraction sites that include Mt. Elgon forest reserve and national park, various scenic hills and rivers. Other economic activities include; sand harvesting, brick making and quarrying. The county has mining potentials in; murram/gravel, quarrying for ballast, construction stones and clay. However, the main industries in the county are agriculture based and rely on raw materials that are produced locally such as sugar cane, coffee beans, logs and tobacco. The industries include Nzoia Sugar Company, coffee factories, Pan Paper and Malakisi tobacco leave centre.

According to the survey done by KARI (2013) and BCIDP (2013), although the county enjoys a high agricultural development potential and mainly depends on maize value chain for her food and livelihoods, she exhibits a poverty level of 53% compared with national average of 47% and food security level of about 33 % (BCAR, 2013). This is evidenced by high level unemployment, low participation of locals in commercial enterprises, low agricultural productivity (BCG, 2013). Consequently, the County has tried to implement numerous initiatives towards achieving food security and reducing poverty but these challenges have persisted hence the need to investigate the maize value chain in the county.

3.3. Study Population

According to Orodho (2009) a study population is the entire group of individuals with one or more common characteristics of interest to the researcher. Thus in this study the study population is the Bungoma County population which by 2013 stood at 1,553,655, in 2015 it was estimated to be at 1,651,485, and was projected to rise to 1, 755,465 in 2017 (KNBS, 2009). It has one of the highest population growth rates in Kenya as demonstrated in the last 3 census periods of that gave an average growth rate of 3.8 percent (KNBS, 2010). The County also has one of the highest population densities which compound the problems of poverty and food insecurity (BCIDP, 2013). Table 3.1 shows the sub counties of Bungoma County with their populations, population densities and area in Km^2:

Table 3.1: Sub Counties of Bungoma County with their area size, population and densities

Sub-County	**Area km²**	**2009 (Census)**		**2013 (Projections)**		**2015 (Projections)**		**2017 (Projections)**	
		Population	Density	Population	Density	Population	Density	Population	Density
Kanduyi	319	229,701	721	259,536	815	275,876	866	293,245	921
Kabuchai	233	141,113	608	159,442	686	169,481	730	180,152	776
Sirisia	214	102,422	480	115,725	542	123,012	577	130,757	613
Kimilili	182	132,822	733	150,074	828	159,522	800	169,566	936
Tongaren	379	187,478	496	211,829	560	225,166	595	239,343	633
Webuye East	162	101,020	626	114,141	706	121,327	750	128,966	797
Webuye West	243	129,233	533	146,009	602	155,212	640	164,984	680
Mt Elgon	957	172,377	180	194,766	204	207,029	216	220,064	230
Bumula	348	178,897	514	202,133	581	214,860	618	228,388	657
TOTAL	**3037**	**1.375,06 3**		**1,553,655**		**1,651,485**		**1,755,465**	**907**

Source: Kenya National Bureau of Statistics (2009), Population and Housing Census.

Table 3.1 indicates that the population size and the population growth rate of Bungoma County are so high such that in the year 2017 the population is projected to increase to

1.755 million people from the current 1.651 million. This means the county must endeavor to produce more maize (food) to feed these people and upgrade maize value chain to be more profitable and earn more income for the people.

Mugenda and Mugenda (2003) define target population as the entire group a researcher is interested in or the group about which the researcher wishes to draw conclusion. In this study, the set or group of individuals with similar characteristics from which a sample was taken to generate information or for collection of data were the maize value chain players in Bungoma County. These were the input suppliers, agro-inputs stockists, farmers, transporters, maize traders, millers and consumers (USAID-KAVES, 2015 and Wilson *et al*., 2015). According to the BCIDP (2013), KARI Baseline Report (2013), BCG (2015) and USAID-KAVES (2015), the focus group or the collection of units of analysis who made the target population for this study was as shown in the Table 3.2:

Table 3.2: Study Target Population

Maize Value Chain Players per category	**No. of Maize Value Chain Players per category in the County**	**No. of Maize Value Chain Players per category from the selected 5 sub counties**	**Remarks**
Farm Input suppliers	0	0	- These industries manufacture or blend farm inputs like fertilizers, seeds and farm equipment
Farm Inputs Distributors	18	13	- They distribute or sell maize value chain inputs on wholesale
Agro-Dealers/ Stockists	167	98	- Each Sub county has about 20 Agro-dealers.
Maize farmers – House holds	218,000	110,797	- Each farmer house hold plants at least some maize
Maize transporters	30	22	- These are the medium and large scale maize transporters
Maize Posho Mills	1350	755	- They are the small scale posho mills
Maize Millers	2	2	- The County has only 2 medium scale millers
Maize Store Traders & Brokers	235	145	- They buy maize and sell direct or store before selling
Maize Value Chain Supporters	80	47	- They provide supportive services to the maize value chain actors
Maize value enablers	10	8	- These are the police makers, regulators,
TOTAL	**219,892**	**111,887**	

(Source: BCIDP, 2013)

Table 3.2 shows the study target population which comprised of 219,892 maize value chain players from the whole county and 111,887 from the five selected sub counties- Sirisia, Tongaren, Kanduyi, Webuye and Kabuchai.

3.4. Research Designs and Methods

Research designs and methods are structures for investigating or carrying out the planned study so as to obtain answers to research questions and for testing hypothesis (Kothari, 2004). They provide the blue prints for the collection and analysis of the data so as to achieve the stated study objectives (Wakhungu, 2014).

3.4.1. Research Designs

Research designs conceptualize structure, plan and describe how, when and where data will be collected (Kothari, 2004 & Burns and Groove, 2009). The research designs used in this study were the cross-sectional survey, descriptive, correlational and evaluation research designs. Cross-sectional survey study design was used to help collect both quantitative and qualitative data from different groups or categories of maize value chain players. It involved using different groups of people who differed in the variable of interest but had other characteristics such as socio economic status educational back ground and ethnicity that were common. It also involved examination of characteristics of, and the differences among several samples or populations at a particular point in time. Data was collected once at a given point in time and over a short period on different samples of the target population avoiding long term cooperation between researcher and the participants.

Descriptive research design was used to gather information, summarize, interpret and present for the purpose of clarification thus reporting the way things were in their real situation (Orodho, 2002). Descriptive design focuses on generating detailed information regarding the key aspects. The purpose of descriptive research is to determine and report the way things are in their natural setting, describe their relationship but does not predict relationship(s) between variables, (Mugenda and Mugenda, 2003; Orodho, 2008; Kombo and Tromp, 2006). Thus it enabled the researcher to describe and conclude on relationships between variables.

Correlation design was used in the third objective to collect data on more than one variable from the sample, which was used to describe the relationship between the variables (Babbie & Mouton, 2001 and Creswell, 2002). Evaluation research design was used in the fourth objective to help determine the relative merits of different approach interventions and the sustainability of the appropriate or proposed strategies (Babie & Mouton, 2010). Evaluation research design is described as a design that helps people make wise choices about future programming as it aims at informing experiences and judgments, perceptions and experiences of program planners, practitioners and community participants (Creswel, 2003). The study was done once and it did not influence or change the respondents and their environment (Cohen & Crabtree, 2006). Table 3.3 presents the research designs used in the study and their respective specific objectives.

Table 3.3: Research designs as per the specific objectives

Specific Objective	Variables	Indicators	Research Design
1. To establish the level of maize value chain development	Maize value chain functions	Maize Value chain Productivity & Profitability	Descriptive & Cross-Sectional Survey
2. To determine level of food security	Factors influencing maize value chain	Food stores/stocks, Number of meals per day in a HH	Descriptive & Cross-Sectional Survey
3. To examine factors influencing poverty reduction	Illiteracy, low maize yields, low income	Living standards, incomes, expenditure levels, poverty level	Correlation
4. To evaluate strategies for enhancing maize value chain	Capacity Building, Infrastructure	Farming system, Extension approaches used, marketing system, infrastructure,	Evaluation

(Source: Researcher, 2015)

3.5. Sampling Strategies

According to Wakhungu (2014) and (Nassiuma, 2000), sampling is an important activity that enables the identification of the specific respondents to be interviewed. Proper sampling ensures that the entire population is adequately represented and that the findings and conclusions derived are also precise. Burns and Grove (2009) refer to sampling as the process of selecting subjects who are representatives of the population or events being studied which also describes the selected elements of research population to be studied and expected to represent the research population. Frankel &Wallen (2008) clarifies that in order to conclude or determine characteristics of the entire target population on the basis of a sample drawn from it; the sampling process involves three elements: selecting the sample, collecting the data, analyzing and making an inference about the entire target population.

Hence, sampling strategies that were used in this study were multi-stage random sampling, purposive, census and simple random sampling. Multi stage random sampling is normally used where the researcher cannot get a complete list of members of the population (Burns and Grove, 2009). In this study sampling was used to select and put the maize value chain players into groups or the chain categories according to their activities in the value chain and random samples picked at more than one stage (Katebire, 2007). Purposive sampling was used to select Bungoma County which is a key producer of maize yet has a high level of poverty and experiences food insecurity (BCID, 2016 and Wabwoba *et al*., 2015). It was also used to select the study target sub counties of Sirisia, Kabuchai, Kanduyi, Webuye and Tongaren for their specific

reasons that were given in section 3.1 and for selecting key informants for the study. Further, the census strategy was used to select the chain enablers and simple random sampling was utilized to select the individual respondents from the categories of inputs agro dealers, producers, traders and posho mill dealers. Data was then collected from the sample sub counties and generalized for the entire county.

After the study sites were purposively selected as Sirisia, Tongaren, Kanduyi, Webuye and Kabuchai sub counties, the target population of maize value chain players was identified and categorized into stages along the maize value chain. Table 3.4 presents the distribution of the target population in the five sub counties in the study site.

Table 3.4: Distribution of the target population in the five study Sub counties

Maize Value Chain Categories	**Sirisia**	**Tongaren**	**Kanduyi**	**Webuye**	**Kabuchai**	**TOTAL**
Inputs suppliers	0	0	0	0	0	0
Inputs Distributors	1	3	5	2	2	13
Agro-Dealers/ Stockists	16	23	21	19	19	98
Maize farmers – House holds	20,364	23,359	23,352	21,470	22,252	110,797
Maize transporters	2	3	7	5	5	22
Maize Posho Mills	161	152	140	152	150	755
Maize Millers	0	0	0	2	0	2
Maize Store Traders & Brokers	17	31	32	26	39	145
Maize Value Chain Supporters	7	8	19	7	6	47
Maize value Chain Enablers	0	0	8	0	0	8
TOTAL	**20,568**	**23,579**	**23,584**	**21,683**	**22,473**	**111,887**

(Source: BCG, 2015)

Table 3.4 shows the distribution of the target population (Maize value chain players) in the study site - five sub counties in Bungoma county (Sirisia, Tongaren, Kanduyi, Webuye and Kabuchai), giving a total of 111,887. From this a study sample size of 398 respondents was then determined by use of the formula ($n = N/1+Ne^2$), given by Dessel (2013). (Formula explained in section 3.6.1). From this multistage random sampling, purposive sampling and census methods were applied to get respective study respondents to be subjected to interviews.

Sample size refers to the number of subjects, events, behavior or situations that are examined in a study (Burns and Grove, 2009). In this study the target group of individuals from which some were used to collect data consists of 111,887 individuals. Hence, according to Dessel (2013), at 95% confidence level and 5% margin error or level of precision, the study sample was given by the sample size calculated in this Formula:

$n = N/[1 + Ne^2]$ …… (Formula ……1)

Where: n = Study sample size,

N = the proportion in the study population estimated to poses the required characteristics (Target population) and

e = level of precision, (0.05).

Thus, $n = 111{,}887/1+ 111{,}887\ (0.05)^2 = 398$

The sample size was confirmed by repeat calculation using formula by Cochran (1963) which gave same answer of n as 398:

$n = N/\ [1 + N\ (e)\ 2]$ …….. (Formula ……..……. 2)

Where;

n – Sample size,

N – Population size and

e – Level of significance

Therefore, the study sample was 398. To allow for data loss and contingencies, 398 + (398 x 0.05) = 418, were the target respondents sampled as respondents for the study and 398 used for analysis.

Sample sizes allocated to respondents to facilitate organized data collection are as shown in Table 3. 5.

Table 3.5 Sample Sizes of the Respondents per Maize Value chain Category

Maize Value Chain Players/ category	**Number of Respondents per category used for sampling (from 5 sub counties)**	**Samples for each Maize Value Chain Category**	**Sampling method**
Input Distributors	13	10	Purposive
Agro-Dealers	98	50	Random sampling
Maize farmers – House holds	110,797	200	Multi-stage Random
Maize transporters	22	15	Purposive
Maize Posho Mills	755	50	Multistage Random sampling,
Maize Store Traders & Brokers	145	25	Random sampling
Maize Millers	2	2	Census
Chain Supporters	47	38	Purposive
Chain Enablers	8	8	Census
TOTAL	**111, 876**	**398**	
FGD	….	5(one per sub county with 8-12members per FGD)	Quota
Observation			Purposive

(Source: Researcher, 2015)

Table 3.5 shows sample sizes for respondents in each maize value chain category in the target population**.** Proportional allocation (Quotas) and random sampling were adopted to ensure that there was equitable representation of the target population in all the study sub counties (Frankel &Wallen, 2008 and Kothari, 2008). Two (2) inputs distributors and three (3) maize transporters were respectively selected from each of the sub counties through quota and purposive sampling while 2 medium scale maize millers and 8 maize value chain enablers were respectively selected through census. Further, 10 agro-dealers, 40 farmers, 10 posho mills and 5 traders were respectively sampled from each of the sub counties through multistage sampling, quota and random sampling. In addition, 38 maize value chain service providers and enablers were selected through quota and purposive sampling respectively from each of the sub counties. Then, the selected respondents in the study sample were grouped into the key various groups along the maize value chain as per their functions to help ease data collection and analysis. These were given as; agro -dealers for those in the farm inputs supply businesses, maize farmers or producers for those involved in the maize farming, traders for those involved in different forms of maize and maize product businesses and maize value chain service providers for the chain supporters and enablers. The key categories and their sample sizes are as shown in Table 3.6.

Table 3.6: Sample Sizes for the Data Collection Value Chain Groups

S/n	Category	Sample size	Composition
1	Maize Farm Inputs Agro-dealers	60	Farm Inputs Distributors and Agro dealers
2	Maize Producers	200	Maize farmers
3	Maize Traders	91	Maize and Maize products traders
4	Maize Value Chain Service Providers	47	Maize Value Chain Supporters, Enablers and Big Millers
5	**TOTAL**	**398**	
	Key Informants Focus Group Discussions		- Chain Supporters and Enablers - Maize Value Chain Stakeholders

(Source: Researcher, 2016)

Table 3.6 shows that further to the grouped maize value chain players for data collection along the chain, the study also used Key Informants (KIs), focus group discussions (FGDs) and Observation Checklist to help corroborate the information collected from the individual respondents. KIs comprised of key maize value chain enablers and supporters that included Head of agricultural extension services in the sub counties, Government regulatory institutions (KEPHIS), County policy makers, County Trade Officers financial institutions, insurance, and NGOs. In addition, there were 5 FGDs consisting of 12 key maize value chain representatives along the chain in each sub county (1 Input distributor, 1 agro-dealer, 2 Lead maize farmer, 1 maize transporter, 1 maize trader, 2 maize posho mill owners, 2 maize value chain service provider and 2 maize value chain enablers). Thus the 5 FGDs covered a total of 60 participants while the KIs totaled to 20 equitably selected across the County with emphasis of the county officials and policy makers where possible.

3.6. Data Collection

The study used both secondary data from archival sources and primary data from the field. Different types of data collection methods that helped obtain information relevant to the research problem, specify the type of evidence needed to accurately describe and assess meaning related to an observable phenomenon (DeVaus, 2001 and Trichin, 2006) were used.

3.6.1. Secondary data collection targets & schedule

Here data was collected from books, papers, magazines, journals, internet, organizations' reports, bulletins, dissertation, newspapers and researchers' reports targeting the most recent sources. The sources of secondary data used included Ministry of Agriculture Offices, National Library, University Library, Internet and MMUST Library. The work of collecting secondary data took twelve weeks, March to June of the year of 2016 and information gathered helped map the maize value chain actors, supporters and enablers along the chain.

3.6.2. Primary data collection tools

Gathering primary data is expensive, tedious and time consuming. Therefore, it is important that the data collection tools are precise and simple enough. In this study, the primary data collection tools or instruments used were structured questionnaires for individual interviews at different maize value chain category levels (Agro-dealers, Farmers and Traders). Questionnaires for key informants (KIs), interviews guidelines for focus group discussions (FGDs), and checklists for observations were used. Research Assistants and data collection enumerators were trained and temporarily employed to help hasten the task. Key informants consisted of the County Director of Agriculture (CDA), County Crops Development Officer (CCDO), County Agribusiness Development Officer (CADO), and Sub County Senior Officers. Other key informants included officers of authority in the National Cereals and Produce Board, Agricultural Finance Corporation, Banks, Insurance Companies, Ministry of Trade, KEPHIS and other Maize Value Chain stakeholder institutions in Bungoma

County. An estimate of 45 minutes was spent per individual interview session and 1 to 1.5 hours for each FGD session. Observations were done guided by a check list, FGDs by discussion guides and interviews by structured questionnaires. The study was conducted following value chain approach whereby the respondents were actors along the maize value chain as well as the service providers and enablers of the chain. This took four months whereby 10 data enumerators/research assistants were engaged to collect data from individual farmers, traders and stockists while the researcher mainly engaged the key informants and FGDs. Plate 3.1 shows the researcher interviewing a key informant in Tongaren Sub County.

Plate 3.1: Photo showing Researcher interviewing a Key Informant in Tongaren Sub Coutny

Plate 3.1 shows the researcher going through the interview guide for the Key Informants with the Agribusiness Officer in the Tongaren Sub County office.

3.7. Research instruments used

Various research instruments were used to collect data in the study and these included questionnaires for individual respondents, researcher's observation checklist and focus group discussion and key informants guides.

3.7.1 Key Informants Interview Guide

Interview guides are superior data collection instruments as compared to other instruments as they create rapport between respondents and the researcher (Khan, 2001). A semi-structured interview guide containing open-ended and structured questions was used to collect information from the key informants. The questions in the Key Informant interview guide aimed at verifying most of the research questions based on the objectives of the study.

3.7.2 Questionnaires

According to Kombo and Tromp (2006), questionnaires are effective for collecting information from a large sample from diverse regions. The questionnaires used in the study contained both open-ended and closed questions and were to collect information from the sampled individual respondents from various maize value chain players.

3.7.3 Focus Group Discussion Guide

The Focus Group Discussion (FGD) is a rapid assessment, semi-structured data gathering method in which a purposively selected set of participants (normally 8 -12 in number) are gathered to discuss issues and hence generate information based on a list

of key themes drawn up by the researcher (Kumar, 2005). The focus group discussion guide utilized participatory approaches that included open ended questions, discussions and clarifications to help corroborate the information already collected.

3.8. Ethical Considerations

It is a requirement that when research is undertaken, the researcher has the expertise, diligence and observes honesty and integrity. This is to ensure that the researcher observes ethical values and rights. The researcher ensured that the rights to self-determination, anonymity and confidentiality were observed as the participants for the study were voluntarily recruited without coercion and their consent sought before engagement in the interviews. First a letter of approval from MMUST allowing the researcher to proceed to data collection was sought. Then a research permit was obtained from the National Commission for Science, Technology and Innovation (NACOSTI) before embarking on the study. This is a requirement by the Resident Committee of MMUST. Permission was also sought from the county government of Bungoma as well as the respondents at all stages before data was collected as well as maintaining objectivity throughout.

3.9. Validation of the Data Collection Tools/Instruments

Validity refers to the extent to which an instrument measures what it purports to measure in a research and gives the degree with which the results obtained in the study accurately represent the phenomena under study (Kothari, 2004 and Babbie & Mouton, 2001). Validation of the data collection tools is the process of testing the reliability of the data collection tools or instruments.

3.9.1. Pilot Study

A pilot study is a preliminary study which is conducted on a small scale in order to establish the effectiveness of data collection instruments (Mugenda and Mugenda, 2003). This is where questionnaires, interview guides and focus group discussion guide are pre-tested using procedures identical to those used during the actual study. In this regard, a pilot study was carried out with 85 (0.2 of the study sample), respondents randomly selected along the maize value chain (Agro-dealers -12, Farmers – 17, Traders – 15, Maize processors – 15, Service Providers - 9, KIs -5, 1 FGD with 12 sub county maize value chain Stakeholders). The size of the pilot study sample was informed by Mugenda and Mugenda (2003), stating that a sample equivalent to at least 10% of the study sample is enough for piloting the study instruments. The primary maize value chain actors (Agro-dealers, farmers, traders and small posho mill owners) were sourced from Kimilili Sub County which was not in the study site. The pilot study was aimed at assessing the clarity of the data collection instruments in order to standardize them before the actual study. It aimed to assess the wording and language used in the questionnaires, focus group discussion guides and observation check lists, help in identifying problems or challenges that respondents might encounter and determine if the items in the research instrument would yield the required data for the study (Mugenda & Mugenda, 1999). The interview timing was also observed for the right scheduling during the actual study and the items which failed to meet the anticipated data were discarded as after their responses the researcher also encouraged the respondents to make necessary corrections and adjustments of the instruments to

increase their reliability. The feedback from the pilot study also helped to ascertain the feasibility of the study (Kumar, 2005).

3.9.2. Reliability of research instruments

According to Kothari (2008), reliability of research instruments refers to the degree to which scores obtained with an instrument are consistent measures. It is the ability of the instrument to obtain reliable and accurate data in the study (Walingo & Ngaira, 2008). In this study, the study tools that included questionnaires for individual interviews, guidelines for key informants, guidelines for focus group discussions and observation check list were tested for reliability. This study applied the Half –Test technique whereby values were assigned to the items in the questionnaires for scoring purposes to help ascertain reliability. Then the items were split into two equal halves and the reliability co-efficient for the half items were estimated using the Pearson product correlation formula, (Half –Test). Then the self-correlation of the whole questionnaire was obtained by use of the reliability of the half test whereby the Spearman Brown Prophesy formula was applied;

$$\rho^*_{xx'} = \frac{N\rho_{xx'}}{1 + (N-1)\rho_{xx'}} \quad \text{……..(Formula 3)}$$

Where $\rho^*_{xx'}$ is the predicted reliability; N is the number of tests combined (see below); and $\rho_{xx'}$ is the reliability of the current test. The formula predicts the reliability of a new test composed by replicating the current test N times (or, equivalently, creating a test with N parallel forms of the current exam). Thus N = 2 implies doubling the exam by adding items with the same properties as those in the current exam. Values of N less

than one may be used to predict the effect of shortening a test. The results from the pilot study were analysed by use of (SPSS) to compute the instruments' reliability which gave a Pearson's moment coefficient value of 0.7. This was good enough as a reliable measure of consistency of the questionnaires and therefore accepted (Kothari, 2008).

Moreover, the use of the Cronbach's coefficient Alpha (Cronbach, 1975) could also be applied to confirm the reliability or the consistency of the instruments when applied under similar situations many times. This is the pre-testing technique to ascertain the reliability of the data collection instruments is used. The researcher administers questionnaires to the randomly selected pilot study respondents in a neighboring sub county or region with similar characteristics as the sampled study respondents (Mugenda 2003). One week after, another set of questionnaires containing the same items as the previous set of questionnaires is then administered to the same farmers. Responses in the second set of questionnaires are coded using the same criteria applied to the earlier set. Analysis of correlation is then carried out on the two sets of responses. A Pearson's moment coefficient of reliability (r) is computed by the help of SPSS and a value is obtained to measure the consistency of the questionnaires (Mugenda, 1999). The instruments used in the pilot study should yield a reliability coefficient of not less than 0.7 to be accepted as reliable for the real study which should be done in the study site not more than two weeks later (Mbwesa, 2006).

3.10. Limitations

The limitations faced in this study and feasible actions taken were as follows;

(i) Some maize value chain players were reluctant to release information for fear of being investigated by KRA. The researcher assured them of total Confidentiality of the information released.

(ii) Insufficient records of work kept by the respondents. The researcher used the FGDs and KIs to corroborate some of the key information

3.11. Assumptions

It was assumed that the following would hold in order for a successful study to be effected;

(i) All participants would be cooperative and truthful.

(ii) The sample size selected was a representative of the target population

(iii)There would be no political interference and insecurity

3.12. Data processing, Analysis and Presentation

Since data was collected from a wide range of respondents, the data collection tools were organized according to its source (respondent category) for ease of data preparation, editing, entry, analysis and presentation. Investigation was carried out through individual Key Informant Interviews (KIIs), Focus Group Discussions (FGDs), individual interviews on agro-stockists, farmers and maize traders, guided observation and informed judgment to yield both quantitative and qualitative data. Then two main data analyses were made using statistical package for social sciences (SPSS –Version

20). Quantitative or inferential data analysis based on the specific objectives, research questions and source of data by use of chi-square and correlation analyses to draw conclusions. Inferential data analysis was used for testing statistical significance of relationships between the variables. Qualitative or descriptive data analysis by use of descriptive statistics (means, modes, standard deviations, variance, percentages, and frequencies) was used to compute frequency distributions, means and percentages. It provided for the descriptive and documentation of the state of affairs as they were. The means, standard deviation and Chi square tests were used to test differences and significances that existed. All these were tested at the probability level of $p=0.05$ or $p=0.01$ level of significance.

However, there were other analyses that were also significant and were used. In transcript of information from key informants and Focus Group Discussion (FGDs) where data was transcribed and issues were analysed and common opinions of different groups and respondents were grouped together depending on the responses provided. Frequencies of the opinions with common opinion were put together, in which the opinion with highest frequencies was presented. In content analysis of data, information from similar studies was compared with information from the current study to establish distinctions. The information analysed from different data collection methods was triangulated before reaching conclusions that were then used to make recommendations. The analyzed data and findings, conclusions and recommendations were presented in form of tables and graphs and charts where necessary or applicable.

Table 3.7 summarizes the study specific objectives with their respective data analysis method.

Table 3.7: Study objectives and their respective data analysis methods

Specific Objective	Methods of Analysis
1. Determine the level of maize value chain development in Bungoma County	Descriptive statistics and Chi-square test
2. Establish level of food security in Bungoma County.	Descriptive statistics, Chi-square test and Spearman rank order Correlation
3. Examine factors influencing maize value chain for poverty reduction in Bungoma County	Descriptive statistics, Chi-square test and Spearman rank order Correlation
4. Evaluate strategies for enhancing value chain upgrading in Bungoma County	Nomothetic evaluation (Pairwise ranking)

(Source: Researcher, 2016)

The Chi-square test general equation was;

$$\chi^2 = \sum \frac{(observed \times frequency - expected \times frequency)^2}{(expected \times frequency)}$$

$$X^2 = \sum_{i=1}^{n} \frac{(O_i - E_i)^2}{E_i}, \quad \text{..... (Formula 4)}$$

Where

X^2 = Pearson's cumulative test statistic,

O_i = an observed frequency in the class;

E_i = an expected (theoretical) frequency, asserted by the null hypothesis of the class;

n = the number of class in the contingency table

Spearman's Rank order correlation was calculated between variables to establish similarities or differences between various rankings. The correlation was obtained using a formula:

$$r = 1 - \frac{6\sum D^2}{N\sqrt{N2-1}} \quad \text{(Formula 5)}$$

The standard error of the correlation was obtained using the formula:

$$S.E.r = \frac{1-r^2}{\sqrt{N}} \quad \text{(Formula 6)}$$

The correlation coefficient computed between variables was interpreted by comparing its magnitude with its probable error. The probable error of the coefficient of the correlation was obtained using a formula:

$$P.E.r = 0.6745\frac{1-r^2}{\sqrt{N}} \quad \text{(Formula 7)}$$

Where:

$P.E._r$ = Probable Error

r = Coefficient of correlation, and

N = the number of pairs or observations used in derivations of r.

When $r < P.E._r$ there is no evidence of correlation, meaning the value of r is not significant ($P>0.05$). On the other hand, when the value of $r > 6\ P.E._r$ the coefficient of correlation is practically certain ($P<0.05$) (Gupta, 2008).

CHAPTER FOUR

THE LEVEL OF MAIZE VALUE CHAIN DEVELOPMENT IN BUNGOMA COUNTY

4.1. Introduction

Agricultural value chain development encompasses the quality and efficiency of the flow of products, knowledge and information between the value chain actors, supporters and enablers. A well-developed value chain offers the opportunity to capture added value at each stage of input supply, production, marketing and consumption, thus generating profit for all. It is established that a developed value chain builds stronger linkages between the chain players which enhances business performance, provides incentives for sustainable resource management and reduces poverty risks Kaplinsky and Morris (2001). Further, according to Kirimi et al., (2011), the importance of any crop can be judged by its acreage, productivity, utilization and share in trade. In order to determine the level of maize value chain development in Bungoma County, the researcher looked at the demographic characteristics of the maize value chain players, analysed the maize value chain and determined the productivity and profit returns of the value chain.

4.2: Demographic Characteristics of the maize value chain players

From the literature reviewed, it was revealed that gender, age, the level of education and occupation are the main demographic characteristics that were important to the research respondents. Therefore, researcher sought to establish the status of these characteristics by randomly and purposively sampling and interviewing respondents

across the chain categories. Then the demographic characteristics were examined to see how they influenced the participation of the players in the maize value chain development.

4.2.1. Gender of the maize value chain players in Bungoma County

The researcher analyzed the distribution of gender amongst the maize value chain players in Bungoma County per the groups of data collection and the findings were as shown in Figure 4.1.

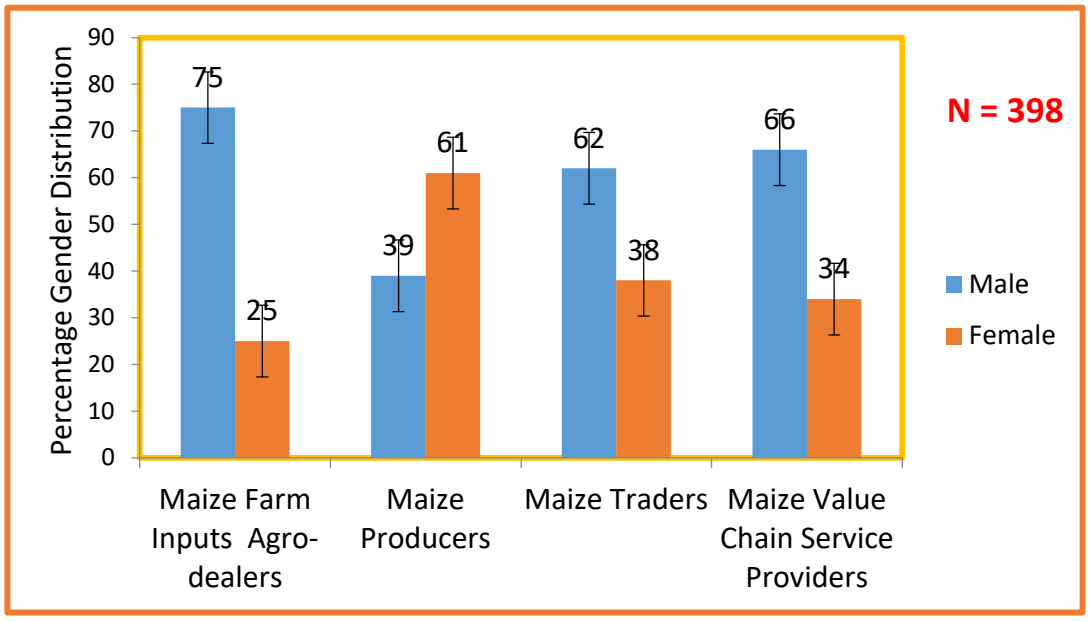

Figure 4.1: Gender distribution amongst the maize value chain players

(Source: Field Data, 2016)

Figure 4.1 indicates that the gender of the maize value chain service providers and enablers, consisting of those who support, make policies and regulate the performance of the maize value chain, who included the agriculture extension officers, trainers, financial institutions, insurance providers and law makers, was 66% males and 34%

females. These are the offices of those who are in power, which make decisions, direct and regulate the activities and functions of the chain. Thus as shown in Figure 4.1, these offices are majorly occupied by men 31 (66%) in Bungoma County. Looking at the maize farm inputs – Agro-dealers, the study revealed that the male gender made 45 (75%) while female agro-dealers were 15 (25%). Moreover, the findings from the gender analysis on the maize traders revealed that the male gender made 57 (62%) and female gender made 38% (43) of the traders. According to the FGDs, it was verified that males were more than females in these categories of the maize value chain because the chain activities here are off-farm maize business activities which are best handled by men since women are believed to lack the capacity. However, in the maize producers' category, the gender distribution is indicated as 39% males and 61% females. The reasoning here, as confirmed by most KIs and observation in the field by the researcher during data collection, was that the females were the farm workers doing all the main maize farm activities like planting, weeding, harvesting and drying. Therefore, on average, gender distribution across all the categories of the maize value chain in Bungoma County is that 255 (64%) are males against 143 (36%) females. The non-overlapping error bars in Figure 4.1 also portray that the gender inequality amongst the maize value chain is very significant. This finding concurs with related literature by BICDP (2013) and GIZ (2013) which reported that in rural areas women are predominantly active in subsistence farming and household requirements, whereas commercial cultivation of maize is dominated by men.

The study established that females are the main producers of maize. This is supported by KNBS (2009) and Kenya Census (2009), reporting that number of females dominates the very large population of Bungoma County. It is therefore implies that for the maize value chain to effectively develop, efforts should be put into having more participation from females in the other categories of the maize value chain. Women should also get actively involved in maize farm inputs supplying, maize trading and maize milling. From these findings, it is revealed that since the county and country at large depend on maize and maize farming for food and livelihoods, then women must be empowered with resources, knowledge and skills in order to effectively increase maize production and productivity. This revelation is supported by the observation made by World Bank (2006) that in Kenya women provide the greatest labour and hence they should be assisted at all levels of agriculture.

4.2.2: Age distribution per Category of the Maize Value Chain Players

The study respondents in each of the maize value chain category were asked to state within which age brackets their ages fell and Figure 4.2 portrays the findings.

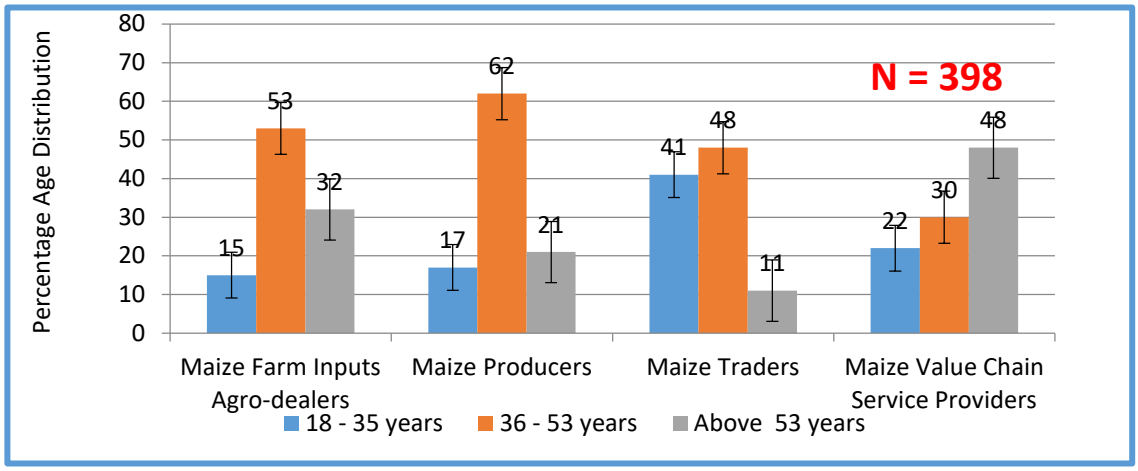

Figure 4.2: Age distribution amongst the Maize Value Chain Players
(Source: Field Data, 2016)

In Figure 4.2, it is revealed that the majority 191 (48%) of the maize value chain players are within the age bracket of 36 - 53 years, except for the maize value chain service providers and enablers that are mainly over 50 years old. A Pearson Chi-Square Test was done and it showed a p value of 0.04 meaning that the age variation amongst the maize value chain players was significant. The non-overlapping error bars shown in Figure 4.2 also confirm that the significance of age variation amongst the maize value chain players. These findings concur with those of Chenge (2014) and USAID-KAVES (2015) who studied food security factors and maize crop respectively, in Bungoma County and concluded that farming is mainly done by mature adults. This means that mature people are the ones actively involved in maize agricultural activities and therefore they should be the ones addressed or targeted for sustainable maize value chain upgrading and development interventions.

Further, Figure 4.2 also revealed that majority of the youths (those between 18-35 years of age) in the maize value chain were found in the category of traders. This finding was corroborated by FGDs who concurred that their youths were very reluctant to do farming activities and KIs at county headquarters who confirmed that there were many unemployed youths in town instead of being in the farms. This finding is in agreement with that of Osti *et al* (2015) whose study found that youths prefer white-collar jobs and are more likely to adopt new technologies. This implies that the youth are more interested in off- farm agricultural jobs that are competitive and bring in fast money. This means that the policy makers and the enablers of the maize value chain

need to facilitate the chain for more enticing maize value chain upgrading strategies in order to retain the youths and sustainability.

4.2.3. Education Level of Maize Value Chain Players

The research sought to establish the level of education of the maize value chain players by category in Bungoma County by asking the respondents to indicate or state their level of formal education and the findings are portrayed in Figure 4.3.

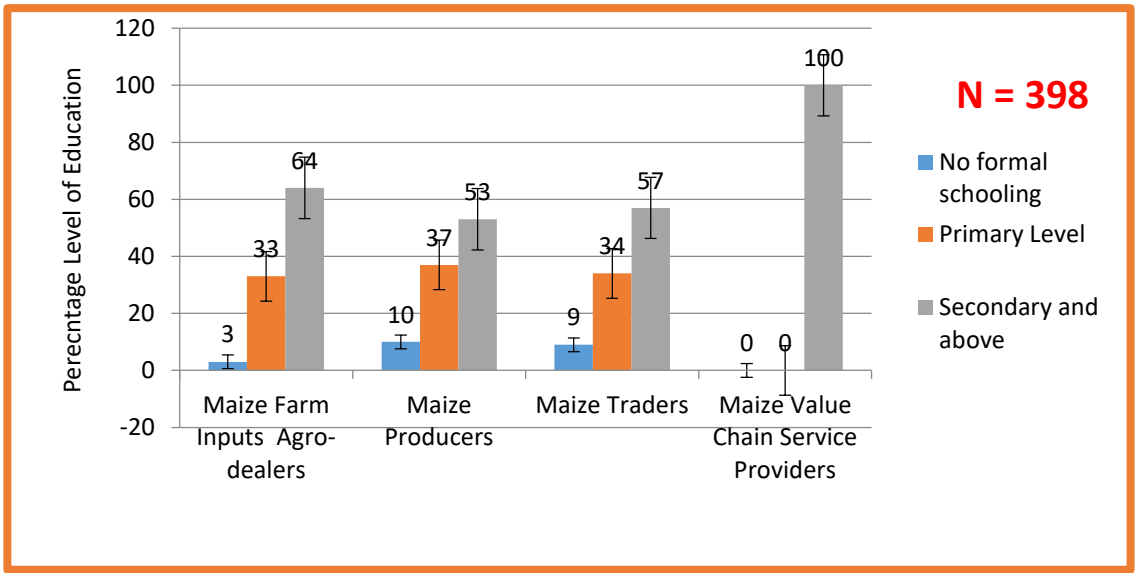

Figure 4.3: Education Level of the Maize Value Chain Players
(Source: Field Data, 2016)

Figure 4.3 shows that on average, 16 (4%) of the maize value chain players had no formal schooling, 108 (26%) had at least primary level of education and 279 (70%) had at least secondary level of education. Thus, on average, 199 (50%) of the maize value chain players had at least primary level of education with the least educated being found at the farmers' level, which had the highest percentage of no formal schooling 20 (10%) and primary level 74 (37%) of education. FGDs agreed with these findings

when they concurred that many female farmers had either not gone school or dropped out. KIs confirmed this when they reported that many girls drop out of school after primary level due to various reasons like school fees and early pregnancies. The findings concurred with BICDP (2013) which indicates that 207 (52%) of the population in Bungoma County had at least primary education. They were also in agreement with SID (2014) which reported that 61% of residents in Bungoma County had at least primary level of education and with Kenya Economic Survey (2013) and Rock (2013) which indicate that about 65% of the Kenyan population had at least completed primary education.

Nevertheless, for an effective agricultural value chain development to be achieved, the actors as well as the chain supporters and enablers should be knowledgeable, informed and innovative in their areas of operation. This means that the maize value chain players, especially, the farmers or the producers, in Bungoma County, require training and capacity building on all aspects of the maize value chain development. When the Pearson Chi-Square Test was done to show the level of significance in education amongst the maize value chain players, it showed a value of $X^2 = 8.125$ ($P < 0.015$) at 3 degrees of freedom. This meant that education and level of education were highly significant as confirmed by the non-overlapping error bars in Figure 4.3. This finding is supported by ACDI (2006) who stated that education and Knowledge, especially amongst farmers enhance adoption of agricultural technologies.

4.3: Mapping of Maize value chain in Bungoma County

Mapping of a value chain is the first step in examining or analysing the players and activities of the chain at each chain stage or category to determine how productive or profitable the chain is, the challenges and investment opportunities that exist and what could be done to enhance the chain (Mitchell *et al*., 2009 and Value-Links, 2013). It entails identifying the key value chain players, their activities and their locations as well identifying what are the market channels and how the product reaches the markets. This study sought to establish the level of development of the maize value chain or how productive and profitable was the maize business as the main source of food and livelihood in Bungoma County. This was done by mapping the maize value chain and examining the chain's productivity, profitability, value–addition, distribution and challenges faced in the maize value chain improvement.

4.3.1: Supplying of Maize Farm Inputs

Maize farm inputs are supplied by agro-dealers or agro stockists who source and supply them to the maize producers and other maize value chain actors. Maize farm inputs include fertilizers, seed, agro-chemicals and farm equipment like hoes, ploughs, tractors, shellers, dryers and stores that are required on a maize farm for the maize to be produced, shelled, dried and stored. From maize inputs - Agro-dealers, the study sought to know what type of maize farm inputs are supplied, distributed, stocked and dispensed in the study area and Figure 4.4 represents the findings;

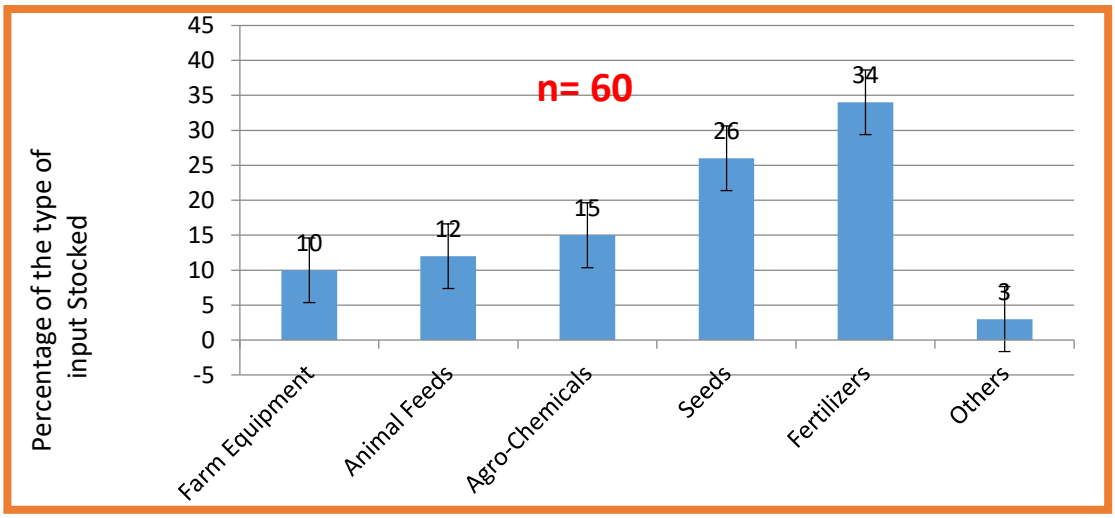

Figure 4.4: Type of Farm Inputs Supplied by the Agro dealers (Source: Field Data, 2016)

Fertilizers 20 (34%), seeds 16 (26%) and Agro-chemicals 9 (15%) are the main farm inputs that are largely supplied, distributed, stocked and retailed by agro-dealers as shown in Figure 4.4. The overlap of error bars for farm equipment and animals, and animal feed and agro-chemicals is a clear indicator that there were no significant differences at 5% significance level in the supply of the respective farm inputs. The Chi-Square test also indicated that there was no significant difference in the supply of agro-chemical and fertilizers [(x_1^2= 8.690, p= 0.065 > 0.05)]. However, the error bars for all the inputs generally showed no overlap meaning that the difference in the type of inputs stocked is significant for maize production. Figure 4.4 also reveals that feeds and farm equipment are less supplied (10% & 12% respectively). FGDs, KIs and even field observation by the researcher confirmed that most agro-dealers stocked maize fertilizers, seeds and some agrochemicals, especially, during the rain seasons. These findings are in line with those of Chenge (2015) and Simiyu (2014) that were done on factors affecting food security in Bungoma County. This could mean that either, there was deficiency in the supply of farm equipment like ploughs, planters, tractors,

shellers, and tarpaulins in the county, farmers do not buy them frequently since they are durable on the farm or that they are not affordable to most farmers.

However, in order to achieve the desired maize production and productivity, a farmer must have the appropriate maize farm equipment at the right time for timely and proper maize farm operations that include land preparation, harvesting and storage. The FGDs with the sub county maize stakeholders, affirmed that farm inputs unavailability to the farmers and poor timing for stocking by the agro-dealers have remained a challenge for a long time. This could be one of the explanations why maize productivity in the region was low compared to the region's agricultural potential, since the recommended productivity enhancing technologies for maize seed, fertilizers and equipment have to be accessed through the agro-dealers. The KIs confirmed that there was a general inadequate application of the recommended farm inputs by the maize producers. This finding is in agreement with those of AGMARK (2012) when they carried out a study on the status of farm inputs supply.

4.3.1.1: Knowledge of the agro-dealers in the maize business development

From the 60 agro-dealer respondents interviewed, the study sought to establish the proportion of those that were knowledgeable in the maize business in relation to the maize value chain development which is presented in Figure 4.5.

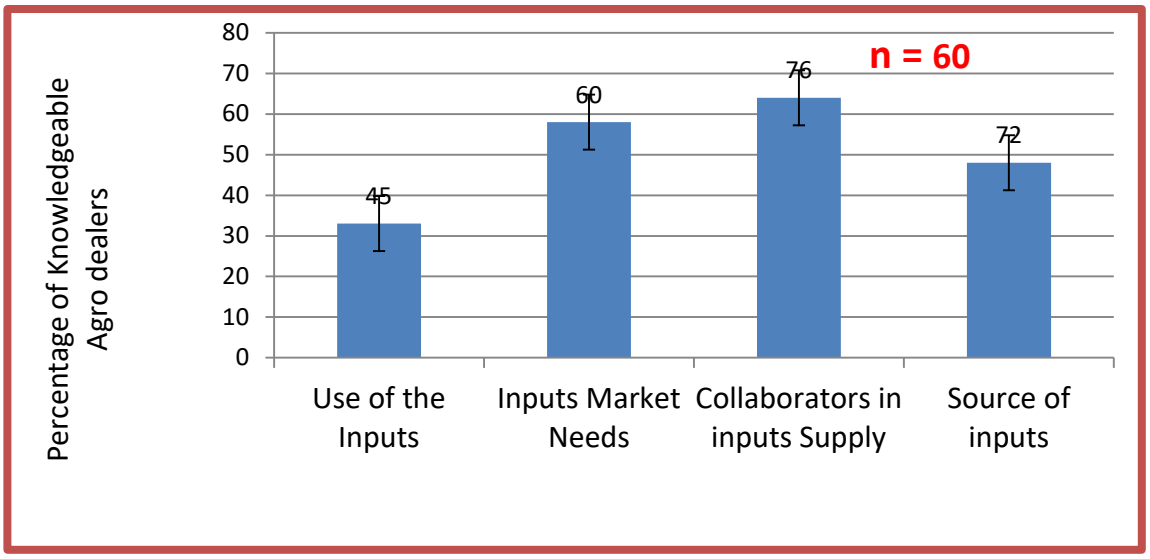

Figure 4.5: Percentage of Agro-dealers Knowledgeable in the Maize Inputs Supply (Source: Field Data, 2016)

For development of the maize value chain to succeed, it is essential that the input suppliers are knowledgeable, especially, in the usage, market, collaborators and source of the farm inputs they deal in. Figure 4.5 indicates that only 27 (45%) had knowledge on how the inputs they sold to clients are used, 36 (60%) agro-dealers understood the market or what the farmers needed and 46 (76%) knew who to collaborate with like which institutions and organizations regulate and control the farm inputs business (e.g. KEPHIS, KCPB and AGMARK). Further, 43 (72%) were knowledgeable in the sources of their inputs, that is who are the manufacturers and distributers of the inputs before they reach their neighbors where they get from. The addition of the percentages in Figure 4.5 is more than 100% because of the overlap in knowledge, that an agro-dealer has in different areas (Others were more knowledgeable in different areas but at least they all knew something in each area).

Further analysis by the Chi-Square test of independence indicated that the agro-dealers' average knowledge in the farm inputs that they supplied significantly depends on level of education [(x_4^2= 12.823, p= 0.012 < 0.05)]. Furthermore, by separating the means and testing significances of correlations for demographic characteristics and knowledge of maize business amongst agro-dealers, findings were such that one sample binomial test (p = 0.001<0.05) indicated that the level of education significantly influences how knowledgeable one is in the maize inputs supplying business. Further still, the Pearson Correlation test indicated that the higher the education status among the farm input dealers, the higher the average knowledge in the farm inputs they dealt with (Corr. = 0.57, p = 0.01<0.05). FGDs agreed that most rural agro-dealers just sold what was on shelf to whoever came to buy without asking for details of where and how it was to be used and the KIs reported that KEPHIS, body in-charge of farm inputs standards, was not keen on the qualifications of the agro-dealers. This confirms why the knowledge of the agro-dealers in the business varied and some cases very low. This finding is in agreement with the study of USAID-KAVES (2015), which reported that untimely availability; overpricing, misinformation and mislabeling of farm inputs were a big challenge that capacity building could help to overcome.

These findings imply that knowledge of maize value chain development amongst the farm input suppliers is at an average of 64% (This is the average of the percentages in the four areas). This is an indication that although most input suppliers and agro-dealers have modest knowledge on how to run their maize inputs supply businesses, they need capacity building in the areas of inputs end usage and sourcing so that may

rightfully and timely stock their shops. They also need to be trained on the functioning of the rest of the maize value chain in order to understand the requirements of the farmers and maintain timely stocks.

4.3.1.2: Status of agro input supplying business in Bungoma County

The study sought to know the status or how serious the agro input supplying business was in the region by interviewing the sampled input agro dealers on their business registration status. The results were as captured in Figure 4.6.

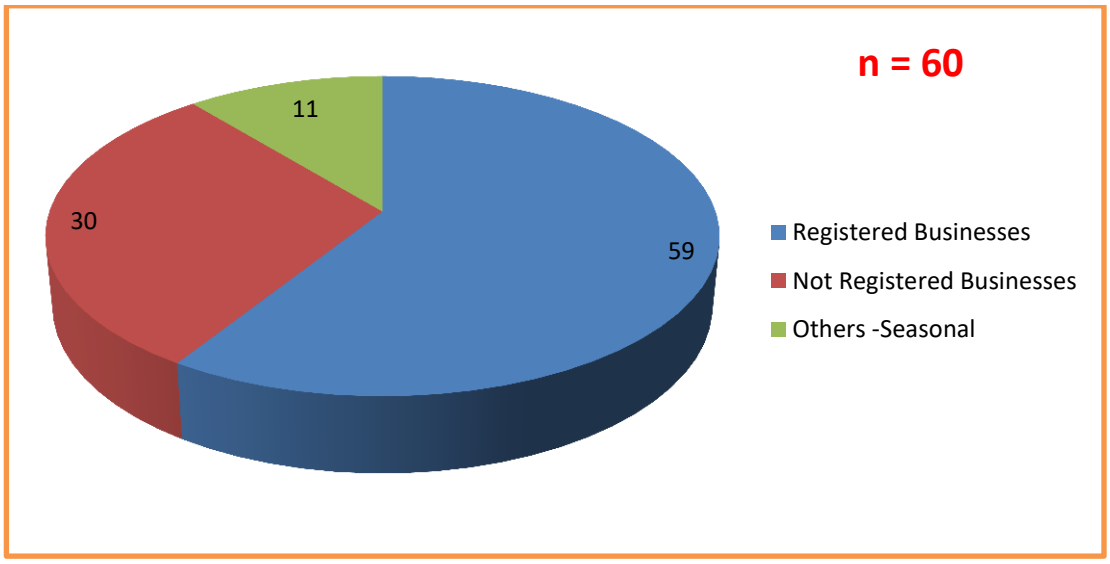

Figure 4.6: Percentage of the Agro-Dealer Business that were registered
(Source: Field Data, 2016)

The results in Figure 4.6 show that 59% of the 60 farm input agro-dealers sampled in the study area was registered, 30% were not registered and 11% were seasonal or convenient farm input supplying agents. This finding implies that only 59% of the agro-dealers found in the County were qualified or mandated to dispense farm inputs in the region. Further, the Chi-Square test indicated that there was a significant difference between the registered and unregistered input suppliers (x_1^2= 10.790, p= 0.030 < 0.05).

This is an indicator that majority of the suppliers in the region are registered. However, the proportion of the unregistered suppliers was significantly greater than zero as indicated by One Sample Binomial test ($p = 0.000 < 0.05$), thus downgrading the seriousness the agro dealing or farm inputs suppliers deserve. This finding is supported by a study finding by AGMARK (2012) that revealed that most agro–dealers need capacity building on the business requirements.

These results reveal that the agro-input supply business is not taken very seriously in the county as the agro-stockists lack the discipline, ethics and adequate competence required for the serious business of developing the maize value chain. This is evidenced by the 30% of the agro-dealers dispensing maize farm inputs without meeting the required business documentation and 11% being allowed to dispense farm inputs seasonally and in the open markets. This could also be one of the reasons why maize farm inputs agro-dealers do not avail the right, quality and timely inputs to producers leading to low farm productivity.

4.3.1.3: Level of operation of Agro-Input Businesses found in the study area

From the respondents and observations, the researcher sought information on the level of operation of agro-inputs businesses. They were to indicate whether their agro-dealing businesses were on wholesale or retail level, who operated their businesses on daily basis and whether they operated throughout the year or on seasonal basis. The findings were as displayed in Table 4.1.

Table 4.1: Level of operation of Agro-Inputs Business

Level of Business (%)		Business Operated By				When does the Business Operate?	
		Owner	Employee	Child	Others	Throughout the year	Rain seasons
Wholesale	12	65%	14%	18%	3%	97%	3%
Retail	88	73%	5%	17%	5%	69%	31%

(Source: Field Data, 2016)

Table 4.1 shows that 53 (88%) of the maize inputs businesses are small retail shops of which some are seasonal 19 (31%), Owner or Child operated (73% and 17% respectively). This indicates that the supply and availability of farm inputs is at very low level, unreliable, inefficient and unsustainable. Plate 4.1 shows a seasonal store for agro-inputs.

Plate 4.1: A seasonal store for agro inputs to be sold on market days in Tongaren Sub County (Source: Field data, 2016)

According to respondents, as confirmed by the FGD in Kabuchai Sub County whereby a participant said;

> It is common practice for agro-dealers in this sub county to move with their agro input wares, mainly fertilizers and maize seeds, from one open market to another displaying their wares in the open for farmers to buy. These are mainly small scale seasonal agro-dealers who move around open markets with the little they can carry, especially at the maize planting time. They even open the bags of fertilizers and dish

> out in small potions using small tins known as Gorogoros in order to catch the very small buyers

This finding was corroborated by other FGDs like the one in Sirisia Sub county who verified that some of the small scale seasonal mobile agro-dealers rent some stores at the market on market days for incase it rained or for the unsold inputs to be kept until next market day.

The study revealed that 53 (88%) of the agro-dealers were small scale retail farm inputs dispensers. This means that they have inadequate capital and store space to avail large quantities and varieties of farm inputs that include fertilizers and maize seeds, to the maize producers. It also means that the small available quantities of inputs are overpriced due to lack of the advantages of the economies of scale and the that the agro-dealers are far apart and well distanced from the producers. The resultant is that the maize farm inputs become unaffordable and inaccessible to the small scale farmers due to high inputs cost, long distances and untimeliness leading to low maize yields. The maize value chain stakeholders (in FGDs) and the extension officers (KIs), when asked about the challenges facing supply of key farm inputs, they confirmed that the high cost and unavailability of the inputs are major causes of low maize productivity. This view is shared by Barnett *et al.* (2011) in their study that stated that farm inputs were unaffordable to rural small holder farmers.

4.3.1.4: Major Challenges facing Farm Input supplying Business

The sampled agro-dealers were asked to state what challenges they faced in their business of supplying farm inputs to the maize producers and other stakeholders and the findings were as presented in Figure 4.7.

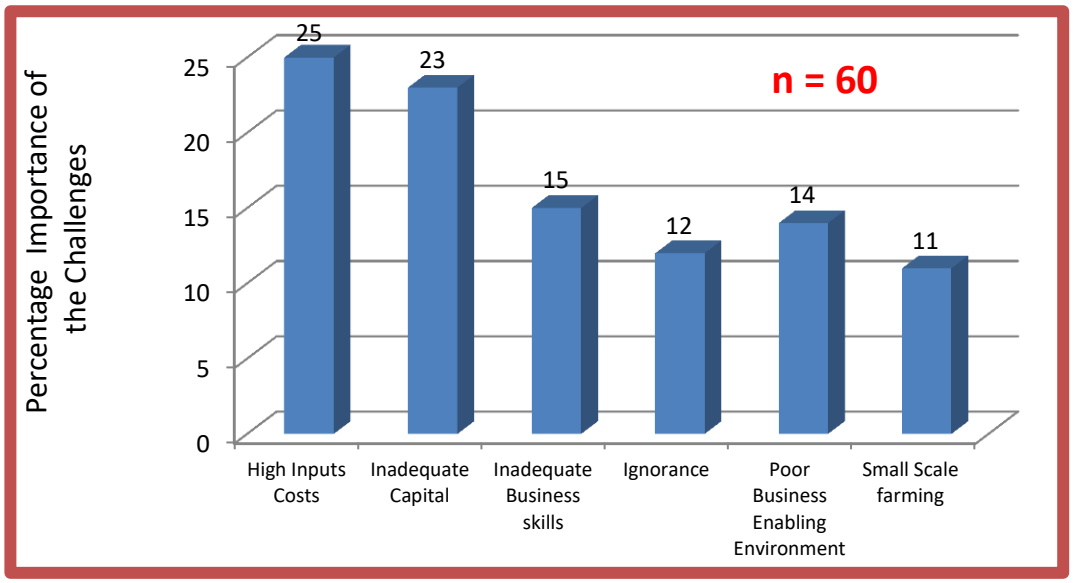

Figure 4.7: Main Challenges faced by the maize agro-inputs Dealers
(Source: Field Data, 2016)

Figure 4.7 shows that high input costs (25%), inadequate capital (23%), inadequate business skills (15%) are the major challenges that majority of the farm input dealers in the region face in their businesses. These findings were supported at the FGDs with maize value chain stakeholders and confirmed by the agriculture extension officers (amongst the KIs) who agreed that due to the unaffordable fertilizers and certified maize seed, many farmers planted home saved seed without fertilizers causing them to harvest dismal yields. Further, One sample Binomial test indicated that the response proportion for all the challenges discussed had ($p<0.05$), meaning that they were all significant in agro-input business to the majority of the agro-dealers in the region.

The challenges that were stated by the respondents (agro-dealers), were subjected to the Omnibus Tests of Model Coefficients whereby they indicated a positive value ($x^2_{(6)}$ =13.2) concurring with the Pearson Chi-Square test (p=0.04<0.05) when ran on the key challenges. These results indicated that the challenges significantly affected the agro-inputs business in the region. Further, using the challenges as the predictor variables in the Omnibus Test of Model Coefficients portrayed positive coefficients (B=29.996 and B=54.688) for poor business enabling environment and inadequate business skills respectively. This test categorizes them as key challenges affecting farm inputs business in Bungoma County as depicted in Table 4.2.

Table 4.2: Variables in the equation for the types of inputs businesses

Challenges (Predictor variables)	**B**	**S.E.**	**Wald**	**df**	**Sig.**	**Exp (B)**
Inadequate Business skills	54.69	1778929.2	.000	1	1.000	2.279E
High Input cost	-59.45	3537498.7	.000	1	1.000	.000
Inadequate capital	-28.32	1579470.9	.000	1	1.000	.000
Ignorance	-56.12	1813708.3	.000	1	1.000	.000
Poor Business Enabling Environment	29.99	3015779.5	.000	1	1.000	6.236E+1
Constant	115.07	4560084.5	.000	1	1.000	9.449E

(Source: Field Data, 2016)

Table 4.2 shows that inadequate business skills and poor business enabling environment (with positive coefficients) are the most key challenges to the agro inputs supply function of the maize value chain. These plus the other challenges like inadequate capital, smallness of businesses, ignorance and high supply inputs cost are a big hindrance in availing timely and affordable farm inputs by the small scale agro-dealers who are the main source of farm inputs to the farmers. This explains why the

cost of maize farm inputs is high and the inputs are sometimes in accessible to farmers in Bungoma County and hence low technology adoption and use leading to poor maize produce. These findings are in agreement with the findings of the study by AGMARK (2013) on interventions for enhancing agro dealer business. They also concur with those of the study by Nyoro (2000) which reported the high cost of farm equipment affects the timeliness and quality of maize production and handling operations.

4.3.2: Category of Maize Production

Production is a very key segment or section of the maize value chain which in this case concerns maize farmers. The study engaged 200 individual farmers from whom it sought to establish the importance of the maize crop to the communities of Bungoma County. This was achieved by interviewing the respondents on maize crop production in the area, the uses of the maize crop, where maize was sold, maize value addition and maize production challenges faced by maize farmers.

4.3.2.1: Maize Production in Bungoma County

The study interviewed the sampled maize producers to seek information on various aspects of maize production in the study area and the findings are as shown in Table 4.3.

Table 4.3: Maize Production in Bungoma County

Producers with Maize as Major crop (%)	Average farm size (Acres)	Average Yield (Bags/Acre)	Usage of Certified Inputs (%)	Using Extension Services (%)	Usage of Bank Loans and Insurance (%)	Those who sell produce (%)
86	2.75	9.8	22	12	1.8	76

Source: Field Data, 2016

Table 4.3 reveals that 86% of the farmers (172 out of 200 sampled farmers), had maize as their major crop with an average acreage of the farm sizes of 2.75 acres that produced an average of 9.8 bags of maize per Acre. This yield is lower than the national average yield of 18bags/acre (GOK, 2014) and the expected average for the region of 25-35 bags/acre (Nyoro, 2002). It also portrays that only 22% use certified fertilizers and seeds and only 12% of the farmers receive agricultural extension services while 1.8% use bank services. Further, as shown in Table 4.3, 76% of farmers sell their maize produce. These findings were corroborated by FGDs and KIs when they said that most farmers did not have food in their houses as they did not produce enough and at the markets maize was mainly sold by traders from outside the locality.

These findings mean that most of maize farming in the region is done on small scale, subsistence level whereby farmers produce maize for home food security using mostly own generated agricultural inputs that include seed, fertilizer, labour and capital. This results into low yields of about 9.8 bags per acre of which most of the farmers sell immediately after harvesting due to their urgent needs for cash. However, the same farmers later buy back the maize for food when their meager food stocks are exhausted and that is why they are called net maize food buyers. This very low adoption and low use of certified farm inputs could be as a result of the low percentage of the agricultural extension services received (12%), low level of education of farmers (Primary level– Figure 4.3) or the fact that females are not the farm decision-makers yet they are the majority of the farmers in the farms (61% - Figure 4.1). Further, the low usage of bank loans and insurance (1.8%) could be due to the financial and insurance institutions

believing that small scale maize farming is a high risk business due to the nature of farming being seasonal and highly vulnerable to climate change effects like droughts and floods, and the farmers not owning collaterals and securities for financial credits. Also, according to KIs (Equity Bank LTD-Bungoma and CDA), most small scale farmers are risk averse when it comes to bank loans as they fear that their farms could be auctioned. These findings and explanations are in line with FAO (2014) and Wanyama *et al. (*2010) who are in agreement when they state that high cost of certified inputs, inadequate agriculture extension services and inaccessible farm credits are major contributors to low farm productivity for small scale farmers. They are also in agreement with those of Ali-Olubandwa *et al*. (2010) on adoption of improved maize production practices among small scale farmers.

4.3.2.2: Uses of Maize in Bungoma County

The study sought to establish the uses of the maize crop in the county from the farmer respondents and Figure 4.8 shows the findings.

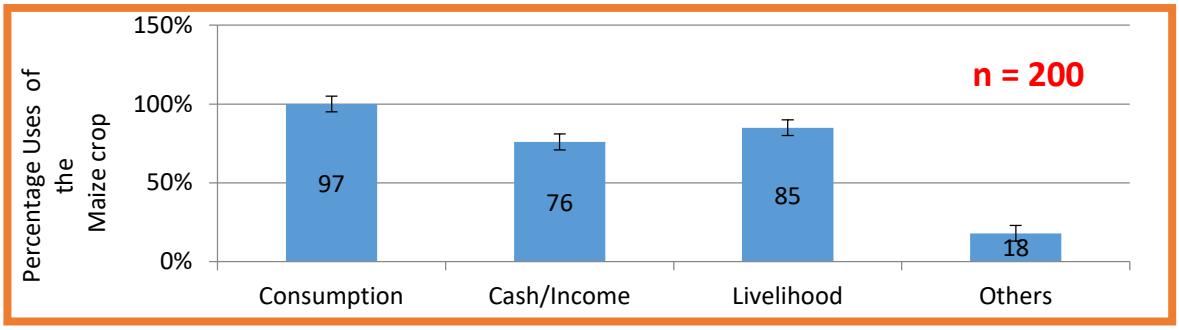

Figure 4.8: Uses of Maize according to Producers in Bungoma County
(Source: Field Data, 2016)

Figure 4.8 shows that 97% percent of the respondents depend on maize for food, 76% for income, 85% for employment and 18% for other uses like animal feed and gifts.

The Pearson Chi-Square test showed significant differences in the response on consumption (with highest response, 97%) and livelihood (second highest, 85%), (x_1^2= 10.790, p= 0.03 < 0.05). However, the test indicated that maize crop to the people, was important for the purpose of cash (income) but not as significant (x_1^2= 4.761, p= 0.056 > 0.05). (Pearson Chi-Square tests were at 2 degrees of freedom). These findings were corroborated by the FGDs and confirmed by KIs that maize meant food and money in the households. To verify this, a male participant in a FGD in Webuye Sub County said;

> My household has gone without food for 2 days because I do not have maize and my wife has been serving the family with Githeri and sweet potatoes.

This finding concurs with those of USAID-KAVES (2015) and Simiyu (2014) when they studied maize in Bungoma for food security. They concurred that for most of the people of Bungoma County, having maize means having food in the household and a livelihood. Therefore, these findings mean that maize crop is essential to the lives of the Bungoma community as they depend on the crop for food, income, employment and other less significant uses like animal feeds, gifts and fuel. However, the importance of the maize crop was not very significant as a cash earner, especially for the small scale farmers who are the majority, because their yields are low and hence the income fetched is also low. This is in agreement with BCG (2015) who reported that maize consumption demand in Bungoma County is higher than the production leaving little room for income.

4.3.2.3: Maize Producers' Markets

From the individual farmer respondents, the study sought to know where or how they sold their produce and who their main buyers were since 76% of them sold maize (Table 4.3) and the findings are as shown in Figure 4.9 in percentages;

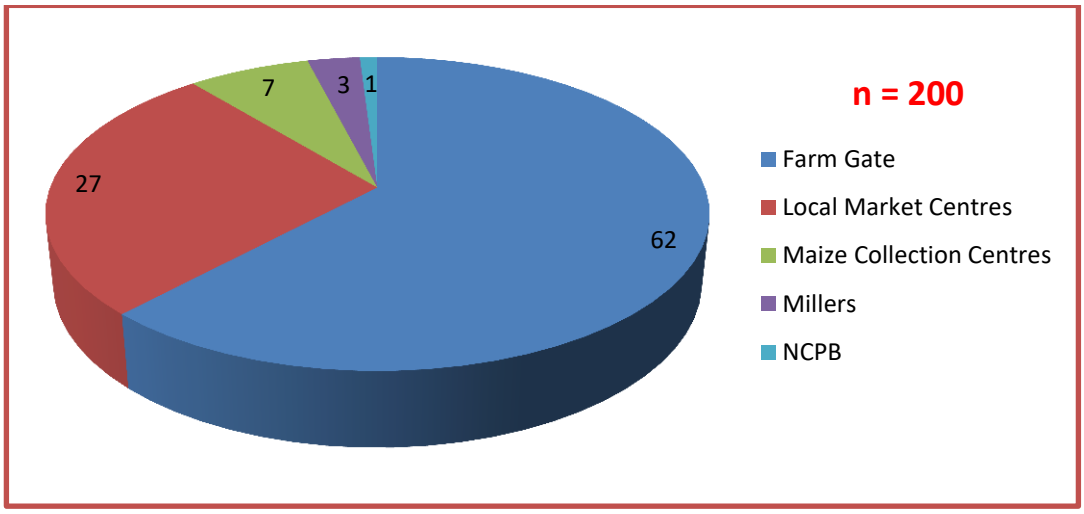

Figure 4.9: Percentage Use of different Market Outlets by farmers

(Source: Field Data, 2016)

Figure 4.9 shows the percentage use of given market outlets by farmers in Bungoma County. It shows that that 124 (62%) of the maize producers sell their maize produce at farm gate with the main buyers being brokers also known as middlemen and 54 (27%) take their maize to market centers where they sell to brokers and local consumers. However, at least 7% of the farmers take their maize to collection points to sell to organized organizations like WFP, CBOs like Naima Marketing Self Help CBO in Tongaren and Chwele Cereal Traders CBO in Kabuchai Sub County. The study also revealed that the main marketing center in the region for farm produce is Chwele Market (83% response). Millers and NCPB purchase maize at very low levels (1% and 1% respectively) and most maize is sold through brokers (90%). Further, the study

revealed that, the major maize value addition activities that farmers engage in are drying, winnowing, sorting and storage. Thus no processing and packaging of maize is done at farmers' level.

These findings reveal that most small scale farmers sell their maize produce at farm gate because they are thirsty for cash, have inadequate storage facilities and apply deficient post-harvest management technologies. They mainly sell to the middlemen or brokers who are ready to pick the maize of any quality and standard but at low prices hence the low incomes most farmers fetch for their produce as verified by the FGDs. The middlemen then take the maize produce to NCPB and Millers where they sell at higher prices or store the maize at local maize stores to resell the maize back to the farmers at higher price during the time of scarcity.

KIs reported that little maize produce from the farmers go directly to the millers and NCPB because the farmers were not ready to attain the high maize standards and quality required, they were not prepared to wait till the NCPB and main millers open to start buying maize and that the NCPB and millers did not pay in cash on delivery. These findings concur with that of USAID-KAVES (2015) from their study on small scale farmers marketing challenges where they suggested that small scale farmers would fetch best prices through farmer groups and produce aggregation that would help them attain the required standards and higher maize prices.

4.3.2.4: Major challenges facing Maize farmers in Bungoma County

From the individual farmer respondents, the study also sought information to establish what challenges faced farmers as one of the key maize value chain players in the region and Figure 4.10 presents the findings in percentages to show the level of importance of a given challenge;

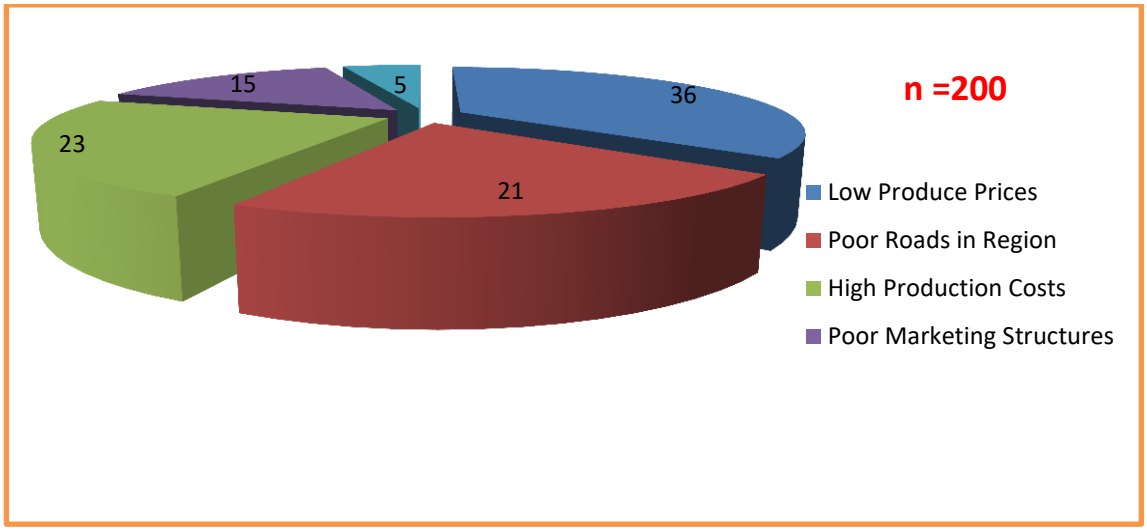

Figure 4.10: Percentage Level of the major Challenges Facing Maize Producers (Source: Field Data, 2016)

Figure 4.10 shows that the major challenges facing the maize farmers in Bungoma County are low produce prices (36%), poor physical and marketing infrastructure (especially rural roads) (21%), high farm input prices and poor market information that cause high production costs (23%) and poor maize marketing structures (15%).These findings were corroborated by FGDs, especially, those from Webuye and Tongaren sub counties who emphasized that low maize produce prices and very bad rural roads were a big problem discouraging farmers' efforts. Other challenges that include theft, hail stones, pests and diseases (5%) were also important as hail stones pests like Fall Army

Worms cause total crop failures in many cases. The challenges were confirmed significant as indicated by one sample Binomial test (p-values<0.05). The KIs also agreed with these findings with the those from agriculture sector adding the new emerging maize pests and diseases like maize lethal Necrosis Disease (MLND) were disastrous especially for the poor farmers who find their management unattainable. These findings are supported by those of Simiyu (2014) who researched on factors that influence maize production in Bungoma Central.

From these findings, farmers in Bungoma County, who are largely small holder farmers (those that cultivate less than 10 acres of land largely for subsistence), could be challenged by low produce prices because they get low yields of about 10 bags per acre on their small acreages. They then mainly sell at farm gate fetching low prices from the brokers at harvest time when prices are lowest and so they earn very little from their maize produce. High production cost is a challenge as the maize farm inputs and farm equipment are already highly costed while the small scale farmers have low income from the sale of their low yields at low prices. Poor roads are a challenge because most farmers are found in the interior rural areas where roads are mainly impassable, especially, during the rainy seasons when farmers need to transport farm inputs to the farms (BCG, 2013). Poor marketing structure, especially, for the maize produce is a challenge to the farmers because they are usually uncertain as to when, how and whom to sell their maize produce each year and therefore they cannot effectively plan or budget for their maize produce.

4.3.3: Traders in the Maize Value Chain

The trader category of the maize value chain included maize transporters, posh mill traders and maize and maize product traders in the market who formed a sample of 91. The study findings revealed that there were no special transporters for maize produce in the region but instead the ones used are those that transport anything else. The transporters mainly consisted of "Boda-Bodas" (bicycles and motor cycles) (65%) and 35% pick-ups and Lorries. These were used to transport produce from farm gates, collection centers and market centers to other destinations. Figure 4.11 shows the percentage of maize transported or sold and their destinations.

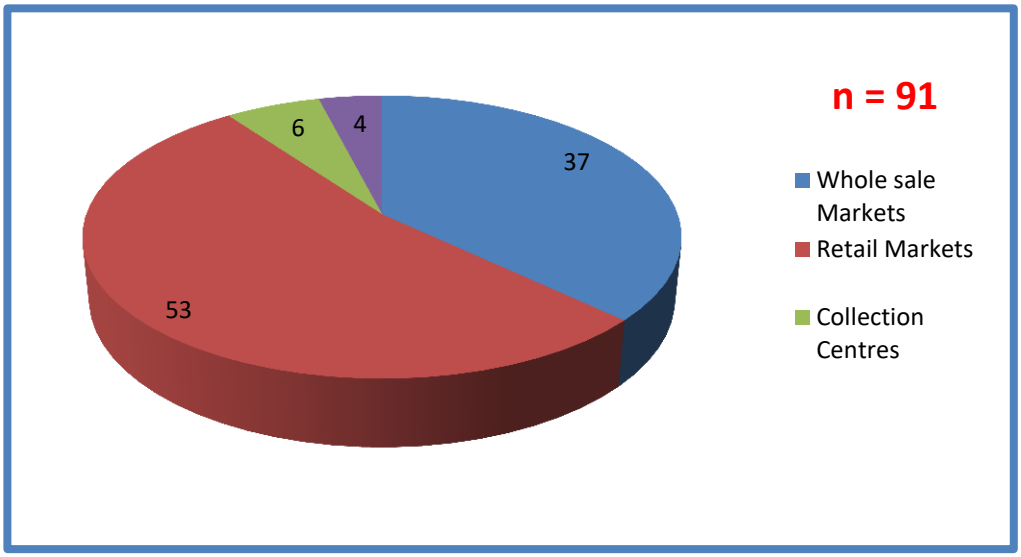

Figure 4.11: Percentage level of maize produce sold at given Market Destinations (Source: Field Data, 2016)

The study findings revealed that most of the maize from the farmers is transported and sold to small retail maize trading shops (53%), 37% is sold to wholesalers, 6% through collection points and 3% to NCPB & Millers as shown in Figure 4.11. The findings also indicated that most of local maize trading is on small scale retail level which was affirmed by the KIs and FGDs who concurred that most maize is sold through small

2kilogram tins (Gorogoros). Moreover, One Sample Binomial test indicated that collection centers, millers and NCPB were not significant ($p > 0.05$) while retail maize stores were the main market centers. This was confirmed by the Pearson Chi-Square test which showed a significant difference in the response on retail stores (with highest response, 53%) and wholesales (second highest, 37%), ($x_1^2 = 5.82$, $p = 0.048 < 0.05$).

Further, KIs and FGDs verified that maize production and trading in Bungoma County is unstructured and unorganized in that it involves very many small retail traders and store assemblers, brokers, medium-scale wholesalers, transporters, small posho millers, medium scale millers and NCPB. Therefore, there was a lot of movement and transporting of maize by mainly the retailers and small scale assemblers buying directly or through brokers from farmers, collection/assembly centres and wholesalers to other destinations like bigger wholesalers, consumers, NCPB and Millers and vice versa. These findings concur with the findings by Kirimi *et al*. (2009) who carried out a study on maize marketing in Kenya.

4.3.3.1: Level of Knowledge on Maize Value Chain amongst the Maize Traders

The sampled traders were interviewed on various maize business related issues in order to establish how knowledgeable they were on the maize value chain as they go about their maize business of buying, selling, drying and transporting. Figure 4.12 shows the findings.

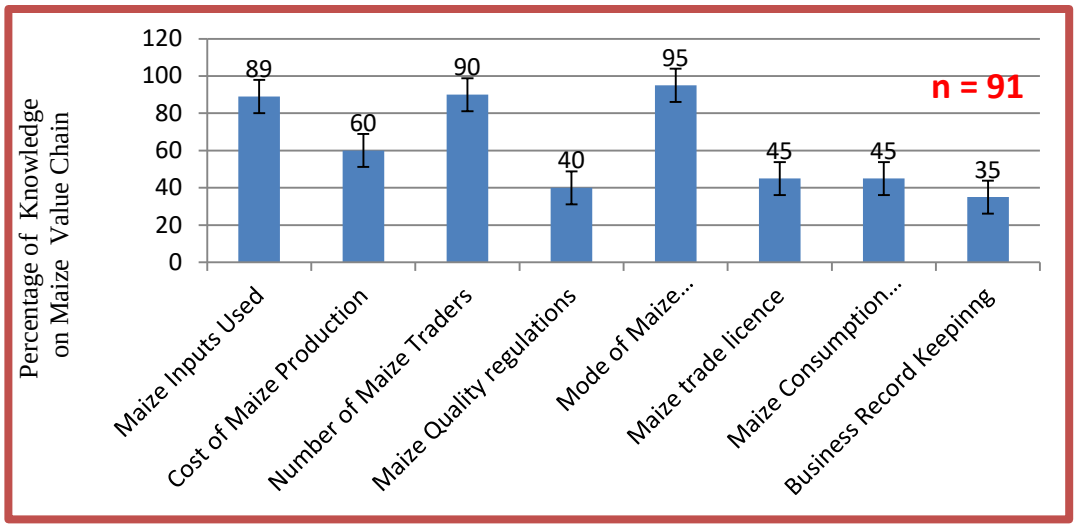

Figure 4.12: Level of Knowledge on Maize Value Chain by maize traders

(Source: Field Data, 2016)

The findings revealed that although the traders/transporters in the maize value chain seemed to do their business on small scale, on average 63% of them were knowledgeable in their businesses as indicated in Figure 4.12. However, only 35% kept good business records, 45% have their businesses well registered and 45% knew about maize consumer preferences and 40% knew the requirements for maize quality for trade. Further analysis by use of Pearson Chi-Square test of independence indicated that the traders' average knowledge in the maize value chain significantly depends on gender (x_1^2= 11.312, p= 0.001 < 0.05) and level of education (x_4^2= 14.325, p= 0.02 < 0.05). Whereas a One Sample Binomial test indicated that the average knowledge among male traders, 73%, was significantly higher than that of the female traders, 60%, p = 0.001<0.05. This difference of male traders being more knowledgeable than female traders could be explained by this response from a FGD when asked why females in the communities were less educated than males and one male participant was seconded by others in Sirisia when he said;

> In farming activities, our women take care of activities like planting, weeding, harvesting and maize winnowing while men do the trading and budgeting of the money from the produce so women do not need a lot of knowledge in maize business matters.

Another participant from the FGD chipped in and added;

> When it comes to trainings called by the ministry in agriculture, women stay at home to take care of the household chores while men who are the traders go to attend the trainings and bring home what they learn from the trainings.

However, the finding that about 63% of the maize traders (who are majorly small scale retailers and middlemen), are knowledgeable on maize value chain is good for the development of maize value chain in Bungoma. It is in line with the requirement of value chain approach that needs all the value chain players to have knowledge on other operations and operators in the value chain (NAMDEVCO, 2014 and Value-links, 2015). However, the traders are still deficient in the areas of maize quality requirement, consumer preferences and maize trade regulations and because the small traders handle small volumes of trade they incur substantial costs and small trade margins associated with handling, grading and transporting maize. Bungoma County maize value chain enablers could come in to facilitate in areas like access to credit, inadequate storage facilities and capacity building. This would be in line with the recommendation by Kirimi *et al* (2011) when they studied maize marketing in Kenya.

4.3.3.2: Sources of Finance for Maize Traders

From the sampled maize traders, study sought to establish where the maize value chain traders got their financing for their maize business operations and Figure 4.13 presents the findings.

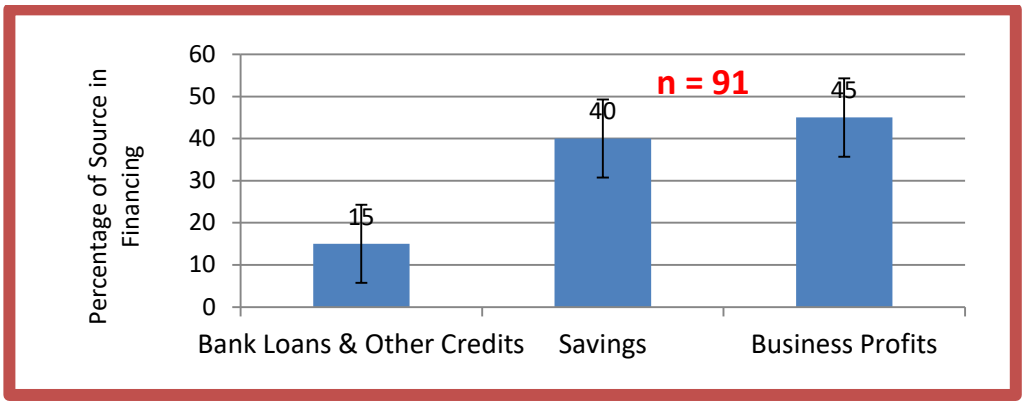

Figure 4.13: Sources of Finance for Maize Value Traders (Source: Field Data, 2016)

Figure 4.13 shows that most maize businesses in the region finance their operations using their savings and business profits. It is also revealed that bank loans and other credits offer limited finances to the maize trade as its percentage source in the financing is only 15%. Further, since most local maize businesses are run by small scale traders, then their volumes of trade, savings and profits must also be small indicating that they are not sustainable. The findings reveal that majority of maize traders in Bungoma County are risk averse and that explains why most of them do not embrace commercial loans. This finding was confirmed by the KIs from the financial and insurance institutions. Nevertheless, because the small scale maize traders deal in small volumes of trade, their own funds from savings and small business profits are not sufficient enough for them to purchase maize from farmers and small assemblies and sell which is not sustainable for the maize value chain that needs to develop.

4.3.3.3: Main challenges facing Maize Traders in the region

The study sought to know if the traders faced any challenges in their maize businesses and the findings are presented in Figure 4.14.

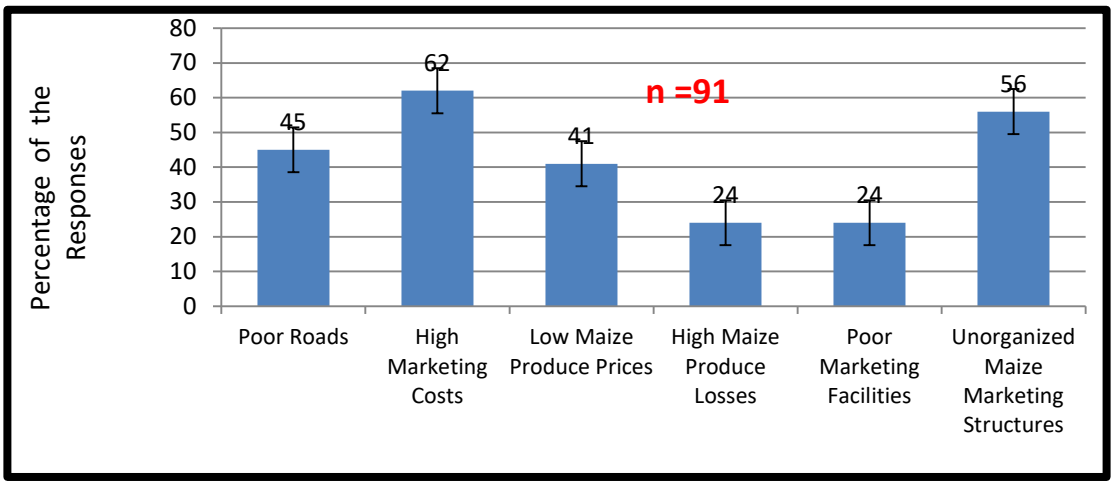

Figure 4.14: Main Challenges facing Maize Traders (Source: Field Data, 2016)

Unorganized maize marketing structures, poor infrastructure (roads) system and high marketing costs in Bungoma County were identified as some of the major challenges affecting maize traders in the region as represented by 56%, 45% and 62% responses to the given challenges respectively in Figure 4.14. Additionally, the Chi-Square test indicated a significant difference in the response on high marketing costs (with highest response, 62%) and unorganized maize marketing structure (second highest, 56%), (x_1^2= 8.43, p= 0.041 < 0.05). Further, KIs and FGDs elaborated that Bungoma County has no structured maize marketing system and everyone or trader sells their maize in their own ways.

The findings emphasize the prevalent nature of maize marketing business in the region whereby brokers and small retail traders buy maize from farmers, small maize

collection points and small traders at low prices and deliver at higher prices to NCPB and larger buyers and millers like Unga Ltd, Milling Corporation of Kenya, Cargill, Eldoret Grain Millers and Mombasa Millers after the maize quality and standards are established. Further, since the small scale traders cannot withstand the prevailing challenges, they easily release their maize produce to the bigger brokers and wholesale traders at low produce prices. This finding is corroborated with those of KARI (2013) and USAID-KAVES (2015) who established that maize marketing in Bungoma County is faced with poor infrastructure and lack of maize marketing structures.

4.3.4: Maize Processors

Worldwide, milling for maize meal is the primary source for value addition component of the maize value chain with the other processed products being mainly cooking oil and Animal feeds (Kirimi *et al*. 2011). According to the KIs and FGDs, in Bungoma County, processing or milling of maize is an important stage in the maize value chain amongst the people as it produces maize flour which is used to make Ugali and porridge which are the main ways they utilize the maize. This was made clear by the FGD with the maize stakeholders from the researcher quoted;

> Locally, in Bungoma we have many small scale maize Posho Mills where the community takes their little maize to be processed into unsifted flour for everyday use. In the whole county, there are only two small/medium scale maize millers, Hongera Maize Millers and Friends Church Millers located in Webuye town. These mills, package and distribute maize flour to supermarkets, wholesale and retail shops for sale on small to medium scale.

Further, the researcher interviewed the manager of Hongera Maize Miller (Amongst KIs), who reported that;

> My mill processes about 200 bags of 90kgs per day. Besides maize flour, maize bran and maize germ are also produced from milling as by-products which are sold for animal feed. Our biggest challenge is the high cost of doing business brought about by low maize yields from the farmers, poor infrastructure, poor business environment and lack of maize trading structures in the county.

The FGD with the maize stakeholders revealed that the maize value chain enablers or the county government needed to mobilize and facilitate for stakeholder partnership development and investment in the value chain as there seemed to be numerous opportunities in solving the challenges.

4.3.5: Maize Value Chain Supporters and Enablers

In this study, the Key Informants (KIs) constituted of the maize value chain supporters, enablers and key maize millers who were purposively sampled from the county and the study sub counties. They included ministry of agriculture extension officers from the county head quarter and study sub counties, Equity Bank Kenya Limited, Faulu Kenya, and One Acre Fund, County Chief Officer, County Trade Officer and the maize value chain enablers who made policies, laws, regulations within which the value chain or business operated. Likewise, the FGD with maize value chain stakeholders was composed of key representatives across the maize value chain. From these KIs and FGD, the study sought to confirm or verify information on services received by the maize value chain players in the county, importance of the maize crop, challenges facing the maize value chain and their proposals on the development of maize value chain in Bungoma County.

The researcher interviewed KIs to seek information to establish what services the maize value chain actors received to support their maize value chain functions and what were the ratings for their performance. The findings were that of all the services provided to the maize value chain actors, insurance services were the least provided or received (1%) followed by 5% receiving financial services. Agricultural extension services were receive by 23% of the actors and 44% received inputs supply services, the same as 44% receiving statutory regulations information services. On average, the level of services provided to the maize chain actors is at 24%. This finding is in agreement with the literature by GOK (2012) on the level and quality of extension service provision which called for strategic measures that would help enhance access to services.

Discussing the findings from FGDs with the chain stakeholders revealed that the agricultural extension services were very poor because the service is mainly provided by the ministry of agriculture and livestock which has less than 300 officers whereby one officer is expected to cover about 2000 farmers thus only about 23% of the maize producers are served. When discussing why the services from the maize chain supporters were poor, one stakeholder responded saying;

> The farm inputs supply services are poor because the inputs suppliers who distribute to the agro dealers in the whole county are only two; Bungoma Chemistry and Ronak Agrovet based in Bungoma County Headquarters. The agro dealers are not found in all wards or locations and so not accessible to all farmers and the cost of inputs is too high for most farmers to use effectively. In addition, the financial and insurance services are also poor because most small scale agro dealers, farmers and traders are not even aware of their services and how they can benefit from them.

This response was supported the whole focus group as another stakeholder added his voice;

> The statutory regulation services from institutions like KPHIS and PCPB are poorly enforced that is why many agro dealers are doing business without proper registrations and selling expired and fake agro-chemicals to farmers. Infact, it is a worrying thought to note that the grades and standards of the traded and consumed maize grains are not anybody's concern.

These findings concur with those of USAID-KAVES (2015) that established that Kenya has weak public agriculture regulatory institutions due to their insufficient resources and low credibility which end up hindering the growth and development of agricultural value chains.

The researcher further discussed the uses of the maize value chain in Bungoma County with FGD of the stakeholders in order to corroborate the information given by the other respondents. The findings were that the entire group (100%) 12 agreed that maize is the most important food crop for the people of Bungoma County. When asked to state reasons for this answer, their views were; maize is a major food crop to all farmers (100%) 12, maize is a major cash crop for the farmers as (76%) 9 and that farmers grow maize for other uses like animal feeds (18%)3 of the. However, they also agreed that although maize is the major food and cash crop in the region, the maize business is not taken as seriously as one would expect as indicated by the following reasons;

(i) Only 59% (approximately) of the maize farm inputs agro dealer businesses were registered.

(ii) Savings is the major source of finance for most farmers and traders as only about 15% of the maize traders source finance as loans from banks and micro-finance institution.

(iii)Value addition on maize majorly consists of only drying, sorting, storage and Posho Milling.

These findings on the importance of maize value chain in Bungoma County by the maize value chain stakeholders corroborated those of the other study respondents. Maize is the main staple crop that drives food security directly while contributing to livestock productivity and the commercialization of higher value, nutritious crops like vegetables through crop rotation. It also has high potential for household incomes through increased productivity, trading and accessible market offered by the extensive network of existing local buyers of surplus maize. These findings are in line with those of many authors like Simiyu (2014), Kirimi *et al* (2011) and USAID-KAVES (2015).

4.3.5.1: Maize Value Chain Service Providers' Knowledge on Maize value chain

From the supporters and enablers of maize value chain, the researcher sought to establish how much they understood the maize value chain in Bungoma County by determining how many of them had information on different categories of the value chain. Table 4.4 illustrates the findings.

Table 4.4: Percentage of the Service Providers with Knowledge of Maize Value Chain

Key areas of Information	**On Farmers**	**On Maize transporters**	**On Maize processors/ millers**	**On Traders**	**On Enablers & Chain Supporters**	**Average level of knowledge (%)**
Supporters	74	61	78	75	75	73
Processors	48	87	80	75	89	76
Enablers	59	38	70	68	88	64
Average %	**61**	**62**	**76**	**73**	**84**	**71**

(Source: Field Data, 2016)

Table 4.4 shows that on average 34 (71%) of the Key maize value chain supporters and enablers had knowledge on the maize value chain development. This means that the maize value chain supporters and enablers are knowledgeable in the value chain since knowing the chain players per category is synonymous to being able to map the chain. This is very important for the value chain upgrading and development as the chain enablers, in consultation with various stakeholders, play crucial role of formulating maize production, marketing and consumption related policies, rules, laws and regulations that define how the value chain performs. The supporters also provide crucial supportive services, research, extension and training services, financial and insurance services, and transfer of information and technologies. These finding agree with that of ASDSP (2014) in the study on agribusiness development in Bungoma County. Plate 4.2 shows the researcher talking to a group of maize value chain stakeholders in Bungoma County.

Plate 4.2: Researcher talking to Maize Value Chain Stakeholders in Bungoma County

(Source: Field Data, 2016)

In Plate 4.2, the researcher had a chance to talk to a group of maize value chain stakeholders who were among the Bungoma County Development Stakeholders having a meeting in Bungoma County. They discussed the challenges facing the maize value chain and the findings were that low maize farm productivity, poverty, poor road infrastructure, unorganized maize marketing and high population were amongst the key challenges that faced the maize value chain in Bungoma County. These findings are in line with those of the study by USAID-KAVES (2015) on maize marketing in Bungoma County.

4.3.5.1: Major Challenges facing the maize value chain as per the Service Providers

The researcher interviewed the maize value chain supporters and enablers to establish what challenges were encountered in their efforts to provide services like capacity building, infrastructure and business enabling environment and the findings are shown in Figure 4.15.

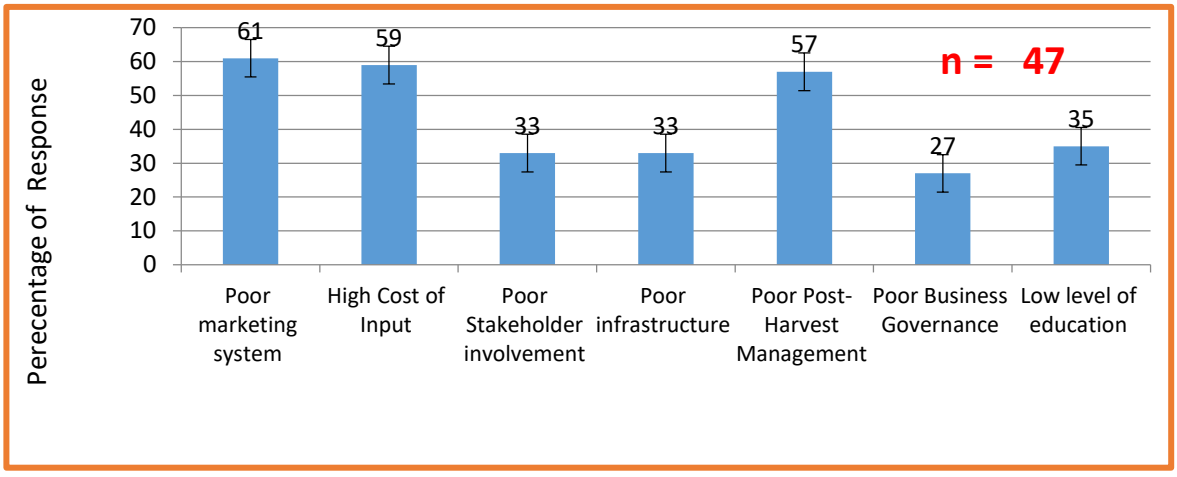

Figure 4.15: Challenges facing Maize Value Chain Development in Bungoma County (Source: Field Data, 2016)

Figure 4.15 indicates that 29 (61%), 28 (59%) and 27 (57%) of the maize value chain service providers thought that poor marketing system, high cost of maize farm inputs and poor post-harvest management were respectively key challenges to maize value chain development. The non-overlapping error bars in Figure 4.15 showed that all of the indicated challenges facing the maize value chain in Bungoma County are significant. These findings were corroborated to be true by the FGDs and confirmed by the KIs. The findings are also in agreement with those of Kirimi *et al*. (2011) and USAID-KAVES (2015) on their studies on maize business in Bungoma County.

4.4: Knowledge of the Maize Value Chain amongst the Chain Players

This section summarizes the data on knowledge of the maize value chain development on all the chain categories examined in order to establish the level of cooperation and coordination of the maize value chain in Bungoma County. The average of the percentage means of the maize value chain knowledge by different categories are used to indicate the level of cooperation and coordination of the value chain thus inferring the level of efficiency of the value chain. Figure 4.16 shows the results.

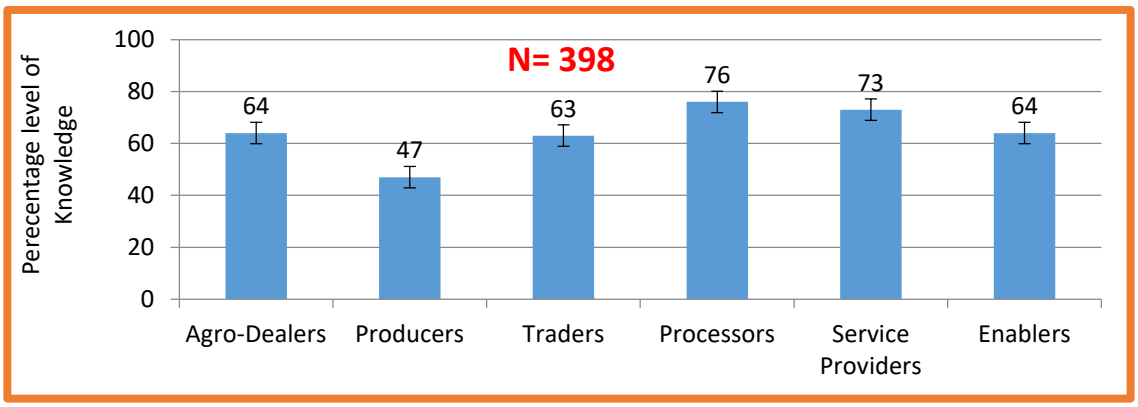

Figure 4.16: Level of Knowledge on Maize Value Chain by Category Players
(Source: Field Data, 2016)

Figure 4.16 reveals that the average percentage mean of knowledge on the maize value chain amongst the chain players was at about 257 (64.5%). This average is given by the average of Agro-dealers-64%, Producers - 47%, Traders – 63%, Processors – 76% Service Providers- 73% and Enablers – 64%).This finding is slightly below the desired level of development for an effective agricultural value chain which should be at least at 75% according to Gloy (2005).

4.5: Measuring the level of development of Maize Value Chain in Bungoma County

Many value chain studies have established that it is essential to measure a value chain's development so as to assess its efficiency and competitiveness. This can be done through various ways which include; mapping value-added distribution, measuring the profitability of the value chain, measuring the productivity of the value chain, measuring the value of wastage of the value chain, value chain benchmarking, measuring value chain agility (Value-Links, 2006).

In this study, the researcher examined the productivity and profitability of maize value chain in Bungoma County to establish the level of development of the value chain by analyzing data collected from various stakeholders' respondents on maize gross margins at various value chain levels. Data required included data on various variables like yield and prices to calculate output and cost of land preparation, seeds, fertilizers, weeding, application of chemicals at farm and in storage, cost of labor for fertilizer and chemical application, and harvesting to calculate the cost of maize production. Table

4.5 shows a gross margin analysis for one acre of maize at county level for the year 2016 to be used to give the profitability of the maize value chain at the maize production level.

Table 4.5: Gross Margin Analysis for One Acre of Maize in Bungoma County in 2016

ITEM		**UNIT**	**TOTAL**
1. Output	1. Yield per acre	bags	18
	2. Price per bag of maize	Kshs.	2800
2. Gross output		**Kshs**	**50,400**
VARIABLE COSTS		Kshs	
4.Land	Ploughing	Kshs	2,600
preparation	Harrowing (Optional)	Kshs	2,500
5. Maize seeds	10Kg @ 1800 10 kg pack	Kshs	1,800
	Planting: 2 DAP - 50kg bags @ 3000 per bag	Kshs	6,000
6.Fertilizers	Top Dressing: 1 CAN - 50kg bags@ 2400per bag	Kshs	2,400
7. Agro-chemicals	1. Type, rate and price: Thunder -100mls @ 800	Kshs	800
8.Post - Harvest Management	1. Hermetic gunny bags: Number & Price 10 @ 250	Kshs	2,500
	2. Drying Tarpaulins -	Kshs.	2,500
9. Transport of inputs			600
	Planting 10md @ Kshs. 260 per md	Kshs	2,600
	Weeding twice 10 md each @ 200 per md	Kshs	2,000
	Top dressing 3 md @ 200 per md	Kshs	600
10. Labor	Stooking 6md @ 200 Per md	Kshs	1,200
requirement	Dehusking @ Kshs. 50 Per bag	Kshs	1,800
	Shelling : @ Kshs. 50 Per bag	Kshs	900
11.Transport of maize to store @10/= / bag		Kshs	1,800
Sub-total		**Kshs**	**32,600**
Miscellaneous costs @ 5% of sub-total		Kshs	1,675
Total variable cost (TVC)		**Kshs**	**34,275**
Gross margin per Acre (Gross output - Total variable cost)		**Kshs**	**16,125**

(Source: Field Data, 2016)

According to Value-Links, (2006), maize value chain productivity at production level stage for one acre of maize crop is given by dividing the gross output by cost of inputs. In this case from the given gross margin analysis, the productivity was given as Kshs. 50,400/34,275 = 1.470, meaning that every shilling used produces Kshs. 0.470. Likewise maize value chain profitability at production level stage for one acre of maize is given by the difference between gross output and total variable cost of production divided by cost of production which is Kshs. 50,400 – 34,275/34,275 = 16,125/34,275 = 0.470. This also means that from Kshs. 1 invested in maize production, Kshs. 0.470 was made as profit. Thus, Table 4.6 depicts the Maize Value Chain productivity and profitability for one acre at production level at farm management level II for the last 5 years.

Table 4.6: Maize Value Chain Productivity and Profitability at Maize Production Level - 2012 -2016

	2012	**2013**	**2014**	**2015**	**2016**
Gross Output	41,400	44,000	46,200	48,000	50,400
Production (TVC)	26,700	27,354	29,435	31,115	34,275
Gross margin	14,700	16,646	16,765	16,885	16,125
Productivity	1.550	1.608	1.570	1.543	1.470
Profitability	0.550	0.608	0.570	0.543	0.470

Source: Field Data, 2017

Thus from the analyses above, productivity and profitability of the maize value chain in Bungoma County at maize production stage at farm management level II for the last five years was such that Kshs. 1 invested in maize production produced Kshs. 0.55, and that was the development level of maize value chain at maize production level.

However, to get the level of development of the whole maize value chain, the analysis must cover the entire value chain and the researcher also looked at the maize retail trading stage, maize wholesale trading stage and small scale maize processing stage the findings are as follows. Thus, maize value chain productivity and profitability at maize retail and wholesale trading levels are as shown in Table 4.7

Table 4.7: Gross Margin Analysis per One Bag at Retail & Wholesale Trade Levels in 2016

Gross Margin Analysis per One Bag at Retail Trading Level in 2016

ITEM	**UNIT COST/PRICE**
Purchase price	2,400
Transport bulking	0
Empty Bag	40
Bagging	0
Loading	0
Weighing	0
Transport selling	0
Offloading	10
County levy	10
Storage	10
Drying	0
Total Cost	2,470
Sale Price	2700
Gross Margin	230
Gross Margin as a % of sale price	9%
Productivity	1.093
Profitability	0.093

Wholesale Gross Margin Analysis per 90kg Bag of Maize

COST OF BUSINESS (PRODUCTION)	
ITEM	**UNIT COST/PRICE**
Purchase price	2,700
Transport bulking	100
Empty Bag	40
Bagging	15
Loading	15
Weighing	10
Transport selling	0
Offloading	0
County levy	10
Storage	10
Drying	30
Total Cost	2,930
Sale Price	3200
Gross Margin	270
Gross Margin as a % of sale price	8%
Productivity	1.09
Profitability	0.09

(Source: Field Data, 2016)

Table 4.7 shows maize value chain productivity and profitability at retail and wholesale trading levels for one bag of 90kg maize produce. Table 4.8 shows the gross margin analysis for one bag of maize at small scale millers' level.

Table 4.8: Gross Margin Analysis for 1 Bag of Maize at Small Scale Millers Level

ITEM	**UNIT COST/PRICE**
Cost of maize	2,650
Offloading cost	20
Overheads	55.
Electricity/diesel	13
Repairs	3
Taxes	15
County levy	13
Labor	7
Losses per bag	26
Distribution	10
Packaging	20
Total cost of milling one bag of maize	2,832
Bags Milled per month	600
Total monthly milling cost	1,699,200
Sale Price for maize meal per bag	2700
Maize meal monthly revenue	1,620,000
By-products revenue	310,500
Total revenue	1,930,500
Gross income	231,300
Gross margin per bag	385.50
Productivity	1.136
Profitability	0.136

(Source: Field Data, 2016)

Hence summary of the gross margin analyses for productivity and profitability of maize value chain across the four value chain stages or levels is illustrated in Table 4.9.

Table 4.9: Summary for Productivity and Profitability of the Maize Value Chain

Maize Value Chain Stage	Gross Margin (Kshs) per bag	Sale Price (Kshs.)	Gross Margin (%)	Productivity	Profitability
Production	896	2800	32	1.470	0.470
Retail Trading	230	2700	9	1.093	0,093
Wholesale Trading	270	3200	8	1.09	0.09
Small Scale Milling	386	2700	14	1.136	0.136

(Source: Field Data, 2016)

From Table 4.9, it is revealed that the average profitability for maize value chain in Bungoma County was given as 0.789/ 4 = 0.19725. These findings established the level of development for maize value chain in Bungoma County to be at about 0.25, meaning that every shilling invested in the chain produces or is improved by Kshs.0.25. The findings also show that the production stage has the highest gross margin compared to the rest of the value chain stages. However, this is still very low. It would have been much better if the stages' lead cost drivers of maize production costs of labor, fertilizer, land preparation and seeds could be minimized. Further, the gross margins at the stages of retail and wholesale trading as well as the processing stages are low mainly because of the high cost of doing business along the maize value chain which include high transportation costs, taxes, overhead costs and wastage of maize produce during transportation, handling and storage. All these high costs need to be brought down for gross margins to be high so that the level of development of maize value chain can be raised. These findings are in line with those of USAID-KAVES (2015) and Kirimi *et al.* (2011) in their studies on maize value chain in Kenya.

4.6: Summary of findings on maize value chain development in Bungoma County

The demographic characteristics of the maize value chain players in Bungoma County show that 64% of the maize value chain players are males, majority are over 36years of age and more than 50% of them have at least primary level of education. Nonetheless, maize producers are mainly women (61%) who are mainly subsistence farmers, have low education level, receive limited agricultural extension services, harvest low yields and are net buyers of maize.

Maize is the most important crop for the people of Bungoma County as it is the major source of food (97%), cash (91%) and others 25%. However, the maize value chain faces numerous challenges which include high cost of maize farm inputs and marketing, poor infrastructure, poor business skills and poor governance. Subsequently, farm input supply stage of the maize value chain is key to maize production, yet the agro-dealers in the area are majorly on small scale level (86%) with average knowledge (68%) on maize value chain activities.

Further, maize businesses in the county are mainly on small scale level (53%), financed with own savings and profits with very few (15%) going for financial credit and insurance facilities. There is no organized maize marketing structure in place with maize processing being done mainly by many small posho mills. Winnowing, sorting and drying are the major value addition activities with women being the major actors at the production level of the maize value chain due to their limited capacities.

The average percentage of the value chain players who are knowledgeable of the maize value chain business at each chain level was at 64.5%. The level of development of maize value chain in Bungoma County was established to be at about 0.25 or 25%, meaning that each unit of resource invested in the maize value chain earns a gain or profit of 25%. This finding is way below the desired level of development for an effective value chain which should be at about 75% according to Kaplinsky and Morris (2001).

In order to enhance the maize value chain so as to attain the desired level of the chain's development that is more competitive, productive and profitable, the maize value chain players need to be knowledgeable in agribusiness to be able to effectively utilize the available technologies and resources for maximum profits. With the required knowledge in agribusiness, they would also be in a better position to identify what technologies and resources are needed when and where and source for them.

CHAPTER FIVE

LEVEL OF FOOD SECURITY IN BUNGOMA COUNTY

5.1. Introduction

This chapter discusses the findings of the second objective of the study which was to examine the food security situation in Bungoma County. Defining food security still remains a subject of debate due to its complex, systemic and multi-faceted nature which is reflected in its many existing definitions. In the study area, food security is defined as having enough maize to provide food (Ugali) enough for all the members that live in the household and visitors at all times. This definition is far from the conventional one that states that, food security exists when people have enough to eat at all times to be healthy and active, and do not have to fear that the situation will change in the future. This is because the respondents' definition does not consider many aspects like nutrition and safety which are paramount to achieving food security. The study interrogated all respondents per each category of the maize value chain in Bungoma County in an effort to examine the factors that relate to the four main pillars of food security in order to establish the status of food security in the county. These pillars are given as food availability, food accessibility, food utilization and stability of food production systems.

5.2 Food Availability

USDA (2006) defines food availability as the physical quantities of food that can be gotten through production, storage, processing, distribution and exchange. According to all the respondents in this study, food availability is synonymous to maize

availability because when one has maize then he/she has food. Consequently, the study sought to establish the status of food availability in the study area through interviewing the respondents, FGDs and observation of various factors that affected maize availability.

5.2.1 Sources of food for the People of Bungoma County

The study sought to establish where respondents got their maize or food from and Figures 5.1 indicates the findings.

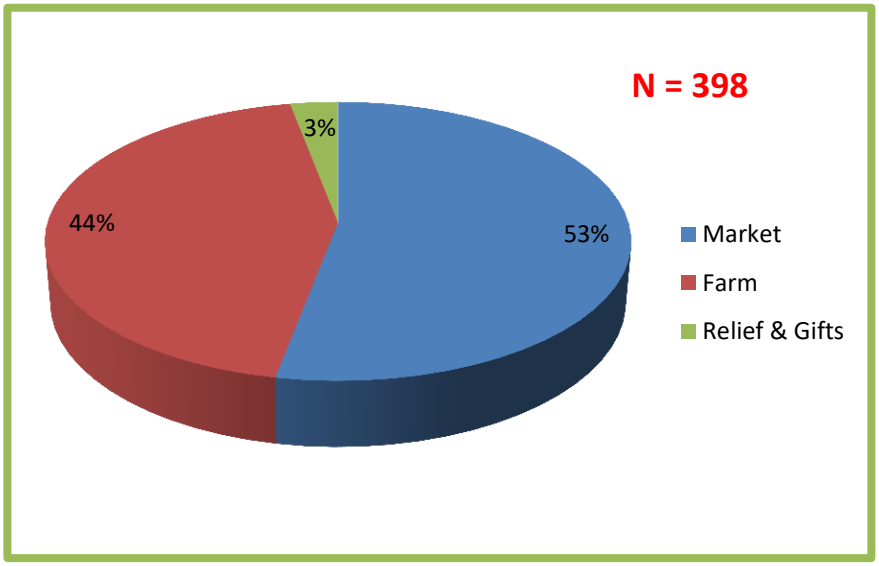

Figure 5.1: Sources of Maize Food in Bungoma County

(Source: Field Data, 2016)

Figure 5.1 reveals that 211 (53%) of the people depend on market for their food, 176 (44%) depend on their farms while 12 (3%) of the people get their food from other sources like relief and gifts from donors. Further analysis by the Pearson Chi-Square test indicated a significant difference in the response on 'market'(with highest rating, 53%) and 'Farm' (second highest, 44%), (x_1^2= 7.34, p= 0.048 < 0.05). This means that

the main source of food or maize for food is the market for both none farmers and farmers as only 184 (44%) produce or harvest enough maize to feed the farmers' households throughout the year. In discussion with the FG of farmer leaders in Sirisia Sub County, they concurred with one of them who said;

> Here in Sirisia, the maize produce from our farms is usually low for most of us. We plant early by the month of March, harvest in the months of July – August and by November-December the maize or food is finished from our household stores. After this, we are then forced to go to maize market to buy maize for food and those who do not have money to buy food from the market have to depend on relief food and gifts from well-wishers

This finding resonates with the argument by Prapti *et al.*, (2010) who wrote that most rural people in developing countries lack resources for the production of adequate food and surplus for cash needs.

To help establish the level of food security, the respondents were further asked to say how many meals their households (HH) had in a day depending on the sources of their food and the results from respondents' responses are as shown in Figure 5.2**.**

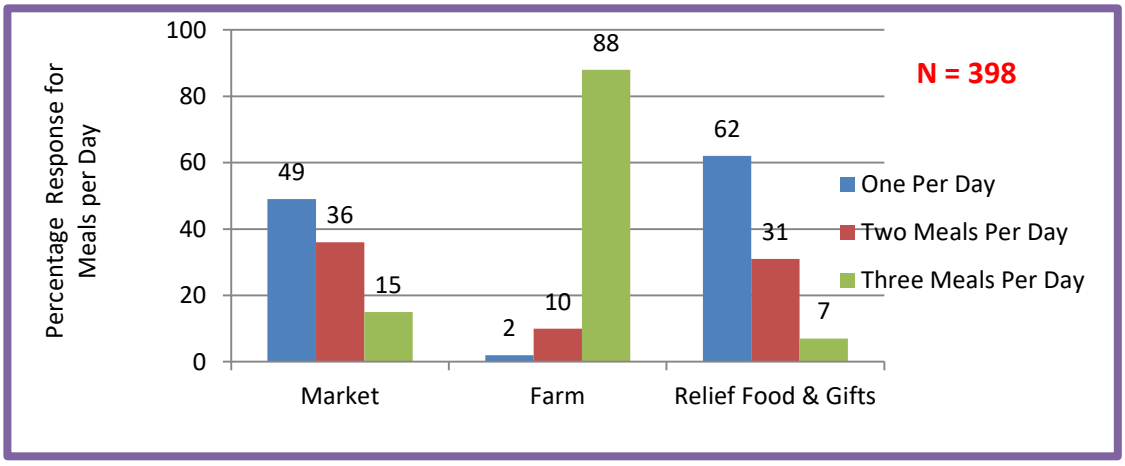

Figure 5.2: Households' Number of Meals per day based on the source
(Source: Field Data, 2016)

Ideally, a food secure household (HH) should have at least three main diet balanced meals in a day. Nonetheless, for Bungoma people, having at least 3 meals in a day is the same as being food secure. Thus, Figure 5.2 clearly indicates that the source of food significantly contributes to the amount of food eaten or the number of meals a HH takes in day. It reveals that 154 (88%) of those people who dependent on the farm for their food have three meals per day while 32 (15%) of those who dependent on the market for food have three meals in a day and only 7% of those who dependent on other sources like relief and gift food have three meals per day. Further, the Pearson's Chi-Square test indicated that there is strong significance in relationship between the "number of meals in a day" and the "source of the food" (x_2^2= 34.295, p= 0.00 < 0.05). These results reveal that most people who depend on their farms to feed their households have enough maize to provide all the food they want at any time but those who get food from the market depend on whether they have the money to purchase the maize food. Getting food or maize from the market also depends on whether the maize is available at the markets and whether the markets are accessible and so only 15% of them are sure of having three meals in a day. Further, the FGDs corroborated that those people who depended on relief and gift maize for food were the most hit with very low food security as they never knew where the next meal would come from and that most of them 8 (62%), have only one meal a day. When this issue was discussed with the KIs, most of them (89%), confirmed that majority of the farmers in Bungoma County are small scale subsistence whose maize yields are too low to feed their households till the next harvest so they end up going to the market for more maize.

According to USDA (2016), the number of meals taken in a day in a given household, could be a good measure for assessing the household's food security, as it signifies the ability to access enough food for an active, healthy life by all members of the household at all times. Hence, it has been established that the average food security situation in Bungoma County is about 37% (Average percentage of the households with three meals in a day). This infers that about 63% of the people in Bungoma County were food insecure. These findings concur with the results of studies that have recently been done on food security situation in the county like KARI (2013), Simiyu (2014) and Wabwoba *et al.*, (2015) who also established that the people of Bungoma County were majorly food insecure.

5.2.2: Type of Maize Farm Inputs Used and Yield Produced

The study sought to establish whether type of inputs used or not used affected the yield received or stored. The respondents were asked to state what type of maize farm inputs they used to produce maize and the yield they harvested for the previous year. The findings from the individual producers were as indicated in Figure 5.3.

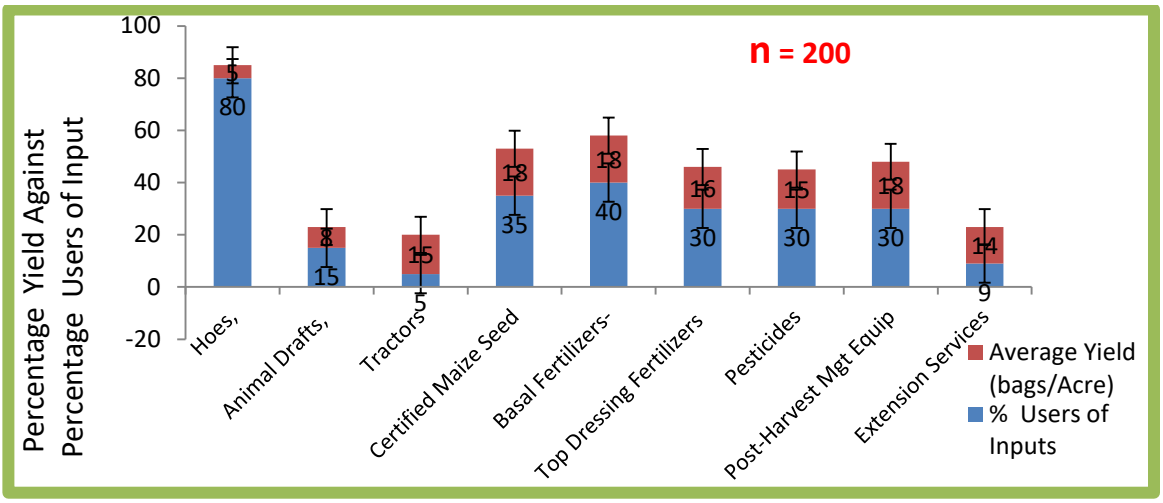

Figure 5.3: Types of Maize Farm Inputs Used and Maize Yield Produced (Source: Field Data, 2016)

The findings in Figure 5.3 reveal that the majority of producers (80%) are poor farmers who use old methods like hoes with poor farm management methods leading to low yields like 5 maize bags per acre. On the other hand, those who use research recommended technologies like certified seeds, fertilizers and receive extension services are few (35%, 45% & 30%) respectively but get high yields like 15-18 bags/acre. The study also revealed that the percentage of farmers who used extension services was very low (9%) and that tractors were insignificantly used by majority of the farmers in the region as indicated by non-over lapping standard error bars. However, all the mentioned farm inputs are significantly relevant to food availability as revealed by the non-overlapping error bars. These findings imply that most maize producers are resource poor, implying that they lack the necessary capacity to effectively use the research recommended inputs and extension services. These findings were corroborated during FGDs on the type of maize farm inputs used when a stakeholder from the Kanduyi Sub County FGD said;

> Most farmers in this area use jembes (hoes) to till their maize fields and others use draft animals to plough. Tractors are very few and expensive for most of us. When it comes to getting fertilizers, the process at the NCPB is too tedious and at the agro-dealers, the prices are too and sometimes not available. So most rural farmers just use what they have. By the way, the agriculture extension officers used to be long time ago. Nowadays, we do not know what happened.

These findings were confirmed by the KIs from the agriculture department of the County Government and they are in line with related literature by BICDP (2013) that reports that the level of extension workers in the county is at the ratio of extension workers to farmers of 1:900. This observation also echoes Odunga (2012) in his

assertion that farmers should go for certified seeds and fertilizers to increase yields, and KARI (2014) who reported that the use of research recommended inputs is very low in Bungoma County. Plate 5.1 portrays a common picture of maize farms in Sirisia Sub County:

Plate 5.1: Type of commonly found maize farms in Sirisia Sub County
(Source: Field Observation, 2016)

Plate 5.1 shows a commonly found type of maize farm amongst poor farmers whereby the farm is full of weeds in a yellowing stunted maize crop as observed in many farms in Sirisia Sub County. FGDs revealed that most poor farmers struggle to get certified maize seed to plant without fertilizers and then due to lack of effective farm equipment and adequate labour, the farms are not effectively weeded which results into low yields. Further, as observed by the researcher, the Plate shows a stand of a poorly managed maize crop that is yellowing and stunted. This could be due to the insufficient

use of research recommended technologies like fertilizers, certified maize seeds and well prepared farms as recommended by KARI (2014).

On the other hand, Plate 5.2 shows an example of a maize farm whereby the farmer accesses extension services and uses recommended technologies in managing her farm.

Plate 5.2: Researcher observing a well- managed farm in Tongaren Sub County together with the farmer and an Extension Service provider

(Source: Field Data, 2016)

Plate 5.2 shows a picture of a farm that is well managed with the researcher on the left, the extension service provider with a head cap in the middle and the farmer on the right. According to the farmer and the service provider, the farmer expects approximately a yield of 22 -28 bags/acre. The farmer confirmed that there must be enough resources (money) for a farmer to afford the recommended maize crop technologies. On interrogation by the researcher, the farmer revealed that she did not keep farm records but she estimated that she needed to spend about Kshs. 30,000 to harvest a good crop of about 28 -30 bags of 90kgs shelled maize in a good season.

5.2.3: Main Factors affecting Food Availability at Household level

From the respondents the study sought information on the issues that affected food availability at household level and the findings were as shown in Table 5.3.

Table 5.1: Factors affecting food availability at House hold level

	Year					
	2012	**2013**	**2014**	**2015**	**2016**	**Average**
1. Maize Yield- bags/acre	14	15	13	15	17	15
2. Average Land Size per HH	2.5	3	2.25	3	2	**2.55**
3. Average production yield/HH	35	45	30	45	34	**39**
4. No. of HH Members	8	7	8	8	8	**8**
5. Amount of Consumption (bags) required per HH	16	14	16	16	16	**16**
6. Number of bags per HH required for cash needs	35	34	39	35	33	**35**
7. Total Average Number of bags required for HH	51	48	55	51	49	**51**
8. Average Deficit/HH	16	3	25	6	15	**12**
9. Maize in store (bags)per HH	4	3	6	1	1	**3**
10. Maize price (Kshs) per bag	1600	1700	2000	2000	2100	**1880**
11. Nearest marketing center (Km)	5	5	5	6	7	**6**

(Source: Field Data, 2016)

The study results revealed that average maize yield per HH was 39 bags while the amount required for home consumption was 16 bags and the requirement for cash needs per HH was 35 bags as shown in Table 5.1. (Look at the average column). Besides food availability, farmers need to satisfy non-food demands like clothing, housing, sugar, salt, farming tools, fees, etc. which means that one must balance household food requirements against all these cash needs. Thus there is an average deficit of 12 bags per HH resulting in food insecurity in the study area. This agrees

with the findings of the study done by KARI (2013) in the county under the agriculture Sector Development Programme (ASDSP) on food security situation in the county. Further, Table 5.2 shows Pearson correlation coefficients for maize availability and main factors that affect it in the region.

Table 5.2: Correlation Matrix for factors affecting food availability at Household Level

		Average maize production	**Average acreage**	**Average maize bags stored**	**Average Price per bag**	**Average number of members in a HH**
Average maize production	Pearson Correlation coefficient	1	.367**	.152	-.077	.454**
	Sig. (2-tailed)		.002	.197	.496	.000
	N	398	398	398	398	398

Source: Field Data, 2016

The correlation between Average maize production and Average acreage is significant as indicated by the Pearson correlation coefficients, Corr. = 0.367 p = 0.002 < 0.05 and Corr. = 0.454, p= .000< 0.05 respectively. Average maize production, increases with increasing average acreage and Average maize consumption increases with increasing Average number of members of a HH as confirmed by positive Pearson correlation values (Corr.= 0.454 and Corr.= 0.367 respectively). This implies that since the average land size is not likely to increase while consumption and needs for cash are increasing with increasing population (increasing HH Members), innovative ways must be developed to increase maize productivity through technologies and improved extension services and methodologies. This finding and observation agree with the recommendation by KARI (2013) and Wabwoba &Wakhungu (2013).

5.2.4: Households with Maize Stores

The study revealed that most farmers and none farmers who purchase maize food, store maize for the main purpose of having food for the household in future before the next harvest. Others, especially the traders, store maize in order to sell in future when the selling prices are higher (around January to July). Thus the maize stored is either from production or purchase. The correlation analysis between Average maize production and Average maize bags stored and Average price per bag were insignificant as indicated by p = 0.197 and p=0.496 respectively. This implies that since maize yields harvested is very low, there is little or none left for storage after consumption or subsistence needs. This was confirmed by the KIs and FGDs in their responses that inferred that maize bags in store can increase with increased maize production and productivity. Moreover, it was also indicative that average maize consumption decreases with increasing average distance from marketing centres as indicated by positive correlation values (Corr.= 0.152) and a negative correlation value (Corr.= −0.077) respectively.

5.2.5: Post-Harvest Management

From the respondents, the FGDs and KIs, it was revealed, corroborated and confirmed, respectively that produce loss challenges start right from the farm when there are rains during harvesting time (August –September) up to consumption when there is wastage due to deficient maize produce post-harvest management practices and technologies used. Figure 5.4 shows the main causes of post-harvest losses.

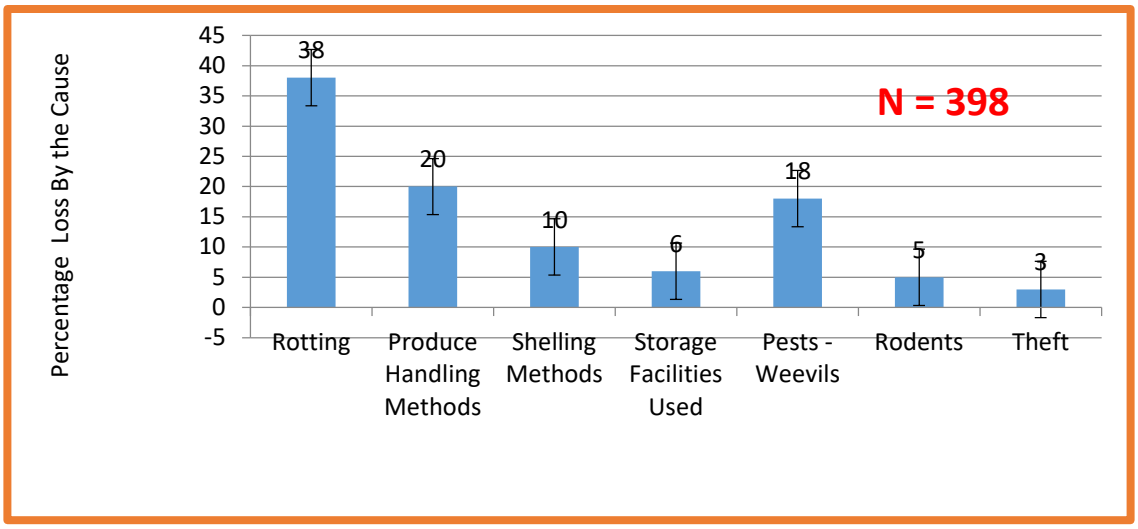

Figure 5.4: Causes of Maize Post-Harvest Losses amongst the MVC Actors
(Source: Field Data, 2016)

Figure 5.4 indicates that maize rotting and post-harvest produce handling methods cause most of the post-harvest produce losses. Responses from the KIs also confirmed that post-harvest losses (PHL) are significant in the community causing about 32% loss of what is produced. This means that about 32 % of the maize that is produced or purchased for food or trade is lost through PHL thus greatly affecting food availability. Moreover, producers when asked about post-harvest management practices they said they mostly hit maize on cobs in sacks to shell and due to inadequate storage facilities and technologies they lose 3-5bags through wastage and pests. These findings were validated by most participants in the FGDs (92) and confirmed by the KIs who added that the maize shelling methods and storage pests like maize weevils also cause significant maize produce losses. These results agree with the report by UNDO (2009) that says that poor post-harvest management in the less developed countries lead to up to 35% produce losses. Plate 5.3 shows how maize is commonly dried, on the bear soil ground before and after shelling;

Plate 5.3: Maize drying on bare soil ground before and after shelling in Kanduyi Sub County

(Source: Field Data, 2016)

Plate 5.3 shows that maize is commonly dried on the soil ground resulting into dirty poor quality produce. It also reveals that there is a lot of rotten maize leading to high losses and the tin (Gorogoro) in the maize shows that the farmer is hurriedly ready to sell. This poor quality and reduced amount of produce lead to food unavailability and low income and the unplanned sell maize immediately after harvesting leads to selling at low prices and lack of maize for food in the near future. This finding corroborates that of Kirimi *et al*. (2011) that established that most small scale maize farmers are net buyers of maize and resonates the related literature by GOK (2014) which reported that, post-harvest management has proved to be a big challenge in Kenya causing up to 35% loss of the produce.

5.2.6: Maize storage facilities

From the maize producers (farmers), the study sought to establish what types of storage facilities are used in the region and the findings were as presented in Table 5.3.

Table 5.3: Available Types of Maize Storage Facilities

Type of Storage Facility	**% Usage**	**Frequency**
On open floor in the House	9	18
Nylon Gunny Bags	65	130
Traditional Granary	8	16
Hematic Bags	8	16
Metallic Silos	2	4
National Cereal & Produce Board (NCPB)	3	6
Modern Stores	5	10
n	100	200

(Source: Field Data, 2016)

Table 5.3 shows that only 18% use the recommended storage facilities which include hermetic bags (8%), metallic silos (2%), National Cereal & Produce Board (NCPB) (3%) and modern stores for storing maize (5%). The study also revealed that most maize (65%) is stored in nylon gunny bags which according to KARI (2014) have poor ventilation leading to poor quality of stored maize. These findings agree with those of KARI (2013) and UNDO (2009) who concurs that farmers, traders, and transporters lack appropriate post-harvest handling and storage facilities leading to up to 35% produce losses.

5.2.7: Maize Value Chain Service Providers and food availability

According to 97% of the service providers who included maize processors (Hongera Millers), CDAO, County Trade Officer, Equity Bank LTD, AFC, SCAOs and field agriculture extension officers, maize was the main food in Bungoma County and it was mainly utilized in form of Ugali and porridge. It was also revealed that maize is utilized in form of Githeri (cooked maize and beans mix) and roasted green maize to some significant extent. About 70% of the KIs and 80% of the FGDs agreed that majority of the people in the region do have meals only twice a day which is a clear indicator that there is no adequate food security in the region.

From the key informants it was established that 86% of the people of Bungoma County are farmers although only about 44% of them got adequate maize for food enough for the whole year. The FGDs concurred that the rest of the community had to supplement their farm produce with food from the market and other sources like relief and gifts, leading to majority of them having only two meals a day. Further, the KIs were asked to state their average annual household production and consumption for the last five years and the CDA gave the average annual production and consumption for the county for the last five years. The respondents gave their production and consumption amount in bags of 90 kgs whereby, the average production and consumption in number of bags times 90kgs were divided by 1000 to give metric tonnes. Figure 5.5 shows the food situation trend in the region for the last five years.

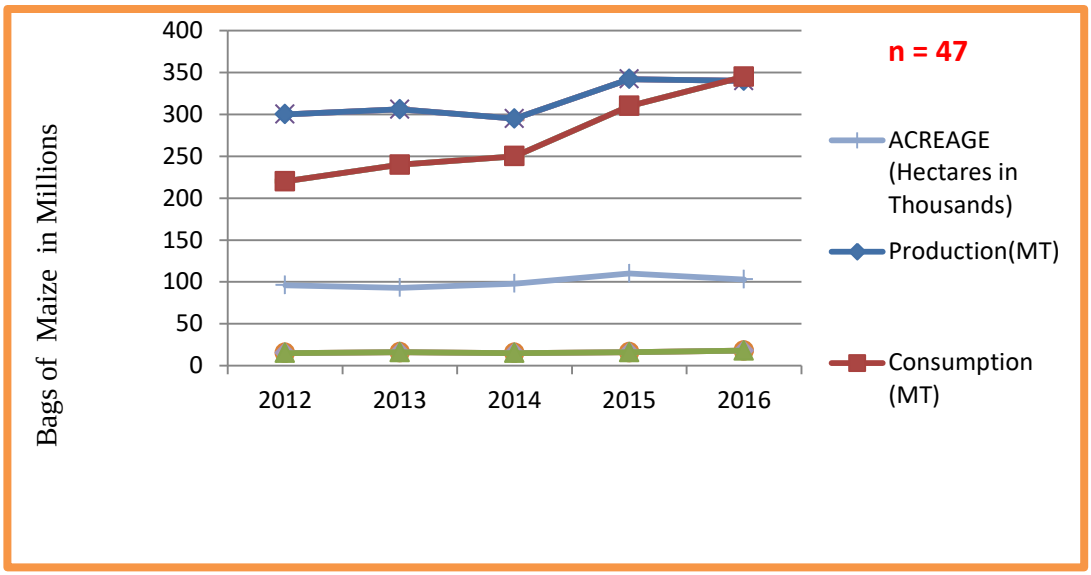

Figure 5.5: Trends of Maize Production and Consumption in the last 5 years

(Source: Field Data, 2016)

According to the Service Providers (CDA- County Director of Agriculture), there was a boost or high enough production of food (maize) in the county in the years of 2012 and 2013 then a drop in the year of 2014 then continued general decline as shown in Figure 5.5. Meanwhile, maize productivity or yield has remained low and consumption rate has remained relatively high and increasing for the last five years. Further, the study also revealed that while the population of the county was about 1,650,750 in 2016, the maize produced in 2015 was 257,087 Metric tonnes an equivalent of 2,856,522 bags of 90kgs. It was also revealed that the requirement for the population of Bungoma County is 3,301,500 bags, therefore, there is a big deficit of approximately 444,978 bags to be imported from outside the county elsewhere (BCG, 2016). It was also revealed that not all the maize produced in the county is consumed in the county as some maize retailers and maize brokers buy from farmers and wholesalers at harvest time and transport to sell to wholesalers, retailers and millers outside the county

leaving the county with a bigger food deficit. These findings agree with those of USAID-KAVES (2015) in a study on maize marketing in Bungoma.

From the FGDs conducted with maize stakeholders in their respective study sub counties, it was confirmed that majority of the community depended on the farms for food but on average about 32% of their produce go to waste mainly due to poor storage facilities and poor post-harvest handling. From the FGDs and KIs it was also confirmed that the main sources of income in the small scale farmer households were; maize farming, maize trading, maize posho mills and casual labour in the maize fields. These findings are in resonance with related literature on food security in Bungoma by Wabwoba *et al.,* (2015) and KARI (2013) which recommended that farmers, traders, millers and the government to work together in order to improve the maize availability status. Plate 5.4 shows the researcher discussing maize production and maize business in the region with farmers at a chief's barazas (meeting).

Plate 5.4: The Researcher having a discussion with a group of farmers in Tongaren Sub County Source: Field Data, 2016).

Plate 5.4 shows the researcher, dressed in a green top, having a discussion with farmers who had grouped at the chief's centre for a barazas to be sensitized on maize production and use of farm inputs. From this plate, it is revealed that females are few and are at the back. This helps to explain why the female farmers are less educated compared to the male gender. They are less exposed as they do not attend education meetings and trainings as vigorously as men.

5.3: Food Accessibility in Bungoma County

Food accessibility is the second major pillar after food availability that affects food security as those who are not able to produce enough own food must buy or have any other means of acquiring food. For a household to be food secure, it must be able to access food that is sufficient, healthy and acceptable, enough for all in the house hold at all times (USDA, 2012). These calls for a household to have the ability to secure entitlements or resources that could be legal, political, economic, physical or social means that one can use to obtain food (FAO, 2007).

From the interviews carried out it was revealed that the respondents had a deficit of an average of 12 (90kg) bags of maize (see Table 5.1), that they had to get off farm for them to be or feel food secure. It was also revealed that traders brought maize for sale into the area from neighbouring countries like Uganda and counties like Trans Nzoia and Uasin Gishu and sold at local markets like Lwakhakha, Sirisia, Chwele, Kimilili, Kamukuyua and Mukuyuni. However, it was evidenced that there were major challenges that made this traded maize almost unattainable to the community and these

included low purchasing power, high maize buying price, poor maize quality and impassible rural roads in some parts. Table 5.4 shows average annual incomes, expenditure needs and market distances from households across the maize value chain actors.

Table 5.4: Food Accessibility amongst the people of Bungoma County

	Agro-dealers	Farmers	Traders
Average Annual Income (Kshs.)	66,000	75,000	89,000
Average Annual Expenditure Needs (Kshs.)	120,000	100,000	110,000
Percentage of the Expenditure needs met (%)	55	75	81

(Source: Field Data, 2016)

Table 5.4 shows that the incomes received could meet 55% of the agro-dealers' expenditure needs, 75% of the farmers' expenditure needs and 81% of the traders' expenditure needs. This means that purchasing maize for food has to compete with the other household expenditures and there is less to go round, the households are not food secure. This was corroborated by the FGDs when some lead farmers said that some households sacrificed having food in order to pay school fees. This finding is corroborated by FAO (2012) who stated that a principal problem in achieving food security is that many people in the world still do not have sufficient income to purchase or grow enough nutritious food.

Further, Table 5.4 also indicates that the value of maize increases as one moves up the chain. A Pearson Chi-Square test for significance in differences in the net incomes amongst different maize value chain actors indicated a significant value of $p= 0.000<0.05$. This means that the average net income among farmers, agro-dealers and traders/transporters are not the same (i.e. are significantly different at 5% significance

level) which also applies to average net expenditures amongst different maize value chain categories. Further analysis by ANOVA test was done to test if average income and expenditure were proportional to the amount of maize produced or handled across the maize value chain and Table 5.5 shows the findings.

Table 5.5: Analysis of Variance in the Average Maize Volumes handled

Model	**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Regression	1067221602226.670	3	355740534075.557	3.342	.028
Residual	4684035408636.536	44	106455350196.285		
Total	**5751257010863.206**	**47**			

(Source: Field Data, 2016)

The Pearson Chi – Square Test that was applied to test if average income and expenditure were proportional or correlated to the amount of maize produced or handled across the maize value chain showed positive results ($F = 3.342$, $p = 0.028$). This finding implies that even if the total amount of maize produced in the county could be adequate for the total population in the county, there are differences in the different categories of the people in the county or along the maize value chain. These differences are in the areas like the purchasing power, distance from the maize market, food preferences and knowledge of where to get maize, makes many households not to be food secure. However, if the acreage of maize production and maize produce yield were increased in the region so that the maize volumes handled at all stages of the maize value chain were increased, then each actor's income would increase thus increasing their purchasing power and accessibility to food. According to the key informants, in order to enhance food accessibility, food must be available at locations where the community can easily reach it and the community must also have the means

to possess it. They proposed that since maize is the main source of food (section 5.2.1) and it either comes from the farms or market, the community must have the means to either produce maize or purchase maize from the market for their food requirements. This revelation is in line the recommendation from Audsley *et al. (*2010) and Wabwoba (2012), who recommends that producers and markets should be facilitated to access information and technologies that will enhance their access to food.

Nevertheless, the study revealed that food accessibility in Bungoma County faces various challenges as shown in Table 5.6

Table 5.6: Challenges faced in food Accessibility

S/No	Challenge	% of Those facing the challenge
1.	Insufficient money to buy food	35
2.	High Maize Buying Price	25
3.	Poor Maize Quality	10
4.	Poor Rural Roads	15
5.	Long Distances to access markets	15
	Total	**100**

(Source: Field Data, 2016)

One sample binomial test indicated that the proportion of those facing the challenge of insufficient money to buy food (35%) is significantly greater than that of those facing high maize buying price (25%), p =0.010. Thus the greatest challenge to food accessibility is insufficient money amongst the households as indicated in Table 5.6. Since the people of Bungoma County mainly depend on maize crop for food and income, they are at great risk of food insecurity as they must always produce maize since the majority cannot afford to feed from the market.

5.4: Food Utilization

Food utilization effectively depends on how food is prepared and consumed besides the available food being safe, nutritious, sufficient and acceptable. In order to determine the level of food utilization amongst Bungoma people, the respondents were asked to state what their main source of food was and in what form they mainly consumed or utilized it. The study revealed that the Bungoma community (98%) use maize grains for food in their households and 96% prepare and consume it in form of Posho Meal Ugali while 4% consume maize in form of porridge, maize & beans mixture (Githeri). Maize Ugali is the most popular and preferred form in which maize is utilized as food as was confirmed by the FGDs. From the FGDs, it was also established that very little, may be less than 2% of the maize produced was utilized as green maize for food although some farmers produced green maize for sale. It was asserted that in Bungoma County, it is a common belief amongst the community that a Bukusu (a person from the community) would not have eaten unless he/she has eaten Ugali, (All other foods are just but snacks). The respondents also indicated that having enough maize that can provide at least three meals in a day means that a household is food secured. These findings are in agreement with those of Wabwoba *et al.*, (2015) and Simiyu (2014) from their studies on food security in Bungoma County.

However, besides the method of preparation and form in which food is eaten, food utilization also refers to; (1) the number of meals per day; (2) the amount of food per meal; (3) the nutrient density of the food consumed and (4) food safety (5)and the capacity of the body to utilize the food consumed. The KIs (96%) confirmed that only

37% of the people had three meals in a day, a large proportion of (55%) had two meals per day while 8% had only one meal per day. This implies that about only 37% of the community was food secure a result which is close to that of KARI (2013) in their study on agribusiness in Bungoma County. These findings also revealed that the community majorly depended on maize for food thus closing out other types of foods. This is risky as it makes the people vulnerable to food insecurity since nutritionally, maize only provides approximately 72% starch, 10% protein, and 4% fat, supplying an energy density of 365 Kcal/100g leaving a lot of nutritional room for other types of food. This is in line with WHO (2014) in its statement that the nutritional value of a given food and the health status of the body are key to food utilization in food security.

5.4.1. Food Processing Capabilities

As it has been revealed in sections 5.2.1 and 5.4, for effective food utilization to be achieved, it is required that the maize is dried and milled or processed into maize flour. The study also revealed that at community and home level, the people depended on many small scale posho mills which mill small quantities on need be basis which is consumed raw and unpackaged. The researcher discussed the issue of maize value addition with a KI, the Bungoma County Agribusiness Officer, who said;

> Maize value addition in Bungoma County is done on a very limited scale. We have only two medium scale maize millers, milling about 200 bags of 90kgs per day, situated in Webuye town. These are Hongera Millers, and Friends Church Millers. Therefore, 'Ugali being the main food in the County, majority of the people rely on maize flour from small scale posho mills which are commonly found in all villages. This also means that there are many investment opportunities for trading in maize milling and maize value addition in the County.

5.5: Stability of Food Security Systems

This refers to the activities and processes that relate to the production, processing, distribution, preparation and consumption of food. USDA (2006) states that in order to have food security, it is essential that food infrastructure is up to date. This means that the physical, policy, and organizational structures that are required for operations, services and facilities are in place and regularly updated. These would facilitate for food production, supply, processing, distribution, marketing, consumption and food waste disposing. It would also ensure that there is long-term stability of food supply and the ability to meet consumption and livelihood needs on a continuous basis. The respondents were interviewed to get information on who were involved in the processes or activities towards achieving food security in the county and findings were as shown in the following Table 5.7.

Table 5.7: Number of Actors involved in various Food Systems

System	Number Available	Percentage (%)
Input suppliers	2	0.017
Agro-Dealers/ Stockists	98	0.09
Maize farmers –House holds	110,797	99
Maize transporters	22	0.02
Maize Posho Mills	755	0.6
Maize Millers	2	0.16
Maize Store Traders & Brokers	145	0.01
Maize Value Chain Supporters	47	0.042
Maize value Enablers	8	0.07
TOTAL	111,876	**100**

(Source: Field Data, 2016)

Table 5.7 shows that 99% of the community is involved in farming or producing maize, leaving only 1% to deal with the rest of the maize value chain. From the findings presented earlier (Figure 5.1), 53% of the population in Bungoma County dependent on market for food. This is because the farmers are not producing

enough maize for food for themselves nor are they earning adequate income from maize for their cash needs. This means that more people should be engaged in the other food security systems and activities in the maize value chain in order to add more value. These findings are in line with those of Nyoro (2000) in his study on Kenya's competitiveness in domestic maize production. He recommended that all processes along the maize value chain should be strengthened and stabilized so that the majority of maize producers are not the small scale resource poor and vulnerable farmers.

5.6: Key Challenges to achieving food Security

The maize value chain service providers were asked to state what they thought were the key challenges afflicting food security in Bungoma County and findings were as shown in Figure 5.6:

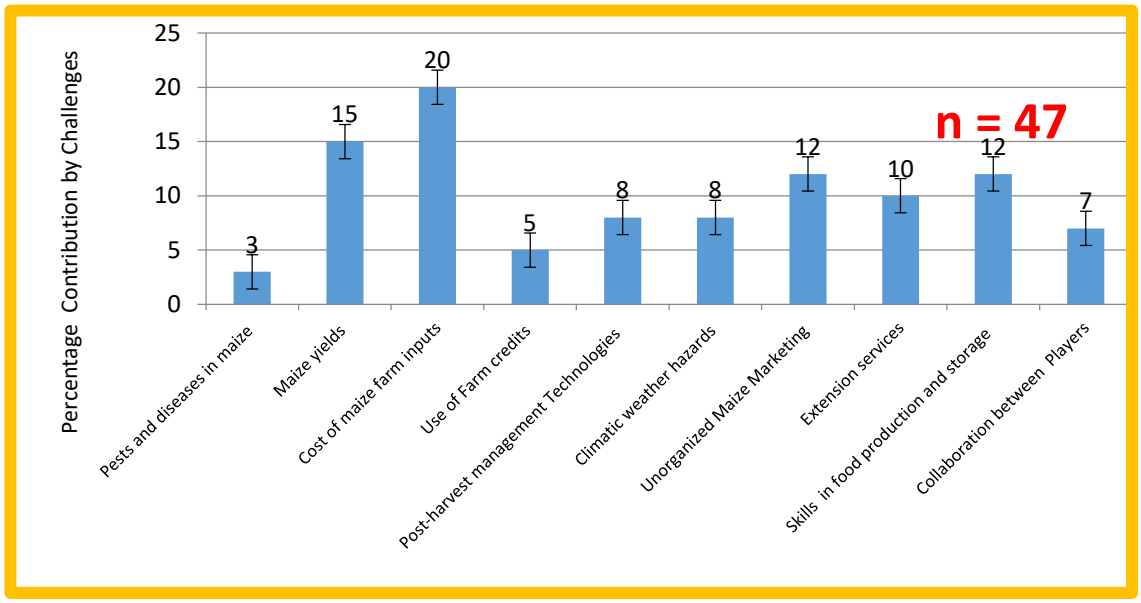

Figure 5.6: Challenges faced in achieving food security in Bungoma County

(Source: Field Data, 2016)

Figure 5.6 indicates that according to the maize value chain service providers, high cost of maize farm inputs (20%), Low maize yields (15%) and unorganized maize marketing structures (12%) were the main challenges hindering the achieving of food security. However, the other stated challenges like deficient skills used in maize food production, storage and insufficient agriculture extension services were also significant in achieving food security as shown by the non-overlapping error bars in Figure 5.6. These findings were confirmed by the KIs when interviewed on challenges faced in achieving food security whereby most quoted high cost of inputs and low maize yields as the biggest challenges faced.

It was revealed that the cost of most maize farm inputs like fertilizers, certified maize seeds, and land preparation equipment like tractors is too high for the majority of the small scale farmers to afford. Moreover, most farm inputs agro-dealers are allocated far from farmers and the increased distance and cost of transporting inputs to the farms further increases the cost of inputs. This forces many farmers to plant uncertified maize seed, plant without fertilizers or apply insufficient inputs measures. FGDs also validated that the challenge of low yields was a key one because it caused the households to have inadequate food and or low incomes for the household cash needs. It emerged from the FGDs that the low yields were either from insufficient use of the recommended farm inputs, from land degradation caused by over use or deficient farm management skills used by the farmers. Further, the maize stakeholders in the FGDs pointed out that emerging maize pests like FAW (Fall Army Worm) and diseases like MNLD (Maize Necrosis Lethal Disease) combined with unforeseen climatic weather

hazards like droughts and hailstone had seriously contributed to low maize yields in the recent years.

Similarly, the study established that poorly organized maize marketing system whereby farmers hurriedly sold their maize produce after harvesting at low prices mainly through brokers either due to the high need for cash or inadequate storage facilities, led to low incomes and low food stores saved for tomorrow's use. Inadequate extension services and inadequate collaboration between maize value chain players contributed to deficient skills used in food production, post-harvest management and storage which in turn contribute to low yields and high produce losses. These findings are in agreement with those of KARI (2013), BICD (2013) and Wabwoba *et al.,* (2015) who established that although maize production is literally a way of life or culture for the people of Bungoma County, it faces many challenges that were affecting maize availability as maize productivity was too low, (46% below the potential for county) and 32% Post-Harvest Losses (PHL).

5.7: Summary of findings on the level of food security

In the study area, food security is defined as having enough maize to provide food (Ugali) enough for all the members that live in the household and visitors at all times. To the community maize is synonymous with food or Ugali and hence food availability is synonymous to maize availability because when one has maize then he/she has food regardless of what other food types could be available. This local definition of food security is contrary to the commonly established definitions as it does not consider

food nutrition, safety and malnutrition as one can still be food insecure in the face of plenty.

Although 86% of the people are maize farmers, only 44% get enough food from their farms and the rest have to rely on the market and other sources like relief food and gifts for food. This leaves 52.9% sourcing for maize for food from the market and 3% relying on relief food and gifts. Therefore, out of all the sources of food, only 37% of the community has adequate food as their households have at least three meals in a day and hence food secure. However, those who get enough food supply from their farms are more food secure than those who rely on other sources. Further, the relationship between available land acreage and amount of maize produced as well as between amounts of maize consumed and number of people in a house hold is that more land acreage under well managed maize production means more food availability and higher number of HH members means more food required.

Most of producers have inadequate resources to invest in maize farms and the low use of recommended technologies like certified seeds and fertilizers result into low farm yields, low farm income and low food security. Moreover, post-harvest produce loss challenges start right from the farm when there are rains during harvesting time up to consumption when there is wastage due to maize rotting, poor handling and poor storage facilities leading to up to about 32% produce loss. Under food utilization, maize is commonly used to make Ugali which is the main form in which maize is eaten as indicated by 96% response. However, other forms such as Githeri, porridge and

roast maize are also eaten although on a much smaller scale (4%). Nonetheless, there are many challenges like pests and diseases like MNLD; declining oil fertility and high cost of inputs that cause low maize yields and post-harvest and storage losses.

CHAPTER SIX

FACTORS INFLUENCING POVERTY REDUCTION IN BUNGOMA COUNTY

6.1 Introduction

This chapter covers the study findings on objective three which was to examine the factors influencing poverty reduction in Bungoma County. In this endeavor, the respondents in the study were interviewed on various key issues related to poverty and poverty reduction which included local meaning of poverty in the community, indicators of poverty and sources of income or livelihoods in the community. The study also sought to establish the average level of poverty in the community. The interviews were carried out per category of the respondents along the maize value chain; Agro-dealers, producers, traders, supporters and enablers. Key informants (KIs) and focus group discussions (FGDs) were also engaged for information corroboration.

6.2. Meaning of poverty to the Maize Value Chain Players in Bungoma County

The study revealed that the maize value chain players in Bungoma County define poverty as the lack of necessities of life like food, land, toilets, education and having no or poor housing. This definition of poverty was more or less synonymous amongst the respondents and it is comparable to the definition of absolute poverty by World Bank (2008) and U.S. Census Bureau (2014) who defined absolute poverty as a condition characterized by severe deprivation of basic human needs, including food, safe drinking water, sanitation facilities, health, shelter, education and information.

6.3: Indicators of Poverty as per the Agro-dealers in Bungoma County

When the 60 sampled maize inputs - agro-dealers were interviewed on what were the indicators of poverty amongst the community, the results were as shown in Figure 6.1.

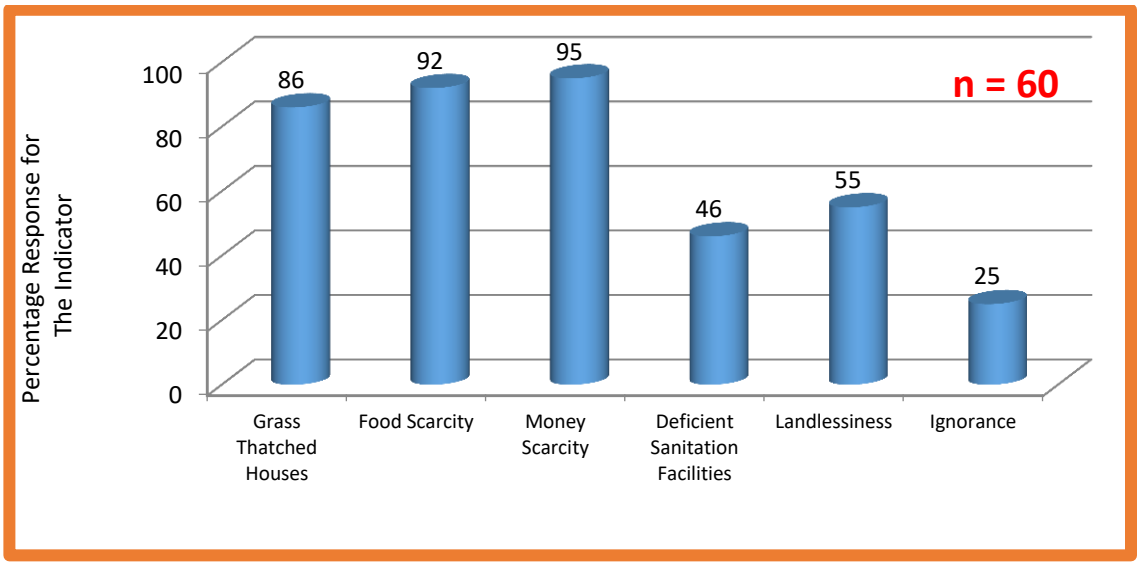

Figure 6.1: Indicators of Household Poverty as per the Agro dealers

(Source: Field Data, 2016)

Figure 6.1 shows that majority of the farm input dealers suggest that grass thatched houses 52 (86%) food shortage 55 (92%) and scarcity of money 59 (95%) are the major indicators of poverty in the region as captured from the responses respectively. However, it was noted by use of one sample binomial test, ($p = 0.061 > 0.05$), that deficient sanitation facilities like water and toilets and landlessness were also important indicators of poverty in the region as indicated by 46% and 55% response respectively. Similarly, results for poverty indicators in the community as viewed by the 200 maize producers and 91 traders that were sampled were as shown in Figure 6.2;

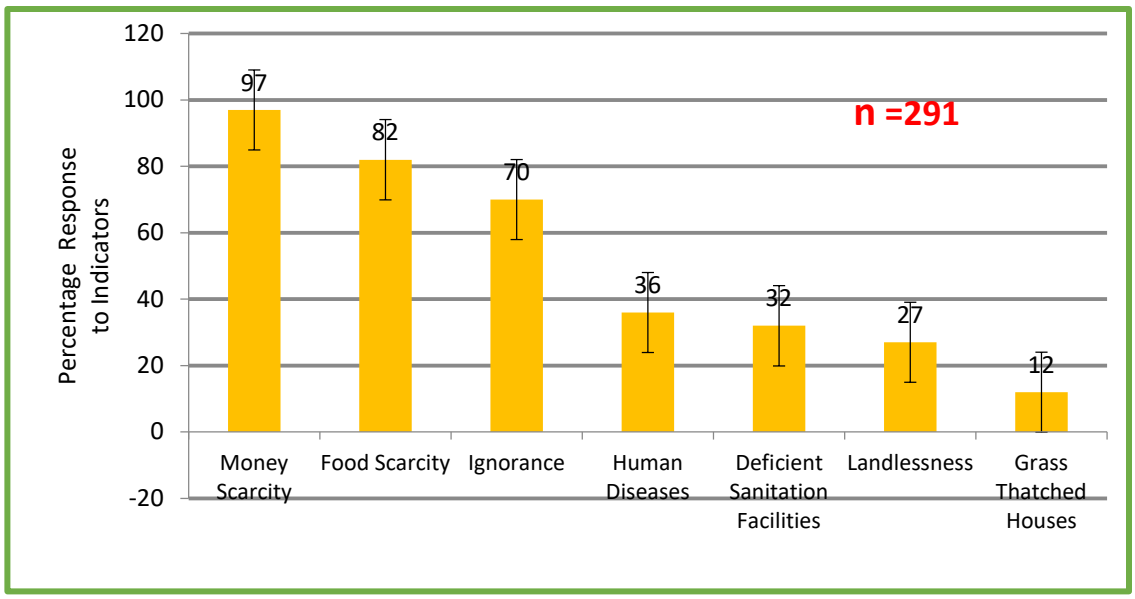

Figure 6.2: Poverty Indicators in the Community as per the maize Producers and Traders (Source: Field Data, 2016)

According to the responses of the producers and traders, money scarcity 282 (97%), inadequate food 239 (82%) and ignorance 70% (204) which were prevalent in the region were the major indicators of poverty amongst the people as indicated in Figure 6.2. Money scarcity stands to be the main indicator of poverty in the region according to the maize value chain producers and traders as confirmed by the Chi-Square test which showed a significant difference in the response on money scarcity (with highest response, 97.0%) and food scarcity (second highest, 82.4%), (x_1^2= 7.98, p= 0.039 < 0.05).

Likewise, according to the maize value chain service providers, poverty was defined as insufficient resources to meet basic needs to support daily life. They were asked to

state what according to them indicates poverty in the community and the findings were as shown in Figure 6.3.

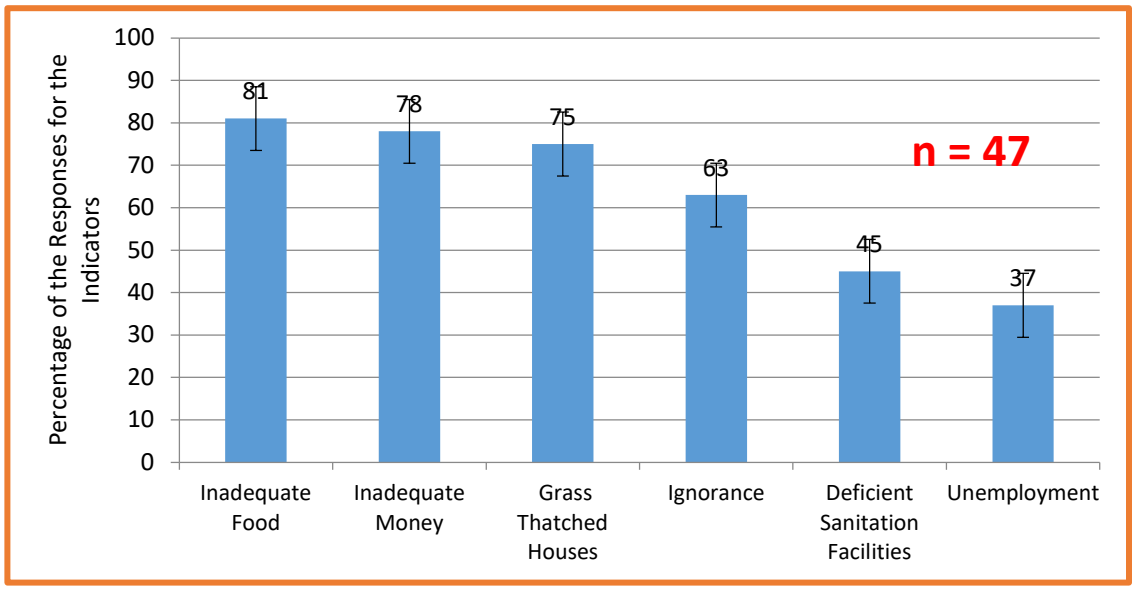

Figure 6.3: Indicators of Household poverty in the community as per the Service Providers (Source: Field Data, 2016)

According to the maize value chain service providers, inadequate food 38 (81%), inadequate money 37 (78%), poorly thatched houses 35 (75%) and ignorance 30 (63%) were the major indicators of poverty in the community as shown in Figure 6.3. These views were affirmed by the FGDs where the general view was that shortage of food and money were the indicators of poverty in the community. Further, the overlapping error bars for inadequate food, inadequate money and grass thatched houses, as shown in Figure 6.3, indicate that there is no significant difference in their importance as indicators of poverty. This was also supported by the Pearson Chi-Square Test for each pair (p-values >0.05).

After considering all views from respondents on the indicators of poverty, Figure 6.4.shows the summary of indicators of poverty in Bungoma County presented in percentage level of responses.

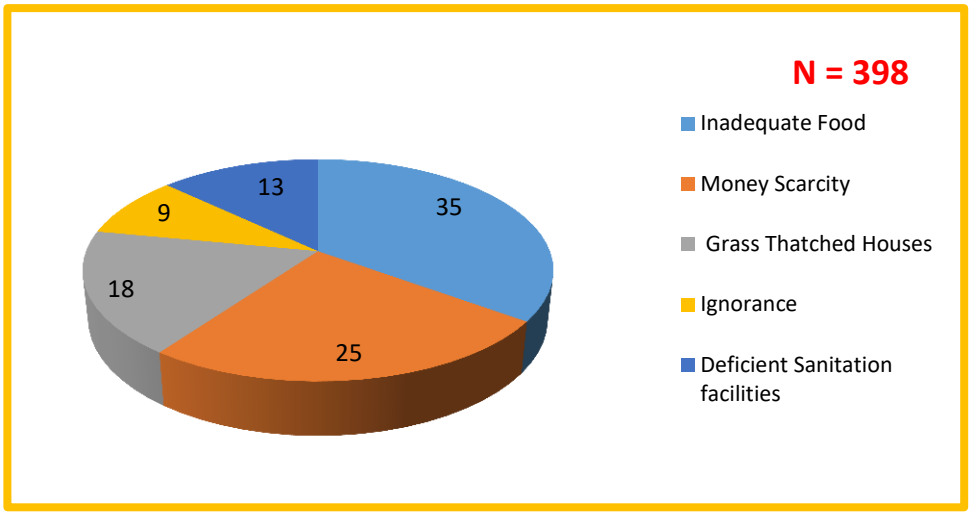

Figure 6.4: Percentage level of importance of indicators of Poverty

(Source: Field data, 2016)

These findings on indicators of poverty in Bungoma County are the views of the categories of the maize value chain players, the maize agro-dealers, producers, traders and service providers. They revealed that those households that had inadequate food 139 (35%), little or no money 100 (25%) or live in grass thatched house 73 (18%) were poor. It was also revealed that the poor in the community also exhibited ignorance or illiteracy or did not have or had deficient sanitation facilities like toilets and clean source of water. During the FGDs, it came out that the poor in the community did not have food in the house most of the time and had money to even buy enough food for their households. They also lived in either poorly grass thatched houses or poor semi-permanent mainly without toilets and of course without water. Thus these FGDs corroborated the findings from the respondents which were confirmed by most of the

KIs confirmed these findings when it came from them that most maize farmers and maize traders, who make the majority of the people of Bungoma County are resource poor and subsistence exhibiting food insecurity and poor living standards. Thus according to the key informants, inadequate food in most households was the most significant indicator that defined the high level of poverty in the region.

Further analysis by the Pearson Chi-Square test indicated "lack of food" as significant and main indicator (with highest response, 90%) of poverty as compared to 'lack of money' (second highest, 70%), (x_1^2= 10.912, p = 0.001 < 0.05). These findings mean that the larger proportion of the people in the community (86%) depending on maize for livelihood need to increase maize production and productivity in order to increase incomes required to reduce the high level of poverty in the region. These findings agree with the findings of KARI (2013) and Bungoma County Agriculture Annual Report (2011).

6.4: Sources of income for the people of Bungoma County

In order for a household to obtain its basic needs for life like adequate food, housing, clothing, education and sanitation facilities, one must have a source of money, income or livelihood to enable him acquire these requirements for life. From the respondents, the study sought to know what their sources of income were and their responses were as captured in Table 6.1

Table 6.1: Sources of income for Small holder Maize Value Chain Actors

	Source of Income	**Frequency of Response (%)**
1.	Maize farming and Trading	45
2.	Maize Farm inputs - Agro-Dealer Business	8
3.	Maize Milling	12
4.	Sell of Livestock	9
5.	Sell of Other Crops like Beans and Bananas	8
6.	Employment	8
7.	None Farm Businesses	4
8.	Casual Labor in Maize fields	6
	Total	**100**

(Source: Field Data, 2016)

In Table 6.1, it is shown that the main source of income for the maize value chain players was maize farming and trading. Therefore using the information captured from FGDs, the researcher worked out the processes, operations and costs involved in acquiring inputs to manage one acre of maize on the farm so as to establish the amount of income an average farmer gets from his/her farm. It was revealed that an average maize farmer in Bungoma County gets a net income of Kshs. 18,816 per acre at medium level (Level 2) of farm management as shown in Table 6.2.

Table 6.2: Gross Margin Analysis for one acre of maize produce

ITEM		UNIT	TOTAL
1. Output	1. Yield per acre	bags	18
	2. Price per bag of maize	Kshs.	2800
2. Gross output		Kshs	50,400
VARIABLE COSTS		Kshs	
4. Land	Ploughing	Kshs	2,600
preparation	Harrowing (Optional)	Kshs	2,500
5. Maize seeds 10Kg @ 1800 10 kg pack		Kshs	1,800
	Planting: 2 DAP - 50kg bags @ 3000 per bag	Kshs	6,000
6.Fertilizers	Top Dressing: 1 CAN - 50kg bags@ 2400per bag	Kshs	2,400
7. Agro-chemicals	1. Type, rate and price: Thunder -100mls @ 800	Kshs	800
8. Post - Harvest Management	1. Hermetic gunny bags: Number & Price 10 @ 250	Kshs	2,500
	2. Drying Tarpaulins -	Kshs.	2,500
9. Transport of inputs			600
	Planting 10md @ Kshs. 260 per md	Kshs	2,600
	Weeding twice 10 md each @ 200 per md	Kshs	2,000
	Top dressing 3 md @ 200 per md	Kshs	600
10. Labor	Stooking 6md @ 200 Per md	Kshs	1,200
requirement	Dehusking @ Kshs. 50 Per bag	Kshs	900
	Shelling : @ Kshs. 50 Per bag	Kshs	900
11.Transport of maize to store @10/= / bag		Kshs	180
Sub-total		Kshs	30,080
Miscellaneous costs @ 5% of sub-total		Kshs	1,504
Total variable cost (TVC)		Kshs	31,584
Gross margin per Acre (Gross output - Total variable cost)		Kshs	18,816

(Source: Field Data, 2016)

Table 6.2 shows that the average small scale farmer who depends on acreage of 2.5 acres of land for a living earns Kshs. 18,816 x 2.5 giving a net household annual income of Kshs. 47,040. The study also revealed that the cost of production per bag of maize was Kshs. 1,755 while profit per bag was Kshs. 1,045 revealing that maize farm income is very low compared to the average farmer household's annual expenditure needs of about 51 maize bags (See Table 5.1). This finding, the result from the Gross Margin Analysis, demonstrate that the returns from maize farming is very low for

average small scale farmers at level II of farm management in Bungoma County who averagely own 2.5 acres of land and harvest an average of 18 bags per acre and thus get a total of 18 *2.5 = 45 maize bags. After removing 16 bags for household food consumption (if they sell all, they will still buy later as they must have food), they remain with 45-16 = 29bags only against the required 35 bags to sell for the household required cash needs. The selling price is usually the prevailing market price which can go as low as Kshs.1600 or lower depending on the situation.

The returns from maize farming is very low for the average small scale farmers and traders mainly because of producing very low yields of 18 bags against the optimum average of 35 bags per acre for Bungoma County. Therefore, the deficient maize farm management skills and low farm productivity are the main reason for the very low returns. Farmers need to collaborate with the relevant maize value chain stakeholders to get the appropriate maize production technologies and farm management skills so as to enhance their maize productivity. If the farmers produced 35 bags per acre, they would get 35 * 2.5 = 87.5 bags to get Kshs. 91,437.50 annually (Net profit), then they would be out of poverty.

The study further revealed that costs of maize seeds, fertilizers and land preparation constituted 43% of the total variable costs. These findings are in agreement with those of Simiyu (2014) and Wanyama *et al.* (2010) who reported that maize farm inputs and modern crop technologies are too expensive for most small scale farmers to effectively use them leading to low maize yields and incomes.

6.5. Causes of poverty in Bungoma County

The respondents per different categories along the maize value chain were asked to state what they thought were the causes of poverty in the community and the results of the responses per the category of agro-dealers were as illustrated in Figure 6.5.

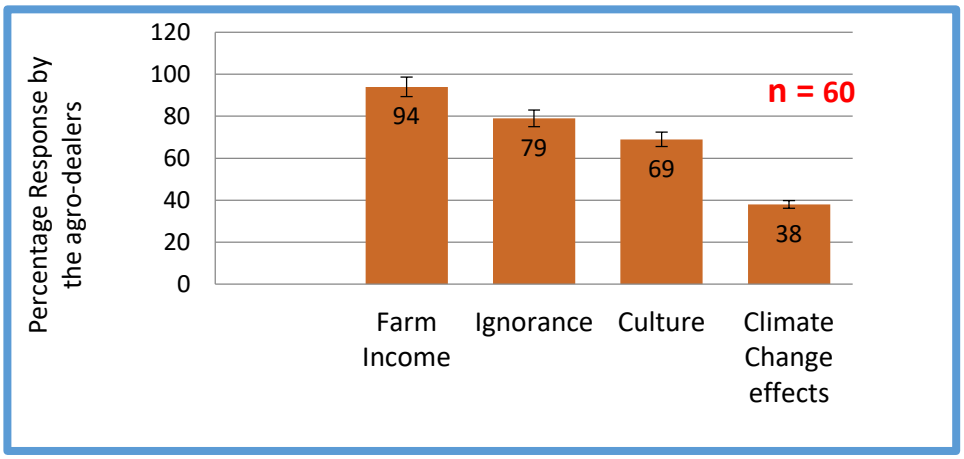

Figure 6.5: Causes of Poverty in the Community as per the Agro-Dealers
(Source: Field Data, 2016)

Figure 6.5 indicates that according to the majority of the farm inputs dealers, farm incomes received, ignorance and community culture whereby people believed that they must grow maize for food with mainly females tending the farms, were the major causes of poverty in the region as indicated by 56 (94%), 47 (79%) and 41 (69%) of the response respectively. Low farm incomes stand to be the main cause of poverty in the region as confirmed by the Chi-Square test which showed significant difference in the response on 'poverty' (with highest response, 94%) and illiteracy or ignorance (second highest, 79%), (x_1^2= 9.873, p= 0.031 < 0.05).

When maize traders were asked to state causes of poverty, their responses were as shown in Figure 6.6.

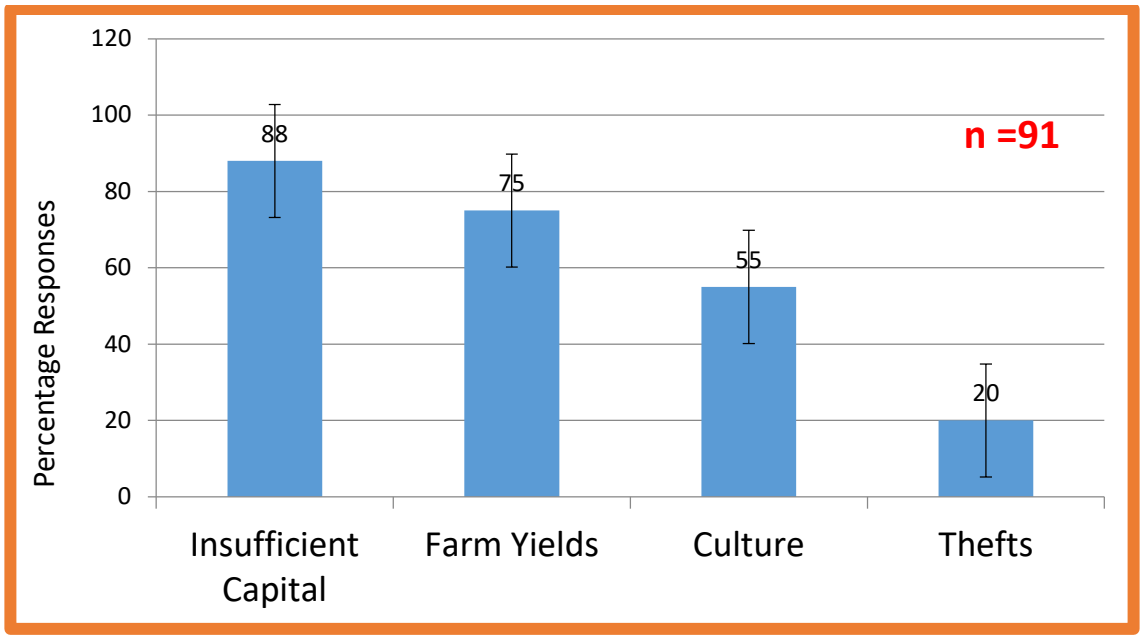

Figure 6.6: Causes of poverty in the community as per the traders

(Source: Field Data, 2016)

According to the traders, insufficient capital, low farm yields, culture and thefts in the region are the major causes of poverty in the community as indicated in Figure 6.6. A binomial test indicated that the causes of poverty in the community (as shown in Figure 6.6) differ significantly from each other at 5% significance level (p-values < 0.05). Figure 6.6 also shows that 88% of the maize traders believe that insufficient capital amongst the community to enable them carryout economic activities is the main cause of poverty in the region.

The study also sought the views of the maize value chain service providers on the causes of poverty in the region and the finding was as illustrated in Figure 6.7.

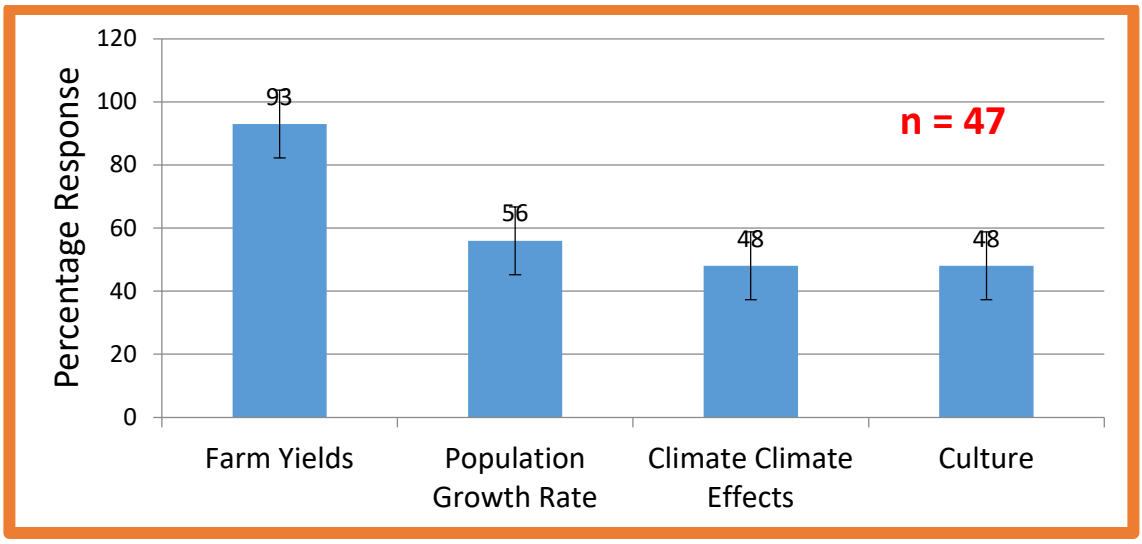

Figure 6.7: Causes of poverty as per the maize value chain Service Providers (Source: Field Data, 2016)

It was revealed that low farm yields and high population growth rate among the people are the major causes of poverty in the region as indicated by 44 (93%) and 26 (56%) respective responses, as shown in Figure 6.7.

The study also revealed that low maize yield, ignorance, people's culture, low incomes, high population growth rate and climate change effects were the significant causes of poverty in Bungoma County; Since most of the people depended on maize produce for food and incomes, low maize yields meant that there was no enough maize produce for food in the households and surplus for sale to bring in money for other house hold needs. This led to households' deficiencies or unmet needs like decent housing, clothing, sanitation, fees and purchase of other foods like vegetables and beef to supplement maize and provide more balanced diet for improved nutrition. Key informants and FGDs sighted illiteracy as one of the causes of poverty as those with no or little education did not effectively understand, apply or seek information and skills

on the crop yield enhancing technologies which led to low farm yields and incomes thus escalating poverty. This finding is supported by Alene *et al.* (2000), who stated that education positively affected the adoption of improved maize production technologies.

Moreover, through FGDs it was revealed that the people's culture of having expansive families, extended families and high population growth rate caused poverty or made it difficult to reduce poverty or escape poverty as the household resources were mainly channeled towards feeding, clothing and housing the big families thus leaving little room for development or improved lives. These findings are in agreement with BICDP (2013) and KNBS (2009) which confirm that Bungoma County has one of the highest population growth rates in Kenya. They report a population growth rate of 3.1% that gave a population of 1, 5 52,973 (Male 758,404 Female 794,566) in 2013, a projection of 1,650,750 (Male 806,157, Female 844,593) in 2015 and 1,751,499 (Male 856,916 and Female 894,583) by 2017. In addition, key informants (48%) revealed that climate change effects like drought, hailstones, unreliable/ erratic rainfall and out breaks of maize diseases and pests cause poverty when they occur and cause damage to crops and property leaving people poorer. This finding is corroborated by Simiyu (2014) and Wabwoba (2015) in their assertions that natural calamities like floods and droughts, caused by climate change contribute to food insecurity in the Bungoma County

6.6 Establishing the Poverty Level in Bungoma County

According to USDA (2006), measuring poverty is a complex issue as every measure has a number of advantages and disadvantages and thus unlikely to satisfy the various demands of all. However, most poverty measures are monetary and input based, with income measures being most preferred. Nonetheless, Ravallion et al., (2001) state that, there are numerous poverty measures that one can employ depending on the purpose. These include; (i)The *headcount index* which measures the proportion of the population that is poor but it does not indicate how poor the poor are, (ii) The *poverty gap index* which measures the extent to which individuals fall below the poverty line (the poverty gaps) as a proportion of the poverty line but does not reflect changes in inequality among the poor, and (iii) The squared *poverty gap ("poverty severity") index* which averages the squares of the poverty gaps relative to the poverty line.

In order to establish the level of poverty in the county in the year 2016, this study employed the *headcount index* (P = n/N) method by Ravallion *et al.*, (2001), to measure the proportion of the population that was poor. The researcher chose to use this measure because it is straight forward and easy to apply. The respondents per category of the maize value chain were asked to state whether it was very difficult or easy to meet the basic needs for their households and results of their responses were as portrayed in Figure 6.8 expressed in percentages.

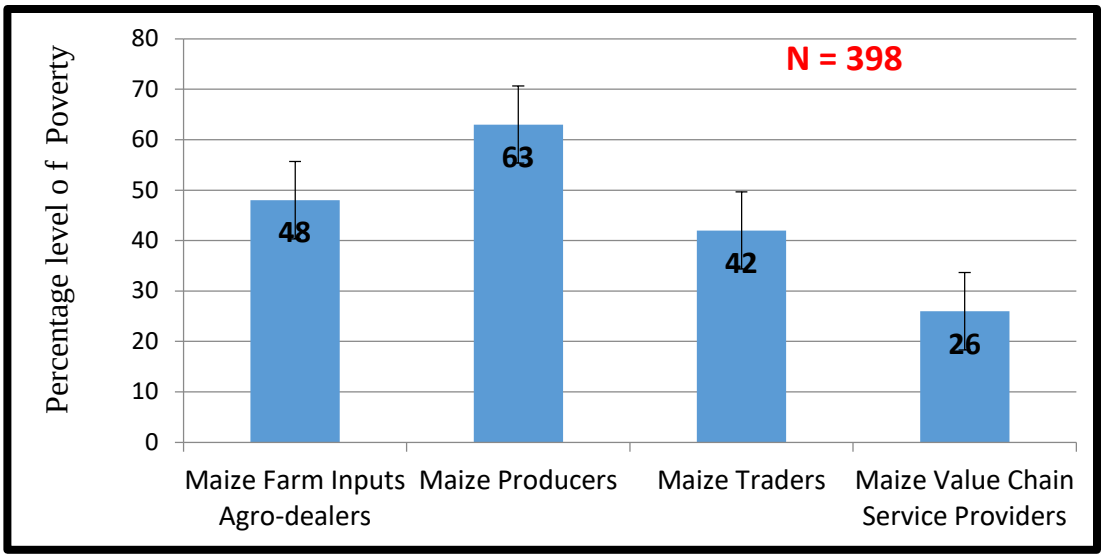

Figure 6.8: Poverty distribution by percentage amongst the maize value chain players (Source: Field Data, 2016)

Figure 6.8 shows the distribution of poverty amongst the categories of maize value chain players based on their responses as to whether it was easy or very difficult to meet the basic needs of their households. The responses indicating that is was very difficult to meet the basic needs of a household meant households could hardly make ends meet thus leaving below the poverty line as defined by World Bank (2015). The study revealed that most poverty was found amongst the maize producers as shown by the response of 63% from individual producers while the least poverty was found amongst the maize value chain service providers. This could mainly be because the maize producers depended on maize yields for income which was generally low due to the many already established challenges while the service providers were mainly employed and their incomes were more or less steady.

In the formula for headcount index (P○ = n/N), P○ is the poverty level, n is the number of poor households and *N* is the total population or sample. Thus n was given by the total responses which indicated that it was very difficult to meet the basic needs in the households and N was the total study sample. Therefore the total number of those whose Response to Very Difficult to Meet Basic HH needs added to 210 (n) out of 398 (N). Hence the poverty level P○ was established to be 210/398 = 52.76% rounding to 52.8%. These findings are in line or in agreement with those of Wabwoba *et al*. (2015) and KARI (2013), who established that the majority of the people of Bungoma County were poor at a poverty level of 52.9%. This implies that the level of poverty in Bungoma County had reduced by a very small margin of 0.1% in three years. Further analysis was done using the method of poverty gap index as per Ravallion *et al*., (2001), which adds up the extent to which individuals on average fall below the poverty line and expresses it as a percentage of the poverty line. Here poverty level was established as follows*;*

$$G = (z - y).I\,(y < z)/z, \quad \text{.....Equation (8)}$$

Whereby:

G is the poverty gap,

z is the poverty line and y is the less actual income.

For poor people where *y* is less than *z, I* is equal to 1, while for rich people the gap is considered to be zero as I becomes zero. The study selected the category of producers or farmer for which to compute the poverty level because the data collected from the respondents in this category proved to be more reliable whereby their average annual net income was established to be Kshs, 47,040 (section 6.5) meaning that they earn

47,040/365 = Kshs. 128.90 per day (365 is the number of days in a year); the poverty line *(z)* used was £1.25 per day as given by the World Bank according to Thorbecke (2008), which is equivalent to 1.25 x 105 = Kshs. 131.25 (105 was the exchange rate for US dollars to Kenya Shillings). Therefore majority of Bungoma County people (farmers) are living below the poverty line with a poverty gap of 131.25 – 128.90 = 2.35 and a poverty gap index of z-y/z = 2.35 / 131.25 = 0.018 or 2%. These findings are in line with those of the report by Kenya Economic Survey (2014).

6.7. Efforts in place towards reducing poverty in Bungoma County

From the respondents the study sought to establish what strategies or coping measures were in place for coping with or reducing poverty and the findings were as shown in Figure 6.9

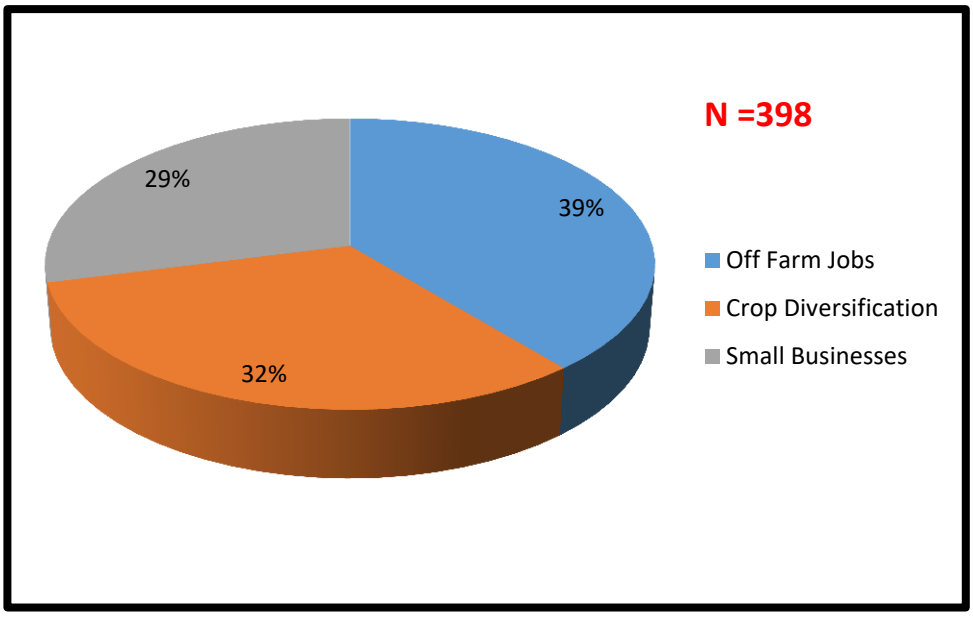

Figure 6.9: Measures used for reducing poverty amongst maize value chain players (Source: Field Data, 2016)

Figure 6.9 shows that the respondents revealed that besides maize farming and trading, 155 (39%) of the maize value chain players do off farm jobs like casual labour and seek some employment, 127 (32%) practice crop diversification and 45% (179) do small business to help make ends meet for their households. These findings were corroborated by the maize value chain stakeholders in the FGDs who agreed that most maize value chain actors have to engage in other livelihoods at different levels like casual labour in other farms, employment and other small businesses like small consumer retail shops in order to supplement what they earn from maize farming and trading. These findings were confirmed by the KIs who reported that what the small scale maize farmers and traders produce and trade in is not enough to meet their need for food consumption and cash expenditure requirements. The findings are in agreement with related literature by USAID-KAVES (2015) indicating that maize alone cannot constitute the source of livelihoods for maize smallholders as the income from maize business is too low. However, some KIs, especially, from the department of agriculture in the county, observed that maize value chain actors, especially producers and agro-dealers, need to be careful while engaging in off-farm and other activities as they sometimes divert resources from the core maize business and lead to reduced income thus escalating poverty further.

6.9: Summary of findings on factors affecting poverty reduction situation

People of Bungoma define poverty as the lack of basic necessities of life like food, land, toilets, education and poor housing which agrees with the definition of Encyclopedia Britannica (2014) and World Bank (2008). On average, 52.8% of the

respondents had difficulties in making ends meet or to meet their basic needs of life for their households. It was also established that the majority of Bungoma County people who are mainly small scale farmers live below the poverty line with a poverty gap of Kshs. 2.25 and poverty gap index of 2%. The study also revealed that major causes of poverty in the community included low maize yields, culture and high population growth rate and ignorance. It was also established that the main indicators of poverty included insufficient food, poor housing and inadequate money flows while the main source of income or livelihoods was maize farming and maize trading.

CHAPTER SEVEN

STRATEGIES FOR ENHANCING MAIZE VALUE CHAIN IN BUNGOMA COUNTY

7.1. Introduction

Chapter seven discusses the study findings on objective four which was to evaluate the strategies for enhancing maize value chain in Bungoma County. Based on the information in the above chapters, maize value chain productivity and profitability in Bungoma County were low. To determine which strategies to employ so that the maize value chain could be upgraded, the respondents per category of the maize value chain were interviewed on what strategies were in use in the maize value chain activities and what strategies could be proposed for enhancing or upgrading maize value chain for improved food security and poverty reduction.

7.2: Strategies used in the supply of maize farm inputs

The sampled agro-dealers were asked to state what strategies they used in the supply of maize farm inputs and the findings were that 12 (20%) sought information from the agriculture extension officers as to when and what to stock shop, 21 (35%) listened to the farmers to know what and when to stock shop. Further the study revealed that 13 (22%) of the agro dealers just stocked shop when they had some money and waited for customers to come and 14 (23%) stocked shop when it rained with what they always sold. When this was discussed in the FGDs, they corroborated that most of the agro-dealers stocked their shops with what they always sold mainly at the onset of planting season. KIs confirmed that most agro-dealers had inadequate technical knowledge as to

what, when and how much to stock and so they relied on what they always sold and sometimes stocking very late in the maize season which increases the problem of inputs inaccessibility. These findings are in line with related literature by World Bank (2013) which stated that small holder agro dealers and stockists are the primary source of inputs for smallholder farmers yet they receive limited extension advisory services.

The Agro dealers were further asked if they faced any challenges in their business of supplying maize firm inputs and Figure 7. 1 shows the findings.

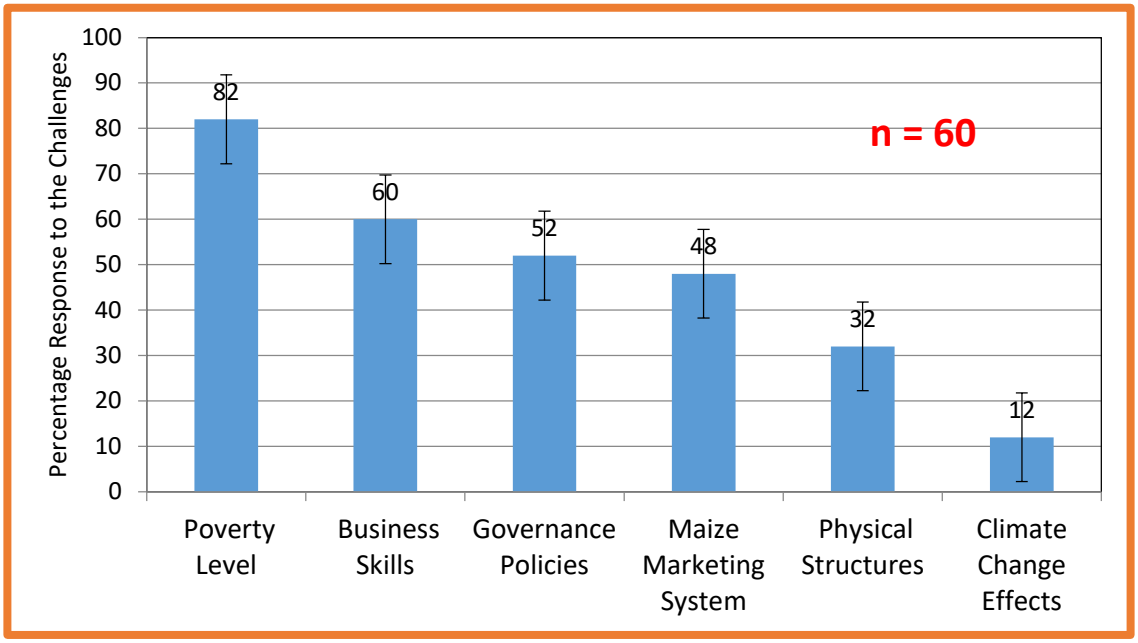

Figure7.1: Challenges faced by Maize Value Chain Agro-dealers

(Source: Field data, 2016)

Figure 7.1 indicates that high poverty level, deficient business skills and poor implementation of agriculture policies that make farming business very expenses are the major challenges faced by agro-dealers as indicated by 49 (82%), 36 (60%) and 31 (52%) responses respectively. Figure 7.1 also shows that all of the indicated challenges

were significant to the inputs supply business as shown by the non- overlapping error bars. Further analysis by the Chi-Square test also showed that high poverty level is the main challenge facing the agro-dealers as indicated by the significant difference in the response on 'High poverty level (with highest response, 82%) and 'lack of business knowledge' (second highest, 60%), (x_1^2= 10.432, p= 0.03 < 0.05). FGDs supported that high level of poverty amongst the maize farmers and poor roads in the region were challenges to effective maize inputs supply while KIs confirmed that agro-dealers were faced with deficient business skills, non performing govern farm inputs supplying policies and unorganized maize marketing system as main challenges.

The agro-dealers were then interviewed on what strategies could be applied to enhance the business of supplying maize farm inputs, their proposals were as shown in Figure 7.2.

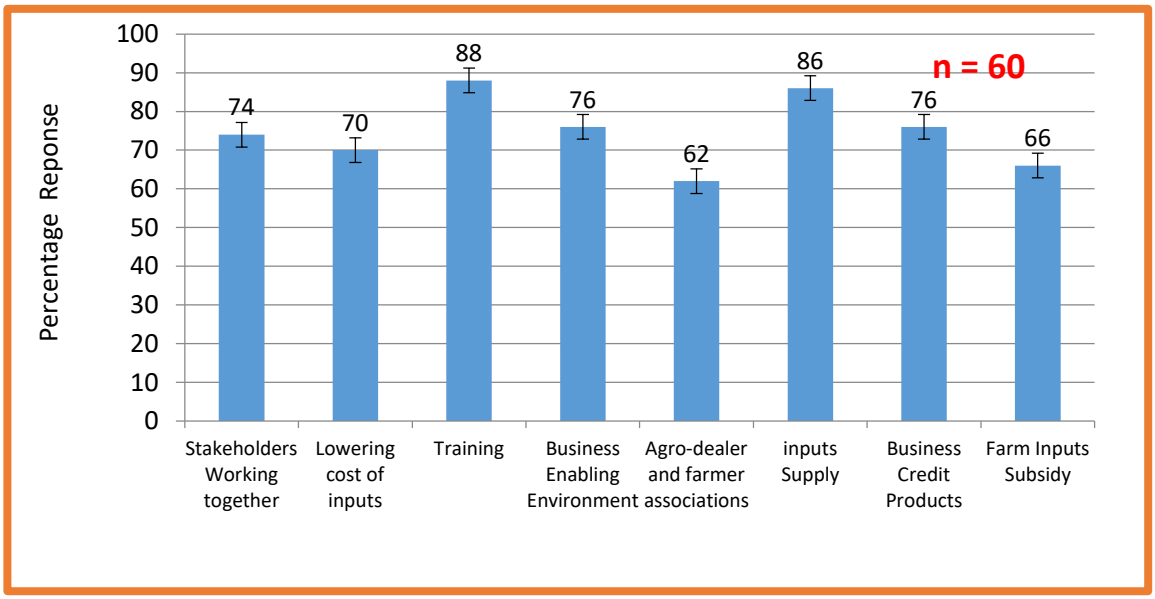

Figure 7.2: Strategies for enhancing the supply of maize farm inputs as per the agro-dealers

(Source: Field Data, 2016)

Majority of the maize farm inputs agro-dealers proposed that training of the agro inputs suppliers 53 (88%), improving business environment 46 (76%), enhancing business credit products 46 (76%) and working together of maize value chain stakeholders 44 (74%) were the main ways of improving the maize inputs supply in the region as indicated in Figure 7.2. Further, it is showed that 70% of the agro-dealers proposed that the costs of supplied maize farm inputs be lowered and 37 (62%) proposed that the county business agro-dealers and farmers to form associations for enhancing level of business.

FGDs proposed that the maize value chain stakeholders should work together to facilitate sharing of information and reducing cost of operations. They also corroborated that forming agro-dealer associations would help the small scale dealers gain higher bargaining power against bulk suppliers of inputs and earn them higher profits. KIs confirmed that the proposal for the government to enable and promote a friendly business environment would mean that the cost of doing business would be kept low with simple bureaucratic requirements and facilitative of affordable and available credit products. They also confirmed that agro-dealers needed to be trained and capacity built in the inputs supply business and be facilitated to access business credits, These proposals for enhancing the maize value chain at the input supplying section are in line with Herr (2007) who revealed that an enabling business environment needs to be in place to facilitate the agro-dealers to operate at a higher, value added level for competitiveness.

7.3. Strategies used by Farmers in maize production

A sample of 200 individual farmers was asked to state what strategies they used in maize production and the findings were as shown in Figure 7.3.

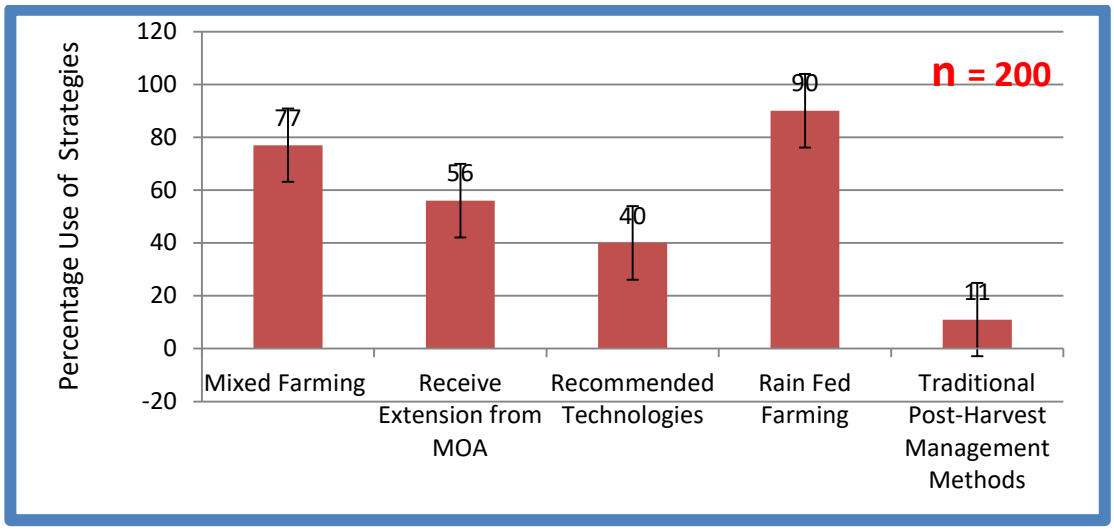

Figure 7.3: Maize Production strategies practiced in the community
(Source: Field Data, 2016)

From Figure 7.3 above, the study revealed that majority of the farmers in the region depend on the rain to produce maize, mainly practice mixed crop farming with little use of recommended farm inputs and depend on Ministry of Agriculture (MOA) for extension services as indicated by 180 (90%), 154 (77%), 80 (40%) and 112 (56%) responses respectively. These findings also reveal that the post-harvest management is mainly through traditional measures. The non-overlapping error bars in Figure 7.3 indicate the significance in the difference due to contribution by each strategy used in maize production. These findings were validated at the FGDs and confirmed by the KIs.

The coefficient of correlation test between low extension services received, little use of recommended farm inputs and maize productivity in the region confirmed the

significant correlation as indicated by the corr. = 0.22 and corr. = 0.067 values respectively. This result is in agreement with the study findings by Simiyu (2014) which established that most farmers in Bungoma County rely on rain for their maize farming with low application of modern crop production technologies which leave them vulnerable to climate change effects like droughts and erratic rains hence low maize yields.

When the individual farmers were asked to propose strategies for improving maize value chain the results obtained from their responses are shown in Figure 7.4.

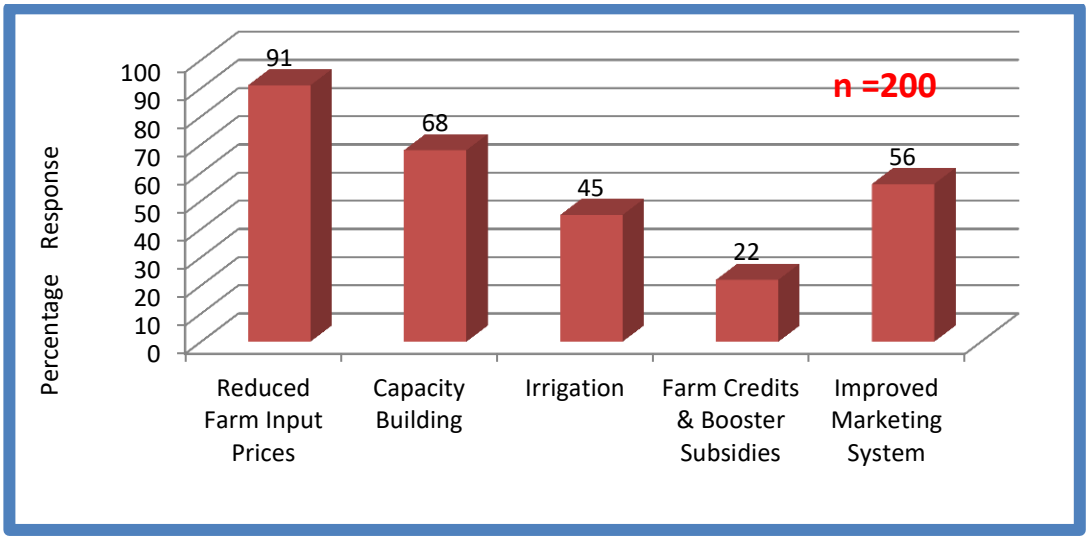

Figure 7.4: Farmers' Proposed Strategies for improving Maize Value Chain

(Source: Field Data, 2016)

Figure 7.4 shows that majority of the famers proposed that reducing prices of farm inputs and capacity building of farmers on better farming methods would improve maize farming business as indicated by 182 (91%) and 136 (68%) response respectively. The finding also implied that increasing access to farm credits and booster

farm subsidies would enhance access and use of recommended farm inputs. This would positively contribute to enhancing maize value chain development as confirmed by the Chi-Square test that showed a significant difference in the response on 'Increasing farm input supply' (with highest response, 91%) and 'Training' (second highest, 68%), (x_1^2= 11.93, p= 0.000 < 0.05). FGDs when asked on strategies for enhancing maize production and productivity, they corroborated that cost of farm inputs should be reduced, capacity building of farmers to be enhanced and maize marketing should be organized. KIs confirmed that all the indicated proposals by the farmers would help enhance maize productivity if well implanted. These findings concur with the findings of USAID-KAVES (2015) and Simiyu (2014) on their studies on maize in Bungoma which showed that high costs of farm inputs, inadequate access to farm credits, insufficient skills in maize production and unstructured maize marketing system were key factors influencing maize production and marketing.

7.4. Responses from Key Informants and FGDs on Strategies used in Maize Value Chain

Interviewing key informants (maize processors, Chain enablers and Service providers in the county), FGDs (Maize value chain stakeholders) and observations confirmed that majority of the farmers in Bungoma County were small scale holders of an average of 2.5 acres. They depend on rain fed maize crop with only about 40% using the research recommended crop husbandry technologies of inputs like fertilizers, seed and farm management that involves good agricultural practices (GAP). They harvest their crop, shell and store the produce in polythene bags and nylon bags in the houses losing about

30-40% of the produce due to poor post- harvest management and marketing strategies. Majority also sell their produce hurriedly after harvesting in order to get cash to meet domestic monetary obligations. However, on interviewing the sampled maize value chain traders, the following challenges, illustrated in Figure 7.5 were cited as key impediments to the development of maize value chain in Bungoma County;

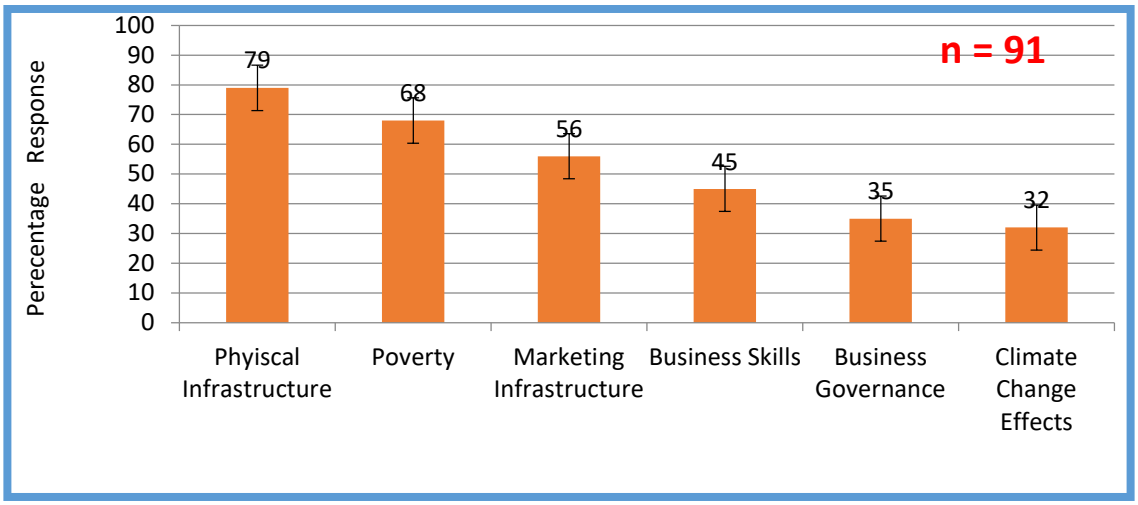

Figure 7.5: Challenges faced in the Maize Value Chain as per the traders
(Source: Field Data, 2016)

Figure 7.5 shows that according to the maize traders, the main challenges faced in the maize value chain include poor physical infrastructure, poverty, poor marketing infrastructure and deficient business skills 72 (79%), 62 (68%), 51 (56%) and 41 (45%) respectively. These challenges were confirmed by 39 (86%) of the KIs and 88% of FGDs (Maize Value Chain stakeholders). Moreover, they also confirmed that low maize yields and high post-harvest losses were the key challenges faced in the maize value chain. These findings are in line with those of Kirimi *et al.* (2001) who established that maize value chain in Kenya faces key challenges like, high costs of farm inputs, poor governance and policy implementation and high dependence on rain for maize production that need to be addressed.

To cope or manage these challenges, majority of the traders (97%) suggested that training and information networking across all those involved in the maize value chain businesses should be enhanced. The traders agreed with farmers and agro-dealers on the suggestions on what strategies could improve maize business in the county so as to improve food security and poverty status. These include trainings, booster subsidies, low cost of inputs and improved infrastructure. These findings resonate with the study by Gloy (2005) and Kaplinsky & Morris (2001) who recommended stakeholder partnership development for maize value chain development.

7.5. Efforts in place towards achieving maize value chain development in Bungoma County

The KIs and FGD (Stakeholders) were asked to state and evaluate what efforts were in place towards achieving maize value chain development and the findings were as indicated in Table 7.1.

Table 7.1: Efforts in place towards enhancing Maize Value Development

Policies, Programmes, Projects, Structures	**Objective & Mode of Implementation**	**Evaluation**
General agriculture extension services	To advise maize farmers on research recommended technologies for maize production	-Extension Officers not enough to reach all farmers. Emphasis on production
Kenya Cereal Enhancement programme	To improve maize productivity, post-harvest management and marketing through partners	-Not reaching all farmers -Dependent on Partners - No effective partnership development
County Government Fertilizer and Maize Seed Subsidy	To increase food security by giving the poor maize farmers free planting fertilizers and maize seeds	-Promotes dependence syndrome -Poor targeting leads to undeserving beneficiary -Emphasis is on the production stage of the chain
Soil Testing & Mobile Laboratories &Fertilizer Project	To improve soil fertility through subsidized testing and recommendations	- Not all farmers are asking for the tests -Emphasis on production stage of the chain
Agriculture Sector Development Support Programme	To convert subsistence agriculture into commercialized agriculture	-Stakeholders not able to take off -Stakeholders not forming partnerships -Not covering the whole chain
County Integrated Development Plan	Commercialization and innovation in agriculture through Agriculture Stakeholder and Partnerships	Potential Partners need more sensitization, capacity building and incentives
Climate and weather education	Mitigation of climate change effects and disaster risk reduction	Farmers must be empowered with resources & technologies

(Source: Field Data, 2016)

The study revealed that there were numerous approaches or strategies being employed in county towards achieving increased maize production and productivity. These include general agriculture extension program and Bungoma County Government Fertilizer and Maize Seed Subsidy project as shown in Table 7.1.

However, according to the KIs and researcher's observation, most of these approaches in place were farmer and crop production focused, largely leaving out the other aspects of the maize value chain. Therefore, there was little focus on enhancing the development of maize value chain. This finding is similar to that carried out by KARI (2014) on scoping of agribusiness in the county.

7.6. Proposed Strategies for enhancing maize value chain

According to the service providers, among other proposed strategies, the maize value chain players require training in their respective line of maize businesses as well as collaboration and partnership development to enhance efficiency in maize value chain development as represented by the percentage responses in Figure 7.6.

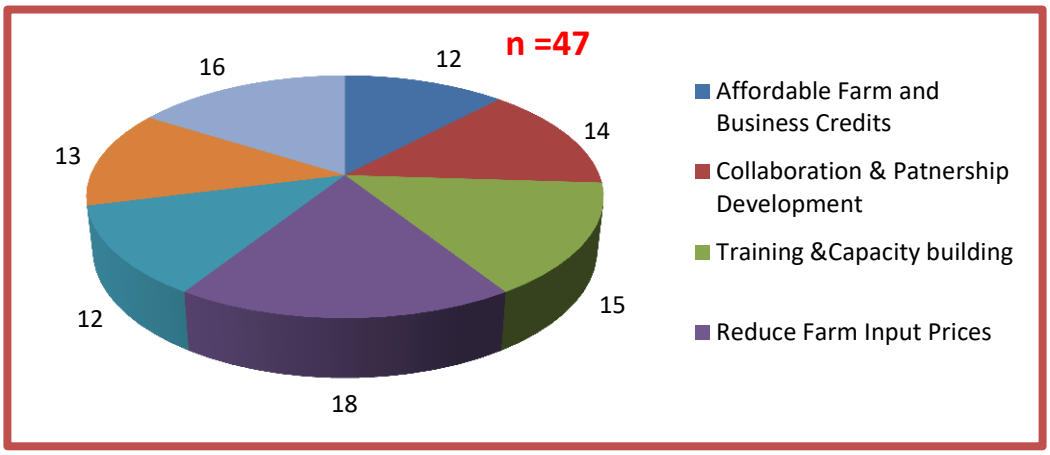

Figure 7.6: Proposed Strategies for enhancing maize value chain as per the Srvice Providers (Source: Field Data, 2016)

Figure 7.6 shows that affordable farm and business credits, collaboration & partnership development, training &capacity building, reduced farm input prices, irrigation, reduced cost of doing business and improved post-harvest management are the key strategies that should be implemented to enhance maize value chain. These are in line

with what the maize input agro-dealers and producers proposed as the strategies for promoting maize productivity and profitability. They are also in agreement with what USAID-KAVES (2015) who wrote that training and capacity building, reducing cost of doing business and collaboration and development of partnerships are key strategies in the upgrading of maize value chain.

When maize traders were interviewed on strategies for enhancing maize business they suggested that working together of the maize value chain players was important as it could help promote maize production and trading through sharing of information and skills. Table 7.2 indicates some of the key benefits of collaboration and partnership development amongst maize value chain stakeholders as suggested by the maize traders:

Table 7.2: Importance of Collaboration amongst Maize value Chain Players

Benefits of Collaboration Amongst MVC Players	**Proportion (%) of the Input Suppliers who Agree with the given Benefit**	
	Reduces poverty	Does not reduce poverty
Facilitates sharing of information	100	0.0
Reduce cost of operations	100	0.0
Reduce insecurity	100	0.0
Time saving	86	0.003

(Source: Field Data, 2016)

Table 7.2 indicates that working together of the maize value chain stakeholders has benefits like information accessibility, reduced cost of operation, reduced business insecurity and time saving as suggested by most of the farm inputs agro-dealers (96%) and 86% of the maize traders. Further analysis by Pearson Chi-Square indicated that

benefits of collaboration by the maize value chain stakeholders were significant since the p value ($p<0.05$) was given as p- value =0.000

In order to evaluate the proposed strategies and come up with the strategies that will enhance the development of the maize value chain, the FGDs and KIs were subjected to the pairwise ranking method to evaluate and the proposed strategies and the results were as shown in Figure 7.7 as guided by the following **Key;**

Code	Proposed Strategy	Code	Proposed Strategy
AFBC	Affordable Farm and Business Credits	RCB	Reduced cost of doing business
CPD	Collaboration & Partnership Development	IPHMT	Improved Post-Harvest Management
T&CB	Training &Capacity building	GAP	Good Agricultural Practices
RFIP	Reduce Farm Input Prices	MT	Modern Technology
I	Irrigation	OMM	Organized Maize Marketing

	AFBC	CPD	T&CB	RFIP	I	RCB	IPHMT	GAP	MT	OMM	Tallying
AFBC		AFBC	T&CB	RFIP	AFBC	RCB	IPHMT	GAP	MT	OMM	**4**
CPD	AFBC		T&CB	RFIP	CPD	RCB	IPHMT	GAP	MT	OMM	**3**
T&CB	T&CB	T&CB		RFIP	T&CB	T&CB	IPHMT	T&CB	T&CB	OMM	**13**
RFIP	RFIP	RFIP	RFIP		RFIP	RFIP	RFIP	RFIP	RFIP	RFIP	**18**
I	AFBC	I	T&CB	RFIP		RCB	IPHMT	GAP	MT	OMM	**2**
RCB	RCB	RCB	T&CB	RFIP	I		IPHMT	GAP	RCB	OMM	**9**
IPHMT	IPHMT	IPHMT	IPHMT	RFIP	IPHMT	RCB		GAP	RCB	OMM	**9**
GAP	GAP	CPD	T&CB	RFIP	GAP	RCB	GAP		MT	OMM	**8**
MT	AFBC	CPD	T&CB	RFIP	MT	RCB	MT	MT		OMM	**7**
OMM	OMM	OMM	T&CB	RFIP	OMM	OMM	OMM	OMM	OMM		**15**

Figure 7.7: Evaluation of Priority Strategies for enhancing the Maize Value Chain (Source: Field Data. 2016).

Thus through the pairwise ranking method that involved evaluating and ranking, the study revealed which of the proposed strategies to prioritize for enhancing maize value

chain in Bungoma County. The prioritized strategies and their ranking as given in Figure 7.7 are shown in Table 7.3.

Table 7.3: Ranked Strategies for enhancing Maize Value Chain

Strategy	**Code**	**RANK**
Reduce Farm Inputs Prices	RFIP	1
Organized Maize Marketing	OMM	2
Training &Capacity building	T&CB	3
Reduced cost of doing business	RCB	4
Improved Post-Harvest Management	IPHMT	4
Good Agricultural Practices	GAP	6
Modern Technology	MT	7
Affordable Farm and Business Credits	AFBC	8
Collaboration & Partnership Development	CPD	9
Irrigation	I	10

(Source: Field Data, 2016)

The study revealed that reducing the cost of maize farm inputs (1), organizing or structuring maize marketing (2), training and capacity building of the maize value chain players (3), reduced cost of doing business (4) and improving post-harvest management were the priority strategies for enhancing maize value chain in Bungoma County. These findings are in agreement with study findings of ICG (2003) where a FGD was used to analyse maize value chain in Uganda and established that that high cost of maize farm inputs, high cost of investment in maize business and poorly structured maize marketing system highly impeded the upgrading of maize value chain.

7.7: Summary of Findings on Strategies for enhancing Maize Value Chain

The study revealed that the maize farm inputs agro-dealers mainly stocked their shops depending on the onset of rains and what farmers usually purchased for their farms. Further, the majority of the maize producers practiced rain fed mixed farming with the ministry of agriculture, livestock and fisheries being the main source of agriculture extension services. It was also revealed that the main challenges faced in employing these strategies included high cost of farm inputs, poor infrastructure, insufficient agricultural extension services, deficient maize production and trading skills and climate change effects.

In order to cope with faced challenges in maize production and marketing so that maize value chain could be enhanced or upgraded, respondents suggested various strategies. These were evaluated, prioritized and ranked as reducing the cost of maize farm inputs (1), organizing or structuring maize marketing (2), training and capacity building of the maize value chain players (3), reduced cost of doing business (4) and improving post-harvest management (5) to be the priority strategies for enhancing maize value chain in Bungoma County. Moreover, the study established that the County had various efforts or projects in place towards achieving increased maize production and productivity. These included County Government Fertilizer and Maize Seed Subsidy, Soil Testing & Mobile Laboratories &Fertilizer Project, Agriculture Sector Development Support Programme and County Integrated Development Plan. However, almost all of them had emphasis on the production stage of the maize value chain and each was being applied on its own or alone. Consequently, 84% of FGDs suggested that the maize

value chain players should work together as this could help solve most of the challenges faced in the maize value chain in the region due to embedded benefits like sharing information (93%), reduced business costs (100%) and enhanced business profits. Further, dependence on rain-fed maize production makes livelihoods of the community vulnerable to risks of climate change effects like drought and Hailstorms and here KIs from the department of Agriculture suggested that the County Government and KARI could collaborate to look into climate smart technologies.

CHAPTER EIGHT

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter covers summary of the study findings, conclusions drawn from the findings, recommendations for each of the four research objectives based on the study findings and suggestions for further research.

8.1. Summary of findings

The study sought to establish the level of maize value chain development, determine the level of food security, examine factors influencing poverty reduction and evaluate strategies for enhancing maize value chain in Bungoma County with a view of enhancing food security and poverty reduction in Bungoma County. The main findings of the study are as summarized per objective as follows.

On the Level of Maize Value chain development in Bungoma County, the average percentage of the maize value chain players who were knowledgeable on the maize value chain business at each level of the chain was at 64.5%. The level of development of maize value chain in Bungoma County was established to be at about 25%, which is way below the desired level of development for an effective value chain which should be at about 75%. The study further established that maize businesses in the county are mainly on small scale level (53%), financed with own savings and earning low profits with only (15%) of dealers going for financial credits and insurance. There was no organized maize marketing in place with maize processing being done mainly by many small posho mills. Winnowing, sorting and drying were the main value addition

activities with women being the major actors here like at the production level of the maize value chain due to their limited capacities.

On the Level of Food Security in Bungoma County, maize is synonymous with food or Ugali and hence food availability is synonymous to maize availability. This local definition of food security is contrary to the commonly established definitions as it does not consider food nutrition and malnutrition as one can still be food insecure in the face of plenty. Although 86% of the people were maize farmers, only 44% of the farmers got enough food from their farms. The rest relied on the market and other sources like relief food and gifts. Therefore the level of food security was established to be at 37% of the community. These are those whose households had at least three meals in a day and hence food secure. However, those who got enough maize supply from their farms were more food secure than those who relied on other sources. Conversely, achieving food security faced many challenges like poverty, maize pests and diseases, poor infrastructure, high cost of inputs and post-harvest and storage losses. This has led to poor maize farm management leading to low farm yields, low farm income and low food security. Further, high reliance on maize for food made the people vulnerable to food insecurity in the presence of alternative foods.

On the Factors Influencing Poverty Reduction in Bungoma County, the study established that the main factors influencing poverty reduction efforts in the community included low maize productivity, culture, high population growth rate and ignorance. Main indicators of poverty included insufficient food, poor housing,

illiteracy and inadequate money flows. Main source of income or livelihoods was maize farming and maize trading. On average, 52.8% of the people of Bungoma County found it very difficult to meet their basic needs of life for their households hence poor with majority who were mainly small scale farmers living below the poverty line with a poverty gap of 2.25 and poverty gap index of 2%. Therefore, if everything remained constant, maize value chain alone cannot constitute adequate source for livelihoods for the people of Bungoma County as its productivity and profitability were too low.

On the Strategies for enhancing maize value chain in Bungoma County, the study revealed that the maize farm inputs agro-dealers mainly stocked their shops depending on the onset of rains and what farmers usually purchased for their farms. The majority of the maize producers practiced rain fed mixed farming with the ministry of agriculture, livestock and fisheries being the main source of agriculture extension services. Main challenges faced in employing these strategies included high cost of farm inputs, poor infrastructure, insufficient agricultural extension services, deficient maize production and trading skills and climate change effects. Strategies for enhancing maize value chain for food security and poverty reduction were identified, evaluated, prioritized and ranked as reducing the cost of maize farm inputs; organizing maize marketing; training and capacity building of the maize value chain players; reduced cost of doing business and improving post-harvest management. The county had various projects in place towards achieving food security and poverty reduction but they all focused on production and each worked in isolation.

8.2: Conclusions

8.2.1: The Level of Maize Value Chain Development

Maize is a very important crop in Bungoma County as it is the main source of food, livelihoods and income. The level of knowledge on the maize value chain amongst the maize value chain players was at 64.5%. However, the level of development of the maize value chain in the County was 25% which is too low for a value chain that is required to enhance food security and poverty reduction. Further, although most of the maize value chain players were adult males with at least primary level of education, majority of maize producers are females (61%) and youths were more interested at the trading stage of the value chain. The burden of producing enough maize to feed the county is mainly driven by the female gender. The examination of the maize value chain established that the key challenges facing the chain in Bungoma County included high cost of farm inputs, poor marketing infrastructure, inadequate affordable financial services and no maize value chain stakeholder partnerships or platforms. In addition, majority of the maize value chain businesses in the county were done at small scale level depending on self-financing which was also meager and unsustainable leading to inadequate maize volumes for food and for income to reduce poverty. Therefore, if everything remained constant, then maize value chain alone would not be able to provide for the required food security and poverty reduction as its productivity and profitability were too low.

8.2.2: The Level of Food Security in Bungoma County

Small scale farmers make 97% of the farmers in Bungoma County while 86% of the farmers grow maize and 95% of the community depends on maize for food. However, due to low maize productivity, low purchasing power, high post-harvest losses, level of food security in the County was established to be at 37%. This indicates the level of those who could afford at least 3 meals in a day. Further, gender discrimination that leaves out female gender in the mainstreaming of maize value chain development while they are the ones that do most of farming, food production and food preparation activities, helps to make households more food insecure. This means that the people of Bungoma County are not food secure as only 37% of them get enough food each day.

8.2.3: The Factors Influencing Poverty Reduction in Bungoma County

The study established that the poverty level in Bungoma County was at 52.8% with a poverty gap of 2.25. Main causes of poverty in the community were low farm productivity, high population growth rate and ignorance. The main indicators of poverty were established to be insufficient food, inadequate money and poor housing. The over-dependence on maize as the key source of food, employment and income while maize is an agricultural product which is vulnerable to erratic weather conditions deters poverty reduction. In addition, ineffective government policies and programmes that hamper maize value chain growth, poor overall infrastructure, deficient business skills and culture of being skeptical of diversification of foods reduce the chances of reducing poverty.

8.2.4: The Strategies for enhancing Maize Value Chain

The predicament of achieving food security and poverty reduction in Bungoma County is escalated by the presence of factors like inadequate access to affordable inclusive financial services for farm credits to small scale maize farmers and overreliance on rain-fed maize production. This has contributed to the livelihoods of the community to be vulnerable to risks of climate change effects like drought and hailstorms helping to downgrade the maize value chain resulting into low maize profitability and low incomes.

The study established that reducing the cost of maize farm inputs, structuring maize marketing, training and capacity building of the maize value chain players, reduced cost of doing business and improving post-harvest management were the priority strategies for enhancing maize value chain in Bungoma County. It was also revealed that promotion of stakeholder participation and facilitation for good business environment would enhance growth and sustainability of maize businesses. Likewise, embracing value chain development approach by the maize value chain players would provide insights into means of acquiring business assets at the level of smallholder households and the local smallholder maize enterprises. This would help enhance the productivity and profitability of the maize value chain and enhance food security and poverty reduction.

Overall Conclusion

The problem of persistently not achieving food security and poverty reduction, which both depended on maize value chain in Bungoma County, was escalated by the presence of factors like low farm productivity, high population growth rate, high cost of maize farm inputs, erratic weather patterns and inadequate affordable farm credits and financial services to small scale farmers. With the available advanced maize value chain technologies, small scale maize value chain actors could be empowered to advance their various trades. This could happen if the key maize value chain stakeholders could collaborate and adopt the agricultural value chain approach in order to analyze the maize value chain for solutions and opportunities to invest for upgrading and enhancing the chain for food security and poverty reduction in the county.

8.3: Recommendations

The following recommendations were arrived at based on the study findings and conclusions.

(i) On the level of maize value chain development in Bungoma County, the county government of Bungoma needs to create a maize value chain stakeholder platform, identify the key stakeholders, mobilize, sensitize and train them on the maize value chain and the needs for maize value chain development

(ii) On the Level of Food Security in Bungoma County, the County needs to improve farmers' access to research recommended technologies like certified fertilizers and

seeds, through trainings and controlled booster subsidies and farm credits to improve farm productivity and profitability to enhance food security

(iii) On the Factors influencing Poverty Reduction in Bungoma County, the County should promote farmer resource mobilization and access to markets through produce aggregation, collective marketing, forward contracting to enhance maize productivity and incomes.

(iv) On Strategies for Enhancing Food Security and Poverty Reduction, the county government of Bungoma needs to promote affordable financial products, reduce high cost of farm inputs, promote research & technology, extension services, improve infrastructure and training for capacity building of maize value chain players and key stakeholders

8.4: Suggested areas for further Research

The study recommends that more research could be conducted in the following areas to help enrich further knowledge on maize value chain upgrading and development;

(i) Maize Aggregation and Ware House Receipting in Bungoma County

(ii) Maize value chain financing products and records

(iii)Maize value chain mapping in Kenya

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APPENDICES

APPENDIX 1: BASIC DATA FOR BUNGOMA COUNTY

Area:	3, 593 KM^2
Arable Land:	2516.7km^2
Population:	1,552,973
Population Growth rate:	3.1%
Population Density:	454p/km^2
Households:	172,005
Education/literacy level:	80.5%
Average farm size:	1.86Ha (2.65 Acres)
Rainfall:	Min-1000mm, Max 1,800mm
Temperature:	0^0C-32^0C
Altitude:	4,321m-1200m asl
Latitude:	0^0 28^1 and 1^0 30^1 North of equator
Wards:	45
Poverty rate (based on KIHBS %): 52.9	
Industry -	Nzoia Sugar Company, Webuye Pan Paper Mill
Infrastructure:	67 km of class A roads, 154 km of class C roads,
Longitude:	34^0 20^1Eand 35^15^1 East of Greenwich meridian
Cash crops:	Coffee, Sugarcane, Rice and Pyrethrum
Food crops:	Beans, Irish potatoes, Sweet potatoes, Sorghum, Cassava, Rice and Millets, Bananas
Livestock:	Cattle, Poultry, Shoats, Fish
Gazette forest 1:	Mt. Elgon reserve 618.2km
National park reserve in Mt. Elgon	50,668.3ha
Wind speed:	6.1km/hr.
Sub counties:	9
Constituencies:	9

Source: Kenya National Bureau of Statistics (2009) Population and Housing Census, Bungoma County

APPENDIX 2: POVERTY DISTRIBUTION AMONGST THE MAIZE VALUE CHAIN CATEGORIES

Categories of the Maize Value Chain	**Responses to Easy to meet Basic HH Needs (No.s)**	**Response to Very Difficult to Meet Basic HH Needs (No.s)**	**Percentage (%) Poverty Distribution per Category**
Key Informants	31	14	6.4
FGDs -Producers	23	37	16.8
FGDs- Stakeholder	7	5	2.3
Maize Inputs- Agro-Dealers	21	29	13.2
Individual Maize Producers	46	94	42.7
Individual Maize Traders	45	25	11.4
Maize Processors	25	16	7.3
	198	**220**	**100**

(Source: Field Data, 2016)

APPENDIX 3: INTERVIEW CONSENT FORM FOR RESPONDENTS

Good morning/afternoon?' My name is ……

I am conducting a study entitled: Maize Value Chain for Food Security and Poverty Reduction in Bungoma County, Kenya. The purpose of the study is to examine maize value chain in Bungoma County with a view of enhancing food security and poverty reduction. The information generated from the study will guide the Bungoma County Government, policy makers and other development planners to make and implement decisions that will enhance food security and poverty reduction in this community.

Procedure for the study

The study will involve asking you some questions concerning food security and poverty reduction at household and community levels

Benefit and risks

The results from this study are expected to be used by the maize value chain stakeholders to enhance food security and poverty reduction status in Bungoma County. There are no anticipated risks to you and your child from this study.

Confidentiality

All the information collected will be treated in confidence and used only for purposes of this study. The dissemination of results will be by way of

summarized information that will have no reference to any particular individual.

Voluntary consent

You are free to choose whether to take part in the study or not, feel free to withdraw at any time during the interview. Feel free to ask any question before or after the interview. For any questions concerning this study please conduct the researcher, Caroline Kamau. Telephone No. 0733 822 973

I hereby invite you to take part in the interview on the above subject. The interview will take approximately 45 minutes.

Statement of informed consent

The above information has been clearly explained to me and I have read/understood it. I do here by voluntarily agree to participate in this study.

Respondent's signature/thumb print.....

Name of Researcher/Research Assistant eliciting consent .....

Signature.....

Date.....

APPENDIX 4: QUESTIONNAIRE FOR INDIVIDUAL AGRO-INPUTS DEALERS

Target respondents: Farm Input suppliers – Stockists, Agro-vets, etc.

Good morning/afternoon?' My name is ……

I am conducting a study entitled: Maize Value Chain for Food Security and Poverty Reduction in Bungoma County, Kenya. The purpose of the study is to examine maize value chain in Bungoma County with a view of enhancing food security and poverty reduction. The information generated from the study will guide the Bungoma County Government, policy makers and other development planners to make and implement decisions that will enhance food security and poverty reduction in this community.

You are kindly requested to give data that shall be held in confidence and only be used for the purpose of this study. Your cooperation will be highly appreciated.

Thank you.

Enumerator Name: _____ Date: …… Start Time ……

County: _____Sub County: _____

1: demographics for the agro-input Dealer

1.1. Name/ Number of the respondent _____Tel (Mobile):_____ Gender: (Tick one) - (Male/Female/Youth)

1.2. Age of proprietor (years) (Tick One) 1. 18-35 2. 36-50 3. Above 50

1.3. Highest Educational level of proprietor: (Tick all that apply)

1. None 2. Primary 4.Secondary 5.College 6.University 7. Others - (specify) …

Objective1: Level of Value Chain Development

1.1. Name of the business: …….

1.2. What is your position in the Business? 1. Owner 2. Employee 3. Child. 4. Neighbour 5. Friend____ (Tick the appropriate answer)

1.3. From the following list Tick the main product(s) that your business deals in. 1. Fertilizers 2.Seed 3.Agro-chemicals 4.Feeds 5. Farm Equipment 6. Other (specify) …….

Tick if you have knowledge on the following

Commodity/ Product	Source of product	Volume of Products sold	Buying Price	Selling Price	Uses of the product	Who are the customers	Collab orators

1.4. Is your Business registered? __ 1=Yes; 0=No. If yes, As what? (Tick the one that applies).

1. Cooperative 2. Self Help group 3. Agro-vet 4.Company 5.General Store 6. Other (specify)……

1.7. What are the three main sources of finance for running your business operations? (Tick from the list below). 1. Partner's shares 2. Savings 3. Sales/ Profit 4. Service charges on Clients 5.Loan from commercial banks 6.Loan from Micro- Finance Institutions 7. Agricultural Finance Corporation (AFC) 9.Cooperatives 10. Others (specify). ____.

1.8. What are the three main challenges faced in seeking business credit? (Tick all appropriate). 1. High Interest rates 2.Inadequate Knowledge and management skills 4.None 5.Others – Specify ……..……..

1.9. Is your business insured? 1. Yes 2. No (Tick One).

1.10. What is the nature of the business? (Tick that apply) 1. Wholesale 2. Retail 3. Others Specify.....

1.11. What are the three main problems of running an agro-dealer business here? (Tick those that apply). 1. Land/premise 2.Inadequate capital 3. Governance 4. Bureaucracy 5. Unstructured marketing system 6.Lack of business skills 7.High levels of illiteracy 8.High cost of inputs 9. Others (specify) ……

1.12. When do you operate your farm input business? (Tick those that apply). 1. throughout the year 2.Long rain season 3. Short rain season 4.Others (specify)…….

1.13. What other services do you offer to your customers? (Tick all that apply). 1. Over the counter advice on products and their use 2. Input transport 3.Produce marketing 4.Training/Crop demonstration plots 5.Credit to customers 6. Others (Specify)…

1.15. Who are your key stake holders and the services provided for your business? (Fill in the table below for who apply)

S/No.	SERVICE PROVIDED	STAKE HOLDERS e.g. MOAL, KEPHIS,
1.	Extension services Eg. Training	
2.	Supply of inputs	
3.	Financial Services	
4.	Insurance Services	
5.	Statutory Regulations	
6.	Others-Specify ……	

1.17. Which of the following do you benefit as a maize stakeholder from the other maize value chain players? (Tick all that apply). 1. Information flow 2. Increased profits 3. Reduced business costs 4. Lobbying 5.Improved supply 7. Higher Quality 8. Increased Productivity 9. Others –Specify...

Objective 2: Level of Food Security

2.1. What is your family's main food? (Tick that apply)

1. Rice 2. Maize 3. Beans 4. Bananas 5. Cassava 6. Others-Specify ……

2.2. In what way do eat/use the crop? ……

2.3. How many meals does your family have in a day? (Tick that apply)

1. One 2. Two 3. Three 4. None 5. Others-Specify ……

2.4 Where do you get your main food from- Market or Farm? …….

2.5. Do you sell any maize of food? …… Yes or No? ……

Please explain? …….

2.6. What have been the food (maize production & stores), availability trends in your House Hold (HH) in the last 5 years?

Year	2011	2012	2013	2014	2015
Maize production- Yield/Acre					
Your Farm Acreage					
Number of HH members					
Maize consumption at HH					
Number of bags needed for Cash Needs per year					
Maize Stores at HH					
Maize prices (Kshs./bag)					
Nearest Market (KM)					

2.7. What is your main source of income? ……

2.8. What have been Income trends in the last 5 years in your business? Fill in the table below;

Year	2011	2012	2013	2014	2015
Net Income Returns (Kshs)					
Expenditure Needs (Kshs)					

2.9. For how long do you keep maize in store for food? 1- Two Month 2- Three Months 3 – Four Months 4 – Five -Moths 5 – Till Harvesting

3.0. It is April -May – June, do you have any maize for food in Store?

1 –Yes 2 -No

Objective 3 – Poverty Reduction

3.1. How do you define poverty in your community? ……

3.2. What are the indicators of House Hold poverty in your community?

(Tick those that apply). 1. Lack of food 2. Grass thatched Houses

3. Semi-Permanent houses 4.Illiteracy 5. Lack of amenities

6. High disease incidences 7.Lack of money lack of land 8.Others -Specify …

3.3. According to you, what percentage of the community are poor, (those that have the ticked indicators above)? (Tick one from the list).

1. 40 2.50 3. 55 4. 60 5. Other – Specify ……

3.4. What percentage of the community dependent on maize crop for their livelihood?

(Tick the one that apply)

1. 20 2. 30 3.40 4.50 5.60 6.70 7.80 8.90 9. Other– Specify …

3.5. What do you think are the causes of poverty in your community? (Tick those that apply) . 1. Laziness 2. Ignorance 3. Insecurity 4. Culture 5. Climate 6. Others-Specify...

Objective 4: Strategies to improve the maize value chain

4.1. Can working together by the maize value chain players help improve the maize value chain? (Tick One) 1. Yes 2. No.

If Yes, Explain How. ……

4.2. What do you think could be the major challenges in developing the maize business? (Tick those that apply).

1. Poor Physical Infrastructure 2. Poor Marketing Infrastructure 3. High Poverty amongst the community 4. Poor Implementation of effective Agricultural policies 5. Environmental Degradation 6. Ineffective Policy development 7. Lack of business knowledge 8. Others – Specify….

4.4. Can the following help improve the maize value chain development?

(Tick those that apply): 1. Trainings 2. Farm Inputs supply. 4...Farm Credits 5. Business Credits 7. Food Relief 8. Subsidies. 9. Others- Specify...

Give any comments/Recommendations

……

……End Questionnaire time

APPENDIX 5: **QUESTIONNAIRE FOR INDIVIDUAL MAIZE PRODUCERS**

Target Respondents: - Individual farmers/Producers

Good morning/afternoon?' My name is ……

I am conducting a study entitled: Maize Value Chain for Food Security and Poverty Reduction in Bungoma County, Kenya. The purpose of the study is to examine maize value chain in Bungoma County with a view of enhancing food security and poverty reduction. The information generated from the study will guide the Bungoma County Government, policy makers and other development planners to make and implement decisions that will enhance food security and poverty reduction in this community.

You are kindly requested to give data that shall be held in confidence and only be used for the purpose of this study. Your cooperation will be highly appreciated.

Thank you.

ENUMERATOR'S NAME: _____DATE: ____/____/2016

Sub County: _____Start Time: ____

1. Demographics

1.1. Name/Number of the Farmer ……M/F……; Married/Single; No. Children …

1.2. Age Bracket (Tick One) 1. 18-35 2. 36-50 3. Above 50

1.3. Highest Education level achieved: 1.Degree 2.Diploma 3.Certificate 4. Secondary 5.Primary 6.None 7.Others Specify……

1.4. How many members are in your House Hold? ……..

1.5. Contact Address……Phone Number……

1.7. Physical Location: County……Sub Count…… Ward…… Location:

1.8. Who are your main collaborators and in what areas (linkages and networking):

Collaborators/Stakeholders	Area(s) of Collaboration

Objective 1: Level of Value Chain Development

1.1. What is your main Crop? (Tick One) 1. Maize 2. Rice 3. Beans

4 Sugar Cane 5. Others –Specify ……

1.2. Please fill in the table below;

Acreage of main crop	Yield (Bags, Kgs/Acre)	What Inputs are used	Input Suppliers	Storage Facility used	Buyers/ Market

1.3. How many farm laborers do you engage to work on one acre? ……

How much do you pay each of them per day - …….

1.4. Do you have a bank account? 1. Yes 2. No (Tick One)

1.5. How do you finance your farming activities? (Tick all that apply)

1. Savings 2. Farm Profits 3.Bank Loans 4.Merry Go Round 5.Donations

6. Others – Specify …….

1.6. How do you market your produce/product? (Tick all that apply)

1. Contract 2. Farm gate 3.local Market 4.Collection Centre 5 . Brokers 6. Others specify…….

1.7. What type of value addition do you practice? (Tick all that apply)

1. Sorting 2. Cleaning 3. Grading 4. Processing 5. Packaging 6. Storage 7. Others - specify……..

1.8. Are you aware of any product quality requirements? (Tick One) 1. Yes 2. No.

If yes, which one (s)? (Tick all that apply). 1. Health/Hygiene 2. Standard Marks 3. Good Agricultural Practices (GAPs)

4. Others - Specify…..……..

1.9. Which Institutions are concerned with standards, regulations or laws that govern your business? (Tick Those that apply)

1. KEBS 2. MOALFCI 3. KEPHIS 4. SELF 5. TRADERS 6. CUSTOMERS 7. OTHERS-SPECIFY…….

1.10. What problems/challenges face you as a farmer? (Tick all that apply). 1. Low produce Yield 2. High produce losses 3. High production costs 4. Poor roads 5.Low Maize prices 6.Poor information network 7.Others- Specify……

1.11. Which of the following do you benefit from as a maize stakeholder from the other maize value chain players? (Tick all that apply).

1. Information flow 2. Increased profits 3.Reduced business costs 4. Lobbying 5. Improved supply 7.Higher Quality 8.Increased Productivity 9. Others – Specify…

1.8. Can working together by the maize value chain players help improve the maize business? Yes or No …… Please explain. : ……

Objective 2: Level of Food Security

2.1. What is the main food in your house hold? (Tick that apply)

1. Rice 2. Maize 3. Beans 4. Bananas 5. Cassava 6. Others-Specify ……

2.2. In what way does your family eat/use the crop? ……

2.3. How many meals does your family have in a day? (Tick that apply)

1. One 2. Two 3. Three 4. None 5. Others-Specify ……

2.4 Where do you get your main food from- 1- Market 2- Farm 3- Relief 4 – Gift

2.5. Do you usually have any food/maize to sell? …… Yes or No? ……

2.6. What have been the food (maize production & stores), availability trends in your house hold in the last 5 years?

Year	2011	2012	2013	2014	2015
Maize production – Yield/Acre					
Number of Acres for HH					
Maize consumption at HH					
Maize Stores at HH					
Maize prices (Kshs./bag)					
Number of bags required for Cash Needs					
Nearest Market (KM)					

2.7. Do any produce go to waste? (Tick One) 1. Yes 2. No

If yes give the average percentage quantity wasted ……..

2.8. What are the main causes of produce wastage? (Tick the main two)

1. Poor Post-Harvest Management 2. Theft 3. Poor Storage facilities 4. Lack of Training 5. Others – Specify ……

2.9. For how long do you keep maize in store for food? 1- Two Month 2- Three Months 3 – Four Months 4 – Five -Moths 5 – Till Harvesting

2.10. It is April -May – June, do you have any maize for food in Store?

1 –Yes 2 –No

2.11. What have been Income trends in the last 5 years in your business?

Year	2011	2012	2013	2014	2015
Net Income Returns (Kshs)					
Expenditure Needs (Kshs)					

2.12. Can working together by the maize value chain players help improve your food security?

Yes or No ……. Please explain. : ……

Objective 3. Factors Influencing Poverty Reduction

3.1. How do you define poverty in this community? ……

3.2. What are the indicators of House Hold poverty in the community? (Tick those that apply). 1. Lack of food 2. Grass thatched Houses 3. Semi- Permanent houses 4.Illiteracy 5. Lack of amenities 6. High disease incidences 7.Lack of money lack of land 8.Others –Specify ……

3.3. According to you, what percentage of the community are poor, (those that have the ticked indicators above)? (Tick one from the list): 1. 40 2.50 3. 55 4. 60 5. Other –

3.4. What percentage of the community dependent on maize crop for their livelihood? (Tick the one that apply) 1. 20 2. 30 3.40 4.50 5.60 6.70 7.80 8.90 9. Other– Specify …….

3.6. What do you think are the causes of poverty in your community? (Tick main three that apply): 1. Low Farm Yields 2. Ignorance 3. Insecurity 4. Culture 5. High Population 6. Climate 7. Low maize Prices 8. Others- Specify...

3.7. Can working together by the maize value chain players help reduce poverty? Yes or No ….. Please explain: ……

Objective 4: Strategies to improve the maize value chain

4.1. What are the current maize farming strategies? (Tick the main three)

1. Rain fed maize farming 2. Mixed cropping and Farming
3. Traditional Post-Harvest Management 4. Little use of recommended Fertilizers and seeds 4. Depend on MOA for extension services 5. Others- Specify ……

4.2.What are the major challenges in improving the maize business? (Tick those that apply).

1. Poor Physical Infrastructure 2. Poor Marketing Infrastructure 3.High Poverty amongst the community 4.Poor Implementation of effective

Agricultural policies 5. Environmental Degradation 6. Ineffective Policy development 7. Lack of knowledge and skills 8. Others – Specify ……

4.4. Can the following help improve the maize value chain development?

(Tick those that apply): 1. Trainings 2. Reduced Farm Inputs Prices 3. Affordable Farm Credits 7. Food Relief 8. Subsidies 9. Improved Infrastructure 10. Others- Specify ……

Give any comments/recommendations: ……

End Questionnaire time ……

APPENDIX 6: QUESTIONNAIRE FOR INDIVIDUAL MAIZE TRADERS

Target Respondents: (Broker/Retail and Wholesale traders and Transporters)

Good morning/afternoon?' My name is ……

I am conducting a study entitled: Maize Value Chain for Food Security and Poverty Reduction in Bungoma County, Kenya. The purpose of the study is to examine maize value chain in Bungoma County with a view of enhancing food security and poverty reduction. The information generated from the study will guide the Bungoma County Government, policy makers and other development planners to make and implement decisions that will enhance food security and poverty reduction in this community.

You are kindly requested to give data that shall be held in confidence and only be used for the purpose of this study. Your cooperation will be highly appreciated.

Thank you.

ENUMERATOR'S NAME: _____DATE: ____/____/2016

Sub County: _____Start Time: ____

1. Demographics

1.1. Sub County: ……..Market…….……Telephone contact ……

1.2. Category of the player (Tick as appropriate) .1. Broker 2.Retailer 3. Wholesalers

4. Transporter 5. Others-Specify ……

1.3. Name/Number: …… Gender of player: (Tick one)

1.Male 2. Female 3. Youth

1.4. Age of player. - 1. 18-35, 2.36-50, 3. Above 50

1.5. Highest level of Education of market player:-1. None 2. Primary 3. Secondary 4.College (Certificate, Diploma) 5. Degree 6. Other-specify ……

Objective 1: Level Value chain Development

1.1. What maize products do you trade in/handle? (Tick all that apply)

1. Green Maize 2. Dry Maize 3. Maize Flour 4.Maize for Animal Feeds 5. Others-specify……

1.2. Produce marketing/Transporting (Fill in the details in the table below)

Produce/ Product	Source (Place)	Target Buyers	Market Destination	Transport Type	Volume in Bags/Season

1.2. Where do you collect or get the produce from? (Tick all that apply)

1. Farm gate 2. Collection Centre 3. Market Centre 4. Others specify …

1.3. Where do you deliver the produce/products? (Tick all that apply)

1. Collection Centre 2. Millers 3. NCPB 4. Retail Market 5. Collection centres 4. Others specify ……

1.4. What constraints do you encounter in trading in the produce from the source to point of sale?

1. ……2. …… 3. ……4……

1.5. Do you have any training in Business Skills? (Tick one) 1. Yes 2. No

1.6. How do you finance your business (Tick all that apply)

1. Own Capital 2. Credit facilities 3.Donations 4. Business profits

1.7. What storage facilities do you use to store produce ? ……..

1.8. Does any produce go to waste? (Tick One) 1. Yes 2. No

1.8. If yes give the Percentage quantity loss of the produce ……..…

1.9. What challenges do you face in handling produce?

1. ……2. …… 3.…… 4. ……

1.10. What are your sources of market information? (Tick all that apply)

1. Telephone 2. Radio 3. Print 4. TV 5. Others specify ……

1.11. Are you aware of the cost of production of maize? 1. Yes 2. No

1.12. Are you aware of the cost of storage of maize?

1.13. Are you aware of the cost of transporting of maize?

1.14. What do you understand by maize Value Chain? …….

…….....

1.15. Which of the following do you benefit from as a maize stakeholder from the other maize value chain players? (Tick all that apply).

1. Information flow 2. Increased profits 3.Reduced business costs 4. Lobbying

5. Improved supply 7.Higher Quality 8.Increased Productivity 9. Others – Specify

1.16. What type of value addition do you practice? (Tick all that apply)

1. Sorting 2. Cleaning 3. Grading 4. Processing/Milling 5. Packaging

6. Storage 7. None 8. Others - specify……..

1.17. Which of the following Institutions are concerned with standards, regulations

or laws that govern your business? (Tick all that apply)

1. KEBS 2. MOALFCI 3. KEPHIS 4. SELF 5. TRADERS 6. CUSTOMERS 7. COG 8. OTHERS-SPECIFY…….

1.18. What do you understand by maize Value Chain? ……

……

1.19. Can working together by the maize value chain players help improve maize value chain? 1. Yes 2. No (Tick one) Yes or No. Please explain. : ……

1.20. What problems/challenges face you as a trader? (Tick all that apply).

1. Low produce prices 2. High Post – harvest Produce losses 3. High marketing costs 4. Poor roads 5.Poor Marketing Facilities 6.Poor information network 7. Others- Specify…….

Objective 2: Level of Food Security

2.1. What is the main food in your house hold? (Tick that apply)

1. Rice 2. Maize 3. Beans 4. Bananas 5. Cassava 6. Others-Specify ……

2.2. In what way do you eat/use the crop? ……

2.3. How many meals do your families have in a day? (Tick that apply)

1. One 2. Two 3. Three 4. None 5. Others-Specify ……

2.4 Where do you get your main food from- Market or Farm? ……

2.5. What have been the food (maize production & stores), availability trends in the sub county in the last 5 years?

Year	2011	2012	2013	2014	2015
Average Maize Production-Yield/Acre at HH					
Farm Acreage for HH					
Number of HH members					
Maize consumption at HH					
Maize Stores at HH					
Maize prices (Kshs./bag)					
Nearest Market (KM)					
What are Cash Needs for HH/Year					

2.6. Do any produce go to waste? (Tick One) 1. Yes 2. No

If yes give the average percentage quantity wasted ……..

2.7. What are the main causes of produce wastage? (Tick the main two)

1. Poor Post Harvest Management 2. Theft 3. Poor Storage facilities 4. Lack of Training 5. Others – Specify ……

2.8. For how long do you keep maize in store for food? 1- Two Month 2- Three Months 3 – Four Months 4 – Five -Moths 5 – Till Harvesting

2.9. It is April -May – June, do you have any maize for food in Store?

1 –Yes 2 -No

2.10. What have been Income trends in the last 5 years in your business?

Year	2011	2012	2013	2014	2015
Net Income Returns (Kshs)					
Expenditure Needs (Kshs)					

2.11. Can working together by the maize value chain players help improve your food security?

Yes or No …… Please explain. : ……

Objective 3: Factors Influencing Poverty Reduction

3.1. How do you define poverty in this community? ……...

3.2. What are the indicators of House Hold poverty in the community? (Tick those that apply).

1. Lack of food 2. Poorly Grass thatched Houses 3. Semi-Permanent houses 4.Ignorance 5. Lack of amenities 6. High disease incidences 7. Inadequate money 8. Insufficient land 9.Others –Specify ……

3.3. According to you, what percentage of the community are poor, (those that have the ticked indicators above)? (Tick one from the list)

1. 40 2.50 3. 55 4. 60 5. Other – Specify …….

3.4. What percentage of the community dependent on maize crop for their livelihood? (Tick the one that apply) 1. 20 2. 30 3.40 4.50 5.60 6.70 7.80 8.90

9. Other– Specify …….

3.6. What do you think are the causes of poverty in your community? (Tick those that apply)

1. Low Maize Yields 2. Ignorance 3. Insecurity 4. Culture 5. Climate

6. Others- Specify...

3.7. Can working together by the maize value chain players help reduce poverty?

Yes or No … Please explain: ……

Objective 4: Strategies to improve the maize value chain

4.1. What are the current maize farming strategies? (Tick the main three)

1. Rain fed maize farming 2. Mixed cropping and Farming

3. Traditional Post-Harvest Management 4. Little use of recommended fertilizers and seeds 5. Depend on MOA for extension services

6. Others- Specify ……

4.3. What are the major challenges in developing the maize business? (Tick those that apply). 1. Poor Physical Infrastructure

2. Poor Marketing Infrastructure 3.High Poverty amongst the community 4. Poor Implementation of effective Agricultural policies

5. Environmental Degradation 6. Ineffective Policy development

7. Lack of knowledge and skills 8. Others – Specify ……

4.4. Can the following help improve the maize value chain development?

(Tick those that apply): 1. Trainings 2.Funds availability 3. Reduced Farm Inputs Prices 4. Farm Credits 6. Business Credits 7. Food Relief

8. Subsidies 9. Others- Specify ……

Give any comments/ recommendations: …… End time …….

APPENDIX 7: MAIZE VALUE CHAIN SERVICE PROVIDERS

Target Respondents: - Chain Service Providers, Chain Enablers, Maize Processors (Agriculture Extension Officers, Financial Institutions, Insurance, County Directors of Agriculture and Trade, Main Maize Millers)

Good morning/afternoon?' My name is ……

I am conducting a study entitled: Maize Value Chain for Food Security and Poverty Reduction in Bungoma County, Kenya. The purpose of the study is to examine maize value chain in Bungoma County with a view of enhancing food security and poverty reduction. The information generated from the study will guide the Bungoma County Government, policy makers and other development planners to make and implement decisions that will enhance food security and poverty reduction in this community.

You are kindly requested to give data that shall be held in confidence and only be used for the purpose of this study. Your cooperation will be highly appreciated.

Thank you.

ENUMERATOR'S NAME: _____DATE: ____/____/2016

Sub County/County: _____Start Time: ____

1. Demographics

1.1. Type of Informant as the respondent _____Tel (Mobile):_____ Gender: (Tick one) - (Male/Female/Youth)

1.2. Age of proprietor (years) (Tick One) 1. 18-35 2. 36-50 3. Above 50

1.3. Highest Educational level of proprietor: (Tick all that apply)

1. None 2. Primary 4. Secondary 5. College 6.University 7. Others - (specify)

1.4. Physical Location: County: ……. Sub County: ……

1.5. What is your area of specialization/ What service do you provide? ……

1.6. Number of Years in service? …….

1.7. What category of the maize value chain do you support? 1. Input Supplying: 2. Production 3.Transport 4. Trading 5. Processing 6. Others (Specify)……..

1.8. Who are the chain's key collaborators and in what area of Collaboration and location):

Collaborator/Stakeholders	Area (s) of Collaboration	Located

Objective 1: Level of Maize Value Chain Development

1.1. Is Maize Crop important to the people of Bungoma County? (Tick one) – 1. Yes2. No. If YES, - Give three major reasons;

1. …… 2.…… 3. ……

1.1. What maize products are mainly handled? (Tick all that apply)

1. Green Maize 2. Dry Maize 3. Maize Flour 4. Maize for Animal Feeds

5. Maize Crop 6. Others- specify……

1.2. What major services do the Maize Value Chain Players receive?

1. ..... 2. …….……

3. ……

1.3. What type of value addition is done on maize? (Tick all that apply)

1. Sorting 2. Grading 3. Processing 4.Packaging 5. Warehousing

6.Storage 7. Cleaning 8. Drying 9. Others-specify ……

1.4. What percentage of the maize agro-dealer businesses are registered? _____

1.5. Who are the major buyers of maize? (Tick the main three) 1. Local House Holds

2. Brokers 3.Millers 4. Market Stores 5. Retailers 6. Others – Specify

……

1.6. What are the three main sources of finance for running maize businesses?

(Tick all that apply) - 1. Savings 2. Loan from commercial bank

3. Loan from Micro-finance institutions 4. Agricultural Finance Corporation

(AFC) 5. Cooperatives 6. Grants 7. Other (specify) ….

1.7. Do maize value chain actors have business management? (Tick one that applies)

……..

1.8. Who are the main Extension Service providers in the County)

……,……

1.9. What type of training do they receive? (Select main three of the following) 1.

Management skills 2. Governance 3. Value chain Development 4. General

Agriculture 5. Agribusiness and Entrepreneurship 6. Skills in value addition 7.Climate change and adaptation

1.11. In your opinion what is main source of market information? (Tick main three).

1. Mobile telephone 2. Internet 3.Verbal 4.Print media 5.Radio 6.TV 7.

1.12. Do any produce go to waste? (Tick One) 1. Yes 2. No

If yes give the average percentage of quantity wasted ……..

1.13. What are the main causes of produce wastage? (Tick the main two)

1. Poor Post Harvest Management 2. Theft 3. Poor Storage facilities

4. Deficient Skills Used 5. Others – Specify ……

1.14. What do you understand by maize Value Chain?

……

1.15. What is the level of understanding of Value Chain approach amongst the maize value chain actors? …….

1.16. Do you think working together by the maize value chain players help improve maize value chain development? Yes or No …….

Please explain. : ……

1.17. What benefits do the maize value chain stakeholders get from the other maize value chain players? (Tick those that apply).

1. Information flow 2. Increased profits 3.Reduced business costs

4.Lobbying 5. Improved supply 6. Higher Quality 8.Increased Productivity 9. Others – Specify.

1.18. What problems/challenges face you as an enabler? (Tick all that apply). 1. Low produce prices 2. High produce losses 3. High marketing costs 4. Poor roads

5.Poor Marketing Facilities 6.Poor information network 7. Poor implementation of policies

1.19. Please suggest three main interventions for enhancing the maize business;

Challenges faced	Suggested Intervention

Objective 2: Level of Food Security

2.1. What is the main food for Bungoma County? (Tick that apply)

1. Rice 2. Maize 3. Beans 4. Bananas 5. Cassava 6. Others-Specify ……

2.2. In what way do the people eat/use the crop? ……

2.3. How many meals do most families have in a day? (Tick that apply)

1. One 2. Two 3. Three 4. None 5. Others-Specify ……

2.4 Where do most people get their main food from- Market or Farm? ……

2.5. Do they sell any food/maize ? …… Yes or No? ……

2.6. What have been the food (maize production & stores), availability trends in the sub county in the last 5 years?

Year	2011	2012	2013	2014	2015
Maize production					
Average Maize Yield /Acre					
Maize prices (Kshs./bag)					

2.7. What is the average numbers of members and acreage per House Hold?

1. Number of HH Members: …… 2. Acreage per HH: ……..

2.8. How do most farmers sell their maize produce ? What are the major markets in the area? 1. Collection Centre 2. Millers 3. NCPB 4. Retail Market 5. Collection centres 6. Farm Gate 7. Brokers

2.9. Where are the main Food Stores? (Tick the main three) 1. House Hold 2. Market Stores 3, NCPB 4. Neighbours 5. Millers 6. Others-Specify …

2.10. What are the main sources of income in the area? (Tick those that apply)

Agro dealer Business	Maize Farming	Maize Trading	Maize Milling	Employment	Off Farm Activities

2.11. For how long do farmers keep maize in store for food? 1- Two Month 2- Three Months 3 – Four Months 4 – Five -Moths 5 – Till Harvesting

2.12. It is April -May – June, do any have any maize for food in Store?

2.13. Can working together by the maize value chain players help improve food security?

Yes or No - (Tick One)

Please explain. : ……

Objective 3: Factors affecting Poverty Reduction

3.1. How do you define poverty in this community? ……

3.2. What are the indicators of House Hold poverty in the community? (Tick those that apply).

1. Lack of food 2. Grass thatched Houses 3. Semi-Permanent houses 4.Ignorance 5. Lack of amenities 6. High disease incidences

7. Inadequate of money 8. Insufficient land 8. Others – Specify.

3.3. According to you, what percentage of the community are poor, …….

3.4. What percentage of the community dependent on maize crop for their livelihood?

…….…….

3.5. What do you think are the causes of poverty in your community?

……

3.6. Can working together by the maize value chain players help reduce poverty?

Yes or No .

Please explain: ……

Objective 4: Strategies to improve the maize value chain

4.1. What are the current maize business strategies? (Tick the main three)

1. Rain fed maize farming 2. Mixed cropping and Farming

3. Traditional Post Harvest Management 4. Little use of recommended fertilizers and seeds 4. Depend on MOA for extension services 5. Others-Specify ……

4.2. What are the major challenges in developing the maize business? (Tick those that apply). 1. Poor Physical Infrastructure 2. Poor Marketing Infrastructure

3.High Poverty amongst the community 4. Poor Implementation of

effective Agricultural policies 5. Environmental Degradation 6. Ineffective Policy development 7. Lack of knowledge and skills 8. Others – Specify …

4.3. Can the following help improve the maize value chain development?

(Tick those that apply): 1. Trainings 2.Funds availability 3. Farm Inputs supply 4.Tours 5.Farm Credits 6. Business Credits 7. Food Relief 8. Subsidies 9. Others- Specify ……

Give any comments/ recommendations: ……..

…… End Questionnaire time ……

APPENDIX 8: INTERVIEW GUIDE FOR MAIZE VALUE CHAIN KEY INFORMANTS

Target Respondents: - Key Chain Service Providers, Chain Enablers, Maize Processors (Head of Sub County Agriculture Officers, Financial Institutions, Insurance, County Directors of Agriculture, County Agribusiness Officers and Trade, Main Maize Millers)

Good morning/afternoon?' My name is ……

I am conducting a study entitled: Maize Value Chain for Food Security and Poverty Reduction in Bungoma County, Kenya. The purpose of the study is to examine maize value chain in Bungoma County with a view of enhancing food security and poverty reduction. The information generated from the study will guide the Bungoma County Government, policy makers and other development planners to make and implement decisions that will enhance food security and poverty reduction in this community.

You are kindly requested to give data that shall be held in confidence and only be used for the purpose of this study. Your cooperation will be highly appreciated.

Thank you.

DATE: ____/____/2016

Sub County/County: _____Start Time: ____

2. Demographics

1.1. Type of Informant as the respondent _____Tel (Mobile):_____ Gender: (Tick one) - (Male/Female/Youth)

1.2. Age of proprietor (years) (Tick One) 1. 18-35 2. 36-50 3. Above 50

1.3. Highest Educational level of proprietor: (Tick all that apply)

1. None 2. Primary 4. Secondary 5. College 6.University 7. Others - (specify)

1.4. Physical Location: County: ……. Sub County: ……

1.5. What is your area of specialization/ What service do you provide? ……

1.6. Number of Years in service? …….

1.7. What category of the maize value chain do you support? 1. Input Supplying: 2. Production 3.Transport 4. Trading 5. Processing 6. Others (Specify)……..

1.8. Who are the chain's key collaborators and in what area of Collaboration and location):

Collaborator/Stakeholders	Area (s) of Collaboration	Located

Objective 1: Level of Maize Value Chain Development

1.1. Is Maize Crop important to the people of Bungoma County? (Tick one) – 1. Yes2. No. If YES, - Give three major reasons;

1. …… 2.…… 3. ……

1.1. What maize products are mainly handled?

1. Green Maize 2. Dry Maize 3. Maize Flour 4. Maize for Animal Feeds

5. Maize Crop 6. specify……

1.2. What major services do the Maize Value Chain Players receive?

1. ..... 2. …….……

3. ……

1.3. What type of value addition is done on maize? (Tick all that apply)

1. Sorting 2. Grading 3. Processing 4.Packaging 5. Warehousing

6.Storage 7. Cleaning 8. Drying 9. Others-specify ……

1.4. What percentage of the maize agro-dealer businesses are registered? _____

1.5. Who are the major buyers of maize? (Tick the main three) 1. Local House Holds

2. Brokers 3.Millers 4. Market Stores 5. Retailers 6. Others – Specify

…….

1.6. What are the three main sources of finance for running maize businesses?

(Tick all that apply) - 1. Savings 2. Loan from commercial bank

3. Loan from Micro-finance institutions 4. Agricultural Finance Corporation

(AFC) 5. Cooperatives 6. Grants 7. Other (specify) ….

1.7. Do maize value chain actors have business management Skills?

……..

1.8. Who are the main Extension Service providers in the County)

……,……

1.9. What type of training do they receive? (Select main three of the following) 1.

Management skills 2. Governance 3. Value chain Development 4. General

Agriculture 5. Agribusiness and Entrepreneurship 6. Skills in value addition 7.Climate change and adaptation

1.11. In your opinion what is main source of market information? (Tick main three).

1. Mobile telephone 2. Internet 3.Verbal 4.Print media 5.Radio 6.TV 7.

1.12. Do any produce go to waste? (Tick One) 1. Yes 2. No

If yes give the average percentage of quantity wasted ……..

1.13. What are the main causes of produce wastage? (Tick the main two)

1. Poor Post Harvest Management 2. Theft 3. Poor Storage facilities

4. Deficient Skills Used 5. Others – Specify ……

1.14. What do you understand by maize Value Chain?

……

……

1.15. What is the level of understanding of Value Chain approach amongst the maize value chain actors? …….

1.16. Do you think working together by the maize value chain players help improve maize value chain development? Yes or No …….

Please explain. : ……

1.17. What benefits do the maize value chain stakeholders get from the other maize value chain players? (Tick those that apply).

1. Information flow 2. Increased profits 3.Reduced business costs 4.Lobbying 5. Improved supply 6. Higher Quality 8.Increased Productivity 9. Others – Specify.

1.18. What problems/challenges face you as service provider? (Tick all that apply). 1. Low produce prices 2. High produce losses 3. High marketing costs 4. Poor roads 5.Poor Marketing Facilities 6.Poor information network 7. Poor implementation of policies

1.19. Please suggest three main interventions for enhancing the maize business;

Challenges faced	Suggested Intervention

Objective 2: Level of Food Security

2.1. What is the main food for Bungoma County? (Tick that apply)

1. Rice 2. Maize 3. Beans 4. Bananas 5. Cassava 6. Others-Specify ……

2.2. In what way do the people eat/use the crop? ……

2.3. How many meals do most families have in a day? (Tick that apply)

1. One 2. Two 3. Three 4. None 5. Others-Specify ……

2.4 Where do most people get their main food from- Market or Farm? ……

2.5. Do they sell any food/maize ? …… Yes or No? ……

2.6. What have been the food (maize production & stores), availability trends in the sub county in the last 5 years?

Year	2011	2012	2013	2014	2015
Maize production					
Average Maize Yield /Acre					
Maize prices (Kshs./bag)					

2.7. What is the average numbers of members and acreage per House Hold?

1. Number of HH Members: …… 2. Acreage per HH: ……..

2.8. How do most farmers sell their maize produce ? What are the major markets in the area? 1. Collection Centre 2. Millers 3. NCPB 4. Retail Market 5. Collection centres 6. Farm Gate 7. Brokers

2.9. Where are the main Food Stores? (Tick the main three) 1. House Hold 2. Market Stores 3, NCPB 4. Neighbours 5. Millers 6. Others-Specify …

2.10. What are the main sources of income in the area?

……

2.11. For how long do farmers keep maize in store for food? 1- Two Month 2- Three Months 3 – Four Months 4 – Five -Moths 5 – Till Harvesting

2.12. It is April -May – June, do any have any maize for food in Store now?

2.13. Can working together by the maize value chain players help improve food security?

Yes or No - (Tick One)

Please explain. : ……

Objective 3: Factors affecting Poverty Reduction

3.1. How do you define poverty in this community? ……

3.2. What are the indicators of House Hold poverty in the community? (Tick those that apply).

1. Lack of food 2. Grass thatched Houses 3. Semi-Permanent houses 4.Ignorance 5. Lack of amenities 6. High disease incidences

7. Inadequate of money 8. Insufficient land 9. Others – Specify..

3.3. According to you, what percentage of the community are poor, …….

3.4. What percentage of the community dependent on maize crop for their livelihood?

…….…….

3.5. What do you think are the causes of poverty in your community?

……

3.6. Can working together by the maize value chain players help reduce poverty?

Yes or No .

Please explain: ……

Objective 4: Strategies to improve the maize value chain

4.1. What are the current maize business strategies? (Tick the main three)

1. Rain fed maize farming 2. Mixed cropping and Farming

3. Traditional Post Harvest Management 4. Little use of recommended fertilizers and seeds 4. Depend on MOA for extension services 5. Others-Specify ……

4.2. What are the major challenges in developing the maize business? (Tick those that apply). 1. Poor Physical Infrastructure 2. Poor Marketing Infrastructure

3.High Poverty amongst the community 4. Poor Implementation of effective Agricultural policies 5. Environmental Degradation 6. Ineffective Policy development 7. Lack of knowledge and skills 8. Others – Specify …

4.3. Can the following help improve the maize value chain development?

(Tick those that apply): 1. Trainings 2.Funds availability 3. Farm Inputs supply 4.Tours 5.Farm Credits 6. Business Credits 7. Food Relief 8. Subsidies 9. Others- Specify ……

Give any comments/ recommendations: ……..

…… End Questionnaire time ……

APPENDIX 9: QUESTION GUIDE FOR FOCUS GROUP DISCUSSION (FGDs)

Target Respondents: FGDs- Maize Value Chain Stakeholders/ Representatives (MVCSH) at Sub County Level

Good morning/afternoon?' My name is ……

I am conducting a study entitled: Maize Value Chain for Food Security and Poverty Reduction in Bungoma County, Kenya. The purpose of the study is to examine maize value chain in Bungoma County with a view of enhancing food security and poverty reduction. The information generated from the study will guide the Bungoma County Government, policy makers and other development planners to make and implement decisions that will enhance food security and poverty reduction in this community.

You are kindly requested to give data that shall be held in confidence and only be used for the purpose of this study. Your cooperation will be highly appreciated.

Thank you.

DATE: ____/____/2016

Start Time: ____

D.1. Demographics

1.1. Name/Composition of the Forum/Group: FGDs.. ……

1.2. Location: County/ Sub County ……

1.3. Gender Distribution:

Membership: …… Males: …… Females: …….

1.4 Age Distribution; 1. 18-35 (….) 2. 36-50 (…..) 3. Above 50 (……)

Objective 1: Level Maize Value Chain Development

1.1. Which is the major crop grown by Bungoma County Farmers? …….

1.2. How is the maize produce/product mostly marketed? ……

1. Contracts 2. Farm gate 3.Market Stores 4.Collection Centres 5. Warehousing 6. Others Specify …….

1.3. What type of value addition is practiced? 1. Sorting 2. Cleaning 3. Grading 4. Processing/Milling 5. Packaging 6. Storage 7. Animal Feeds Production 8. Others - specify……

Agreed Answer/s ……

1.4. What type of product quality requirements are in place?

1. Health/Hygiene 2. Standard Marks 3. Good Agricultural Practices (GAPs) 4. Others -Specify…..… Agreed Answer/s ……

1.5. What Institutions are concerned with standards, regulations or laws that govern your business? ….. Agreed Answer/s ……

1.6. What do you understand by maize Value Chain? ……...……

1.7. Which of the following do you benefit from as maize stakeholders? 1. Information flow 2. Increased profits 3.Reduced business costs 4.Lobbying 5. Improved supply 7.Higher Quality 8.Increased Productivity 9. Others – Specify …

Agreed Answer/s ……

1.8. Can working together by the maize value chain players help improve maize value chain? Yes or No., Please explain: Agreed Answer/s ……

1.9. What problems/challenges face the maize farming and business?

1. Low produce prices 2. High produce losses 3. High production costs 4. Poor roads 5. Poor Marketing Facilities 6.Poor information network 7.Others- Specify….

Agreed Answer/s ……

1.20. Give three main recommendations for enhancing the maize farming and business

Challenges faced	Suggested Intervention

Objective 2: Level of Food Security

2.1. What is the main food in your house holds?

1. Rice 2. Maize 3. Beans 4. Bananas 5. Cassava 6. Others-Specify…

Agreed Answer/s ……

2.2. In what way do you eat/use the crop? ……

2.3. How many meals do your families have in a day?

1. One 2. Two 3. Three 4. None 5. Others-Specify …

Agreed Answer/s ……

2.4 Where do you get your main food from- Market or Farm? ……

2.5. What are the answers to the following?:

Average Maize production -Yield/Acre	
Average Number of HH Members	
Average Acreage per HH	
Maize produce prices (Kshs./bag)	

2.6. What are the major markets in the area?

Agreed Answer/s ……

2.7. Which are your main Food Stores? 1. House Hold 2. Market Stores 3.NCPB

4. Neighbours 5. Millers; Agreed Answer/s ……

2.8. Do any produce go to waste? Agreed Answer/s ……,

Quantity wasted? ……..

2.9. What are the main causes of produce wastage?

Agreed Answer/s ……

2.10. What are the main sources of income in the area?

Agro dealer Business	Maize Farming	Maize Trading	Maize Milling	Employment	Other Crops

Agreed Answer/s ……,

2.10. For how long do farmers keep maize in store for food? 1- Two Month 2-

Three Months 3 – Four Months 4 – Five -Moths 5 – Till Harvesting

2.11. It is April -May – June, do any have any maize for food in Store?

2.12. Can working together by the maize value chain players help improve your food security? Agreed Answer/s ……,

Objective 3: Factors Influencing Poverty Reduction

3.1.How do you define poverty in this community?

Agreed Answer/s ……,

3.2.What are the indicators of House Hold poverty in the community?

Agreed Answer/s ……, ……..

3.3. According to you, what percentage of the community is poor? 1. 40 2.50 3. 55 4. 60 5. Other – Specify … Agreed Answer/s ……,

3.4. What percentage of the community dependents on maize crop for their livelihood?

1. 20 2. 30 3.40 4.50 5.60 6.70 7.80 8. 90 9.Other– Specify

Agreed Answer/s ……, ……..

3.5. What do you think are the causes of poverty in your community?

1. Laziness 2. Ignorance 3. Insecurity 4. Culture 5. Climate 6. Others-Specify... Agreed Answer/s ……,

3.6. Can working together by the maize value chain players help reduce poverty?

Yes or No ….. Agreed Answer/s ……,

Objective 4: Strategies to improve the maize value chain

4.1. What are the current maize farming strategies? 1. Rain fed maize farming 2. Mixed cropping and Farming 3. Traditional Post-Harvest Management 4. Little use of recommended fertilizers and seeds 5. Depend on MOA for extension services

Agreed Answer/s ……, ……

4.2. What climate smart technologies or measures do you recommend to be used in the maize business? Agreed Answer/s ……, ……

4.3. What are the major challenges in developing the maize farming and business?

1. Poor Physical Infrastructure 2. Poor Marketing Infrastructure

3.High Poverty amongst the community 4. Poor Implementation of effective Agricultural policies 5. Environmental Degradation 6. Ineffective Policy development 7. Lack of knowledge and skills

Agreed Answer/s ……,

4.3.Can the following help improve the maize value chain development?

1. Trainings 2.Funds availability 3. Farm Inputs supply 4.Tours 5.Farm Credits 6. Business Credits 7. Food Relief 8. Subsidies

Agreed Answer/s ……,

Give any other comments/ recommendations: ……

End Questionnaire time ……

APPENDIX 10: OBSERVATION CHECKLIST

The researcher and research assistants used the following check list to observe and inquire to establish the following;

Observations	**Comments**
Condition of main houses State of Maize farms Kind of mixed farming Source of water Sanitation facilities available Main source of fuel used Farming system Physical infrastructure Storage facilities used Type and state of markets Distance of Agro-dealer from Farmers	

APPENDIX 11: PROPOSAL APPROVAL LETTER FROM SGS -MMUST

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

Tel: 056-30870
Fax: 056-30153
E-mail: sgs@mmust.ac.ke
Website: www.mmust.ac.ke

P.O Box 190
Kakamega – 50100
Kenya

Office of the Dean (School of Graduate Studies)

Ref: MMU/COR: 509079

Date: 3rd February 2016

Caroline Netia Awori Kamau
CDS/H/06/13
P.O. Box 190-50100
KAKAMEGA

Dear Ms. Kamau

RE: APPROVAL OF PROPOSAL

Following communication from the Departmental Graduate Studies Committee and the Faculty Graduate Studies Committee, I am pleased to inform you that the Board of the School of Graduate Studies meeting held on 22nd January 2016 considered and approved your Doctor of Philosophy proposal entitled: '***Maize Value Chain for Food Security and Approved Poverty Reduction in Bungoma County, Kenya***" and appointed the following as supervisors:

1. Prof. Samuel China - Departmental of Disaster Management & Sustainable Devt - MMUST
2. Dr. H. W. Nyongesa - Departmental of Sugar Technology - MMUST

You are required to submit through your supervisor(s) progress reports every three months to the Dean SGS. Such reports should be copied to the following: Chairman, Centre of Disaster Management and Humanitarian Assistance Graduate Studies Committee and Chairman, Disaster Management and Sustainable Development. Kindly adhere to research ethics consideration in conducting research.

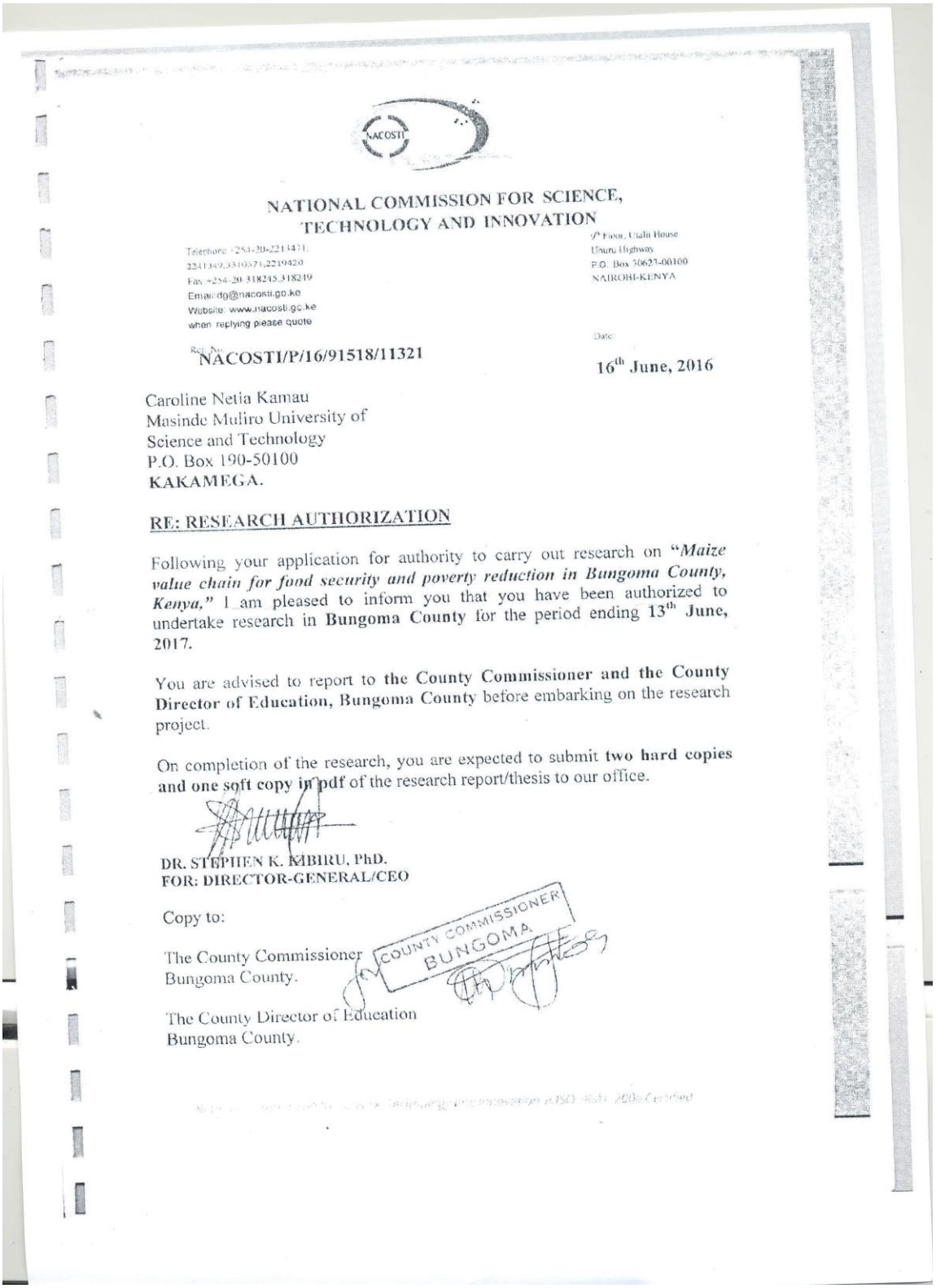
It is the policy and regulations of the University that you observe a deadline of three years from the date of registration to complete your PhD thesis. Do not hesitate to consult this office in case of any problem encountered in the course of your work.

We wish you the best in your research and hope the study will make original contribution to knowledge.

Yours Sincerely,

PROF. HENRY KEMONI
EXECUTIVE DEAN, SCHOOL OF GRADUATE STUDIES

APPENDIX 12: NACOSTI APPROVAL/PERMIT FOR RESEARCH



NATIONAL COMMISSION FOR SCIENCE,
TECHNOLOGY AND INNOVATION

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

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

Ref. No. NACOSTI/P/16/91518/11321

Date: 16th June, 2016

Caroline Netia Kamau
Masinde Muliro University of
Science and Technology
P.O. Box 190-50100
KAKAMEGA.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Maize value chain for food security and poverty reduction in Bungoma County, Kenya,"*** I am pleased to inform you that you have been authorized to undertake research in **Bungoma County** for the period ending **13th June, 2017.**

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

On completion of the research, you are expected to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.

DR. STEPHEN K. KIBIRU, PhD.
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Bungoma County.

COUNTY COMMISSIONER
BUNGOMA

The County Director of Education
Bungoma County.

APPENDIX 13: BUNGOMA COUNTY APPROVAL FOR RESEARCH

REPUBLIC OF KENYA

MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY
State Department of Education – Bungoma County

When Replying please quote
e-mail: bungomacde@gmail.com

Ref No: BCE/DE/19 VOL I/219

County Director of Education
P.O. Box 1620-50200
BUNGOMA
Dates: 8th August, 2016

The Sub – County Directors of Education
BUNGOMA COUNTY

RE: AUTHORITY TO CARRY OUT RESEARCH – CAROLINE NETIA KAMAU – REF. NO- NACOSTI/P/16/91518/11321

The bearer of this letter, Caroline Netia Kamau is a student of Masinde Muliro University of Science and Technology – Kakamega. She has been authorized to carry out research on ***"Maize value chain for food security and poverty reduction in Bungoma County, Kenya,"*** for the period ending **13th June, 2017.**

Kindly accord him the necessary assistance.

CHARLES ANYIKA
COUNTY DIRECTOR OF BUNGOMA
BUNGOMA COUNTY

APPENDIX 14: EVIDENCE OF RESEARCH PUBLICATION

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Type of Manuscript: (Research/ Review): ..... Research .....

Author(s) name(s): ..... CAROLINE NETIA A. KAMAU (MRS.) .....

.....

Corresponding Author's name, address, affiliation and e-mail: .....

..... CAROLINE NETIA A. KAMAU (MRS.)

..... P.O. Box 1417, BUNGOMA ; carolnetia@yahoo.com

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Signature: ..... *Date:* 5/12/2016

APPENDIX 15: RESEARCHER'S IDENTIFICATION