An Analysis of the Effects of Gender and Institutional Support Services on Smallholder Maize Farmers' Commercialization Decisions in Transitional Systems in Western Kenya

A Thesis Submitted in Partial Fulfilment of the Requirements for the Award of the Degree of Master of Science in Agricultural and Applied Economics

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Declaration and Approval

Declaration

This thesis is my original work and has not been presented for an award in any other university.

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This thesis has been submitted with our approval as supervisors.

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Publications

The following papers have been written from this thesis.

Journal paper

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Dedication

I dedicate this thesis to my loving family and friends for the support they have given me throughout this journey.

Acknowledgement

First and foremost, I would like to thank God for giving me good health and focus to undertake my studies.

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Abstract

Smallholder staple cereal farmers in many developing countries are often characterized by low levels of commercialization due to various challenges limiting their ability to effectively access and participate in markets. However, most previous studies on agricultural commercialization have mainly focused on the effects of various socio-economic factors, with limited attention to gender dynamics and critical institutional impediments or enablers. Moreover, over the past decade various transitions have been noted in farming systems. These include: diversified production systems, commercialized agriculture, improved access to support services (such as financial institutions, trainings), and decreased land sizes and women participation in agriculture. However, none of the previous studies has documented the effect of the emerging transitions on commercialization. In order to address the aforementioned knowledge gaps, the present study analysed the role of gender and selected key institutional variables on choice of market channels and extent of commercialization in transitional smallholder maize farms in three contiguous counties of Western Kenya; Bungoma, Kakamega and Trans Nzoia. Primary survey data was collected from 301 randomly selected farm-households. Descriptive statistics, multinomial logit (MNL), Heckman two-step and multiple linear regression models were applied in data analysis.

Results showed that there was a considerable gender gap in access to productive resources and institutional services. Male Headed Households (MHHs) were found to have better access to markets, used relatively more inputs and support services such as extension services, and had higher levels of maize production. Female Headed Households (FHHs) on the other hand, had a higher access to development groups and credit. Results from statistical proportion tests indicate significant differences in wealth, land, amount of maize harvested,

total inputs used (seeds, fertilizers), quantity of maize sold, education level and access to extension services; MHHs had relatively more access than the FHHs.

Transport costs, membership in development groups, access to credit, maize lost due to risk factors, wealth, trust in traders, poor prices, education level, dependence ratio, distance to the market, gender of the household head, access to extension services and number of traders known were found to have a significant effect on the household's choice of market channel and the household's decision to commercialize as well as the level of commercialization. Further analysis demonstrated that different factors affect market participation decisions among FHHs and MHHs differently. Some factors were found to either solely affect MHHs or FHHs. For instance, access to credit and extension services were found to significantly affect commercialization decisions among FHHs while they were insignificant for MHHs. On the other hand, number of traders known by MHHs was found to have a significant effect on their commercialization decision. Number of traders known was insignificant among FHHs. Farmers who experienced transitions were more commercialized as opposed to those who did not. Notably, there are differences as to how institutional support services affect commercialization in transitional and conventional systems. Wealth index, access to credit and amount of maize harvested all had a positive effect on commercialization among farmers experiencing infrastructural and devolution transition whereas, dependence number and number of traders known negatively influenced market participation among these farmers.

These findings call for targeted interventions to increase smallholder farmers' commercialization levels. For instance, there is need to increase the level of access and use of support services. Better access to timely extension services will help improve production methods among smallholder maize farmers. Incorporating information communication technologies such as mobile phones, radio, and television in dissemination of information

will be important in increasing farmers' access to these services. This will help to increase the ratio of farmer access to extension services. Additionally, loan facilities that favour agriculture are necessary to increase smallholder farmers' access to credit services. For example, use of seasonal repayment schedules as well as accepting social capital as collateral for loan access are likely to spur farmers' use of credit facilities in various agricultural value chain activities. Implementation of these strategies will increase timely access to quality inputs to enhance productivity. Additionally, there is need to formulate gender-sensitive policies that aim to increase female farmers' participation in support services and agricultural markets. There is need to encourage commercial re-orientation of the objectives of collective action among FHHs to increase access to support services such as credit, inputs and markets. Lastly, results from transitions indicate it is important to increase farmers' access to all weather roads as well as reduce their distance to market facilities as this will positively contribute to commercialized agriculture.

Key words: Commercialization, gender, transitional systems, Institutional Support, Heckman model.

Table of Contents

List of Figures

List of Tables

List of Acronyms

ASDS	Agricultural Sector Development Strategy (Kenya)
CIMMYT	International Maize and Wheat Improvement Centre
DFID	Department for International Development (United Kingdom)
DTMA	Drought Tolerant Maize for Africa
FAO	Food and Agriculture Organization of the United Nations
FHHs	Female Headed Households
ICTs	Information Communication Technologies
MHHs	Male Headed Households
MNL	Multinomial Logit
NGOs	Non-Governmental Organizations
PCA	Principal Component Analysis
SDGs	Sustainable Development Goals
SSA	Sub-Saharan Africa
VIF	Variance Inflation Factor
SIMLESA	Sustainable Intensification of Maize-Legume Cropping Systems for Food Security in Eastern and Southern Africa

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Improving nutrition and hunger reduction are important targets of the United Nations' sustainable development goals (SDGs). Three quarters of the estimated 1.2 billion poor people in the world live in the rural areas and mainly depend on agriculture, fisheries and forests as their main sources of livelihood (Anriquez and Stamoulis, 2007). Agriculture contributes directly to incomes through increased output and indirectly through low food prices and employment (DFID, 2005). According to Kuhl et al. (2006) growth in the agricultural sector has higher impact on poverty reduction in comparison to non-agricultural sectors.

Like many other countries in sub-Saharan Africa (SSA), Kenya is characterized by high poverty levels and 53% of the total population live below 1.25 USD per day. Growth of the agricultural sector has the impetus to make great contributions to poverty eradication (DFID, 2005). Due to this, pillar number one of the Malabo Declaration of 2014 commits to support agriculture as the main growth initiative to achieve food security and growth in the African continent (African Union Commission, 2014).

Agricultural commercialization is one of the strategies advocated by the Kenyan government to eradicate poverty and improve living standards. In 2008, the government launched a blue print document called the Vision 2030, which emphasized the idea that agricultural sector is vital for economic growth. The Agricultural Sector Development Strategy (ASDS) is another key policy document that emphasizes on commercializing the agricultural sector (Republic of Kenya, 2010). Its main objectives were to improve the management of factors of production

and transform agriculture into a commercial enterprise. Agricultural commercialization refers to a shift from subsistence production to market-oriented value chain activities from use of purchased inputs to generation of profit-motivated goods and services (Goletti, 2005; Sokoni, 2007). Most countries in the SSA have adopted agricultural commercialization as a mechanism for improving livelihoods through increasing labour productivity (Olwande and Mathenge, 2012).

Maize is a major staple food in Kenya accounting for one third of calories consumption (Bor et al., 2011). About 56% of the total land cultivated in Kenya is under maize production. Close to 3.5 million smallholder farmers are involved in producing 75% of the maize output, whereas the rest is grown by large-scale farmers (Kirimi and Swinton, 2004). As noted by Di Falco et al. (2016) maize accounts for 28% of the total gross farm output for smallholder farmers. Maize contributes a greater share of crop income for rural populations. In Kenya, maize is utilized as human food in different forms; consumed as maize meal, green maize and maize grain (Muyanga et al., 2005). Majority of maize producers in Kenya are smallholders and the integration of this sector with the other sectors of the economy gives it an opportunity to positively impact on food security, rural incomes, and poverty reduction (Omiti et al., 2009).

According to Kirimi et al. (2011), maize in Kenya is marketed through six major channels. They include; brokers, wholesalers, posho mills, large scale millers, retailers and National Cereals and Produce Board (NCPB). The choice of market channels depends on numerous factors. For example, Bor et al. (2011) observed that smallholder farmers prefer selling their maize to private buyers because of spot payments.

Commercialization of maize in Kenya is still at 40% despite the significant role it plays for agrarian dependent rural livelihoods (Olwande and Mathenge, 2012). According to Anderson

(2010) low maize commercialization is due to high transaction costs, poor market information and poor infrastructure. Alene et al. (2008) also highlighted these challenges as the major bottlenecks facing SSA producers in market access. Poor market development and missing markets in some cases are also major constraints to smallholder commercialization (Jirström et al., 2010). But, from a nutritional point of view the low commercialization may not necessary be bad if most of the maize is being retained within the households to meet local food demands; particularly for those whose dietary requirements are dominated by cereals such as maize. What might be puzzling however and worth of empirical analysis is the level of use of purchased inputs and trade-offs between maize and other commodities to enhance the diversity of households' consumption bundles assuming rationality of consumption behaviour.

Over the past five decades, SSA has experienced major transitions in land tenure, farming systems and changes in population density. Increase in population causes changes in the ratio of persons to land hence farmers have to adapt their farming mechanisms on their small farms to meet increased demand (Muyanga and Jayne, 2012). Jirström et al. (2010) observed that the average farm sizes in SSA decreased from 2.42 ha in 2002 to 2.16 ha in 2008. They further showed that mean per capita access to land in Kenya declined by 20% over the same period from 0.22ha to 0.18ha. As farm sizes decline, farmers respond by changing from shifting cultivation to annual cropping, decrease in fallow lands and adoption of intensification practices so as to increase production on the diminishing parcels of land. These transitions highlight some of the changes experienced by smallholder farmers in SSA. Smallholder farmers in Kenya have vastly experienced changes in farming practices as well as access to support services. This has been coupled with changes in governance structure from the central to devolved governance structure. A combination of all these transitions is expected to have an influence on both agricultural production and commercialization.

Technology-related measures such as adoption of improved maize seeds and application of both organic and chemical fertilizers have also been put in place to increase maize production and intensification in SSA (Otsuka and Yamano, 2005). Organizations such as International Maize and Wheat Improvement Center (CIMMYT) have spearheaded introduction of high yielding varieties, which are drought tolerant, resistant to pests and have a shorter growth period (Cairns et al., 2012). Macauley (2015) observed that several projects from different development partners have been designed and implemented in SSA to increase farm-level production. For example, the Drought Tolerant Maize for Africa (DTMA) project by CIMMYT facilitated introduction of 160 drought tolerant varieties whose yield is superior compared to the existing varieties under optimum and stressful conditions.

Development corporations and policy makers have emphasized the relevance of agricultural marketing for development, in order to increase output among smallholder farmers, which in turn is expected to increase productivity. Onoja et al. (2012) stated that having a stable domestic market provides a critical path for export market participation. Dnzaku and Saprong (2010) observed that lack of infrastructure and high transaction costs are the major factors hindering agricultural commercialization in SSA.

According to FAO (2011), gender refers to the social roles and identities associated with being male or female. These roles are shaped by religious, ethnic, economic and cultural factors. Women play an important role in agricultural production with regards to food production, distribution and utilization. However, Quisumbing et al. (2015) observed that women are commercially disadvantaged due to differences in access to resources as compared to male farmers. The FAO (2016a) highlighted that only 30% of women involved in agriculture participate in markets. Commercialization is mostly associated with adoption of new technology (Fischer and Qaim, 2012). Gender inequalities in access and utilization of

technology and extension information are always skewed against female farmers, hence limiting their ability to participate in markets.

Despite gender differences in access to productive resources, female producers account for 70-80% of food production. However, there is scanty empirical information on the role and needs of female farmers (Holmen, 2011). Due to this shortfall, Anderson et al. (2016) supports the need to conduct gendered analysis of agricultural value chains so as to understand roles that are male and female specific. Further, there is need to focus on gender and intra-household dynamics while researching on agriculture (Quisumbuing et al., 2014). Participation in agricultural value chains is highly gendered depending on the commodity in question, for instance women exhibit a higher participation in low value staples that are mostly sold in informal markets (Oduol et al., 2013). In reference to food staples and gender, Jirström et al. (2010) observed significant differences in yield between male-managed and female-managed farms with yield in male managed farms being high.

Coles and Mitchell (2009) noted that income distribution along agricultural value chains is in favour of men hence participation of women in these chains may not always be beneficial. According to Cisco and Olunga (2016) Kenyan women accounted for 70% of labour provided but only received 38% of income from the produce. Another study by Rubin et al. (2009) revealed that, although women in SSA are more involved in crop husbandry, they only control a small amount of cash proceeds from these enterprises.

Barret (2007) and Sharma et al. (2012) observed that institutional barriers such as poor access to services and inputs, unavailability of infrastructure and fluctuation of prices and poor linkages to markets are the major causes of poor commercialization among smallholder farmers. Institutional support services refer to activities that support agricultural production and marketing. They include training, access to credit, transport, extension services and a

system of input supply among others. Support services have multiplier effects across different subsectors of the economy. Services meant for producer organizations and agro-enterprises also help stabilize market chains and create employment opportunities in the rural areas. Wobst et al. (2004) showed that access to roads, extension services, production technology and infrastructure (institutional support services) led to higher input demand and increased output.

Since greater shares of the population in developing countries' economies mainly depend on agriculture, participation in agricultural markets in the rural areas can improve the welfare of rural households (Muricho et al., 2015; Hlongwane et al., 2014). Djurfeldt and Wambugu (2011) in their analysis in eight SSA countries including Kenya found that marketing possibilities for maize smallholder farmers have been stagnant and/or declining over time. This limits the potential for smallholder farmers to improve their livelihoods through market participation.

1.2 Statement of the Research Problem

Despite the potential benefits of increased commercialization, there is still low participation by smallholder farmers in both input and output markets (Sigei, 2014; Hlongwane et al., 2014). According to Sharma et al. (2012) poor market linkages thwarts commercialization. The FAO (2016b) shows that institutional support services such as networks (social capital), access to finance, training and information, access to inputs and technology are necessary for increased commercialization.

There is extensive empirical evidence on determinants of agricultural commercialization in Kenya (see for example, Omiti et al., 2009; Muricho et al., 2015; Fisher and Qaim, 2012). However, it is important to note that these studies only incorporated one or two institutional

support services in their analysis. The issue of how gender relates to market participation has also not been addressed in these studies yet they are pre-requisites for market participation.

Further, it has been noted that Kenyan smallholder farmers have experienced transitions in their farming systems and access to agricultural support services in recent decades. Muyanga and Jayne (2012) acknowledged that increasing population density had led to diminishing land sizes through fragmentation. Farmers are then forced to adopt intensification measures so as to maintain production in smaller land sizes. Kenya has also experienced variation in access to support services among smallholder farmers. Nambiro et al. (2006) noted that decentralization from government to public private partnerships of agricultural extension services increased farmers' access to extension service. Research has also shown that access to financial services has increased among smallholder farmers in Kenya. Hong and Hanson (2016) noted that different organizations such as *One Acre Fund* have improved smallholder farmers' access to loans. However, the effect of these transitions on commercialization levels among smallholder farmers has not been empirically analyzed.

The current study sought to fill these gaps by focusing on institutional support determinants such as access to extension services, credit and social capital. In addition to this, this study also engendered its analysis as well as incorporated the effect of farm transitions on commercialization.

1.3 Objectives of the Study

The purpose of this study was to analyse how gender and institutional support services influence participation in markets by transitional smallholder maize farmers.

The specific objectives were to:

i. Characterize farmer demographics, farm transitions and access to institutional services along gender dimensions.
ii. Analyze effects of institutional support services on choice of marketing channels.
iii. Evaluate effects of gender and institutional support services on amount of maize sold.
iv. Analyze effect of infrastructure and devolution transitions on the amount of maize sold.

1.4 Research Hypotheses

i. There is no significant difference in farm transitions, access to institutional support services and marketing patterns between male-headed and female-headed households.
ii. Gender and institutional support services have no significant effect on decision to sell and the choice of marketing channel.
iii. Gender and institutional support services have no significant effect on the total amount of maize sold.
iv. Infrastructure and devolution transitions have no effect on the amount of maize sold among smallholder farmers.

1.5 Justification of the Study

Characterization of smallholder farm transitions, farmers' access to institutional services and marketing along gender dimensions provides insights that will enable both the central and county governments to know what kind of support is needed to boost commercialization among farmers. Information on access to institutional support services by gender will be beneficial to policy makers in making gender sensitive policies. This helps to address the fourth objective of Kenya's national gender policy, which seeks to support public corporations on implementing gender responsive policies (Republic of Kenya, 2011). Information obtained from this analysis will inform SSA countries on the kind of support

services needed to boost commercialization. This is in line with Malabo Declaration pillar number five on commitment to boost intra-African trade in agricultural commodities and services.

Analysis of factors affecting the choice of market channels will provide insights that will enable development corporations to prioritize support for channels that are most preferred by smallholder farmers. Such insights will improve level of market participation among the identified channels, in line with the National Agribusiness Strategy of Kenya chapter four; which prioritizes having markets at the core of production, processing and product development as the stimulus to having a vibrant agricultural sector (Republic of Kenya, 2012).

This study will provide insights for policy makers to be able to make policies on relevant institutional support services that are needed to help boost commercialization across farmers. Similar ideas are echoed in *article 6.2.2.1* of Kenya's Ministry of Agriculture, Livestock and Fisheries strategic plan for 2013-2017; which emphasizes need to develop appropriate policies for the agricultural sector.

Engendered analysis provides information to policy makers in the three Counties to develop gender-relevant policies for agricultural development. For instance, the disaggregated analysis will help Bungoma County in realization of *section 7.71* of its 2013-2017 integrated development plan, where it seeks to create equitable empowerment to all through creation of responsive policies. Furthermore, *section 1.5* of the Kakamega County 2013-2017 integrated development plan prioritizes improving equity in gender related issues so as to increase development and reduce social injustices. *Section 8.8.2* of the Trans-Nzoia County Integrated Development Plan seeks to address marginalization of vulnerable groups such as youth,

women and the elderly. Gender disaggregation of results from this study will provide a basis for achieving this objective in this county.

Results on the effect of infrastructural and devolution transitions on commercialization patterns are beneficial in these counties in terms of priority setting investments meant to improve agricultural commercialization. With reference to infrastructural transitions these results will help in increasing access to improved roads among smallholder farmers, whereas in devolution transitions the results will help in reducing the radius covered by farmers while accessing markets.

1.6 Study Area

This study was carried out in three neighbouring counties in western Kenya; Bungoma, Kakamega and Trans-Nzoia Counties (Figure 1). These counties were selected because of the importance of maize as a crop in each of them. For Kakamega County; the total land acreage under food crop is 114,053 ha and maize is the major food crop grown. The average land ownership is 1.5 acres and 10 acres for smallholders and large scale farmers, respectively. Bungoma County covers an area of 3,032Km^2 and has a population of about 3.5 million. The county for a long time has been referred to as grain basket of Western Kenya. The distribution of land across large and small farms follows the same pattern like Kakamega County. Close to about 70% of area under cultivation is on food crops, accounting for approximately 201,654 ha. Trans-Nzoia County undertakes agriculture as the major economic activity with maize being largely commercialized. Agriculture offers employment to about 80% of the rural population in this county. The total acreage under food cropping is 143,807 ha. The average farm sizes for small and large farms are 1.5 and 31.25 acres, respectively.

Farmers in these study areas are exhibiting transitions in farming systems due to increased population pressure and cultural land inheritance causing land fragmentation. Farmers have now resorted to intensified production methods on the dwindling land sizes to meet food demand. Use of improved varieties, integrated pest management and fertilizer have been adopted by farmers so as to increase production (Pretty et al., 2011). In addition, these counties for a long time have been dependent on agriculture. However, households in these counties are now exploring other avenues for livelihood diversification so as to support agriculture. Diversification into off-farm activities such as labour markets, salaried employment and micro businesses have been explored by farmers in the region over the past decade (Alobo Loison, 2016). Some investment initiatives have also been implemented in the area in terms of agricultural support services (increased access to financial services, infrastructure development). Further, a research project called AFRINT had been conducted in these study areas since the year 2002 to 2016 that studied different livelihood diversification options that farmers in these study areas had. It is important to investigate how agricultural commercialization has fared amidst these changes.

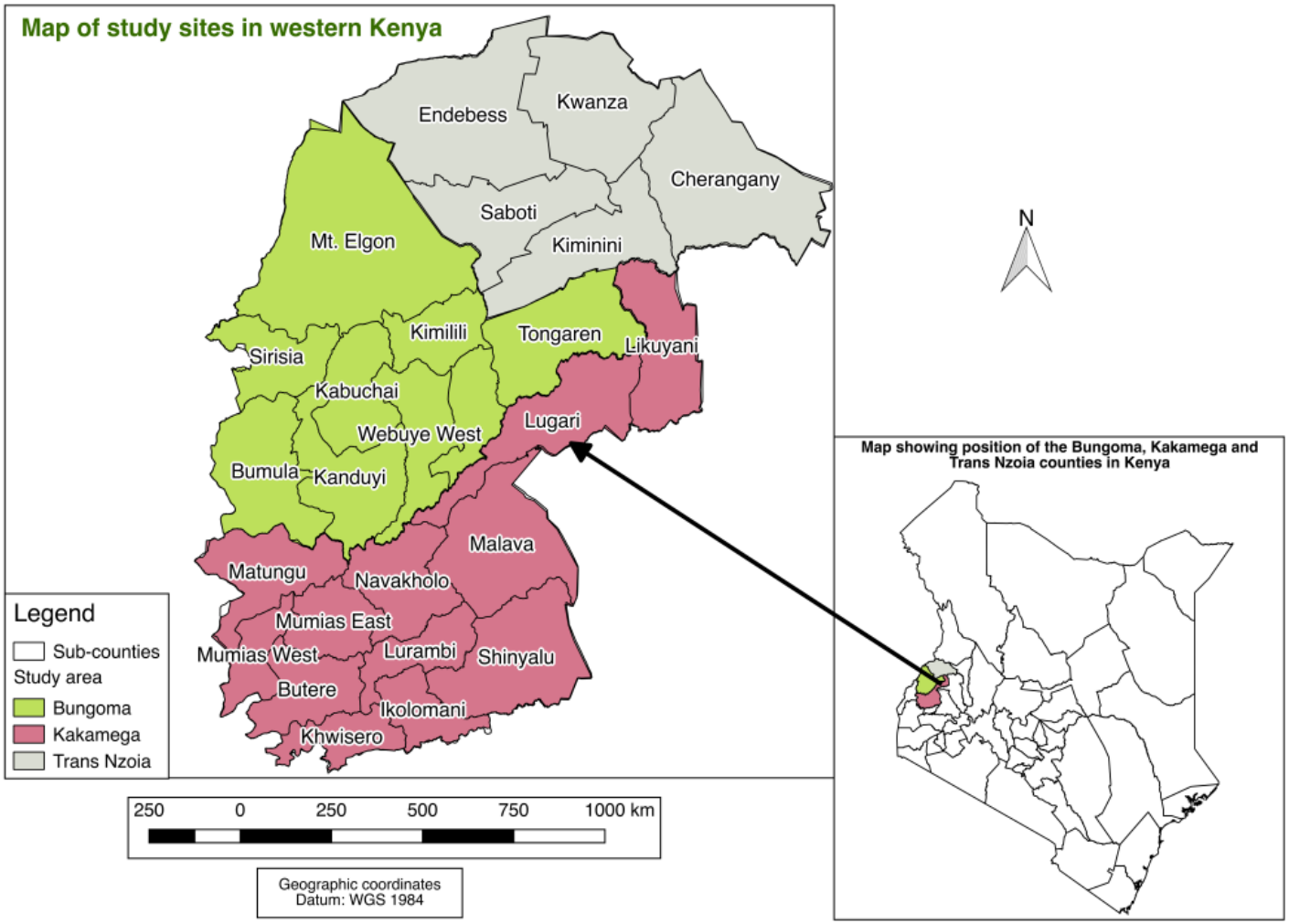

Figure 1: A Map of the Study Sites in Western Kenya

Source: County Integrated Development Plans of 2013 – 2017.

1.7 Organization of the Thesis

Subsequent chapters of this thesis are organized as follows. Chapter two provides a review of the literature. Chapter three discusses theoretical and analytical frameworks. Sampling and data needs are also explained in this chapter. In chapter four results from the analysis are presented. Chapter five offers conclusions and policy implications.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 A Review of Market Participation Concepts and their Relevance to Livelihoods

Market participation encompasses a gradual transformation process from subsistence production to semi-commercial then fully commercial production with a goal of increasing output and earning optimal profits. Pingali and Rosergrant (1995) describe commercialization as a shift from integrated farming systems to more specialized production. Pingali (2001) observes that market participation is more than just selling output. It also means enabling farmers to increasingly base their use of inputs and outputs on the resource scarcity, cost minimization and profit maximization principles. This approach calls for optimal substitution of non-traded inputs with high quality purchased inputs and a shift to specialized production systems (Timmer, 1997). The current study follows Gebremedhin and Jaleta (2010) definition of market participation as the proportion of output sold. Agricultural commercialization is exhibited on both input and output sides. On the input side, households are more considered to be commercialized if they significantly use more of high quality purchased inputs. From the output side; a household that participates in the market increases its marketed produce.

According to Arias et al. (2013), increasing agricultural productivity and improving smallholder farmers' ability to cope with risks are key measures in response to price volatility. However, increasing agricultural productivity in sectors with poor market linkages will have limited success. Similar observations have been noted in sectors with strong market linkages but low agricultural productivity. Smallholder farmers' integration into markets and creating inclusive value chains has the potential of increasing food security and poverty eradication (Barrett, 2007). Commercialization provides avenues for households to generate

income that increases disposable income for purchasing food and improved livelihood. Ramoroka (2012) observed that participation in agricultural markets leads to economic development. Households participating in markets are able to enjoy gains from trade due to their ability to specialize in production in areas where they have comparative advantage (Rios et al., 2009). Moreover, shifting from subsistence production to a market-oriented production positively contributes to improved welfare for smallholder farmers.

Seth (2009) showed that commercialization had a positive effect on food security. He observed that a 1% increase in the rate of commercialization increased the household food security level by 0.27%. He further illustrated that this relationship could be attributed to large revenues derived from market participation and reinvested into production through input purchases. Another study by Tirkaso (2013) also confirmed that improved market participation contributes to food security through improved incomes. Access to food depends on the amount of disposable income available to the household more so among smallholder farmers.

Sharma et al. (2012) noted that market participation has the potential to contribute to poverty eradication. This is in agreement with the observations by Mitiku (2014) that market participation has the ability to improve incomes and living standards of smallholder farmers on condition that bottlenecks to commercialization are eliminated. Transformation of the agricultural sector to commercialized production from subsistence can effectively contribute to food security and poverty eradication. According to Wickramasignhe and Weinberger (2013) market participation for agrarian economies does not only lead to development systems dependent on the market but also encourages efficiency in utilization of resources. Omiti et al. (2009) noted that for smallholder farmers to have better incomes and stable livelihoods there is need to build their capacity to produce marketable surplus.

2.2 Gender Disparities in Access to Agricultural Resources and Benefit-Sharing

Gender equity is one of the priority areas identified in the Sustainable Development Goals (SDGs). Meinzen-Dick et al. (2011) observed that if gender is not taken into account in agricultural extension, research and development systems, it will be hard to increase production so as to meet demands of the future generations. Gender equity in agriculture is a development issue that will benefit men, women and society at large. Gender differences are important factors for agricultural production where management and ownership rights are defined by culture.

Holmén (2011) identifies the role of women in SSA as a key policy issue to be addressed. Women play an important role in agriculture but more often they are under-recognized and more constrained than men. The FAO (2011) estimated that close to 60-80% of food in developing countries is produced by women. In addition to supporting the key pillars of food security (food availability, food access, food utilization and stability), women also participate in community-level activities such as crop cultivation, afforestation and conservation of soil and water that foster agricultural development (Habtezion, 2012).

Despite the important role played by women in agricultural development in SSA, gender inequities predominantly affect female farmers. Meinzen-Dick et al. (2011) pointed out certain disparities between male and female producers in developing countries, including technological resources, human capital, land, extension services and productive resources. Disparities that limit women access to productive resources make them more vulnerable to food insecurity (World Bank, 2011). In addition, women also lack the capacity to use and/or obtain resources. For example, in some areas women may have access to land but lack the capacity to use fertilizer in production. Marginalization of women relative to men is also extended in terms of intangible assets such as human capital, human rights, social capital and

decision making power. Koirala et al. (2015) observed that although women are instrumental in agriculture, control of productive resources and key decision making in agriculture is dominated by men.

Land is the most important asset base for agrarian-dependent households. Despite the high dependence by women on agriculture as an economic activity, literature shows that women are disadvantaged in both access to and use of land (Marenya et al., 2015). In Ghana, Deere and Doss (2006) observed that land ownership by females was 10% compared to about 16% to 23% for their male counterparts. Allendorf (2007) noted that strengthening land ownership by women leads to better livelihood outcomes.

Women are less advanced in access to labour and extension services (Meinzen-Dick, 2011). Specifically, women often face more constrains in accessing hired labour, which results to low agricultural productivity. Due to the household responsibilities faced by female farmers it makes them to be less productive as their male counterparts; this productivity gap ranges from 4 to 40% (Larson et al., 2015). These disparities among male-headed and female headed households majorly discriminate against women, leading to low levels of input use, low rates of production and commercialization (Gatzweiler and Von Braun, 2016).

FAO (2011) showed that there was a significant difference in education whereby female household heads were found to be less educated than their male counterparts. Marenya et al. (2015) found that FHHs were more disadvantaged in their access to extension services relative to MHHs. Although access to extension services was low in both MHHs and FHHs, utilization of this information by FHHs was low compared to their male counterparts (Meinzen-Dick et al. 2011).

A meta-analysis of different studies on gender differences between male and female farmers by Quisumbing et al. (2015) showed that if gender disparity was taken into consideration women will be equally efficient farmers as men. Okali (2011) concluded that women were lagging behind in agricultural production because they were using primitive production techniques.

Meinzen-Dick et al. (2011) reported an inverse relationship between agricultural productivity and gender disparity. Reducing gender gap not only empowers women but also contributes to agricultural development and improves food and nutrition security. Gender equity can contribute to a rise in productivity by up to 30% and the number of people who are malnourished could be decreased by approximately 17% (Habtezion, 2012). Further, Quisumbing et al. (2014) demonstrated that achieving gender equity has the potential of improving household welfare. Gender equity contributes to social, environmental and economic sustainability (Warnecke, 2015; Akram-Lodhi, 2017). It is important to address issues of gender inequities at different levels of economic development.

Women are predominantly disadvantaged in terms of commercialization due to differences in access to resources. Since commercialization is mostly associated with technology, disparity in access and use of this component reduces women participation in the market (Fischer and Qaim, 2012). Agricultural innovations play a significant role in increasing agricultural productivity which inspires the shift from subsistence to commercially oriented agriculture (Awotide et al., 2016). Further, they noted that agricultural commercialization was positively associated with gender disparity. This is because more than often cash crops are controlled by men. Originally cash crops such as coffee were regarded as men's crops whereas subsistence crops were referred to as women's crops (FAO, 2011). This gendered division of crops is obtained from the fact that women are more responsible for food security of the household

thus, more oriented towards subsistence crops, men on the other hand are responsible for income generation hence they focus on cash crops. Ali et al. (2015) suggested that programs aimed at increasing female farmers' participation in cash crop production should also ensure they have adequate access to output markets so as to have successful transformation from subsistence to market-based production.

According to the World Bank (2009), women are highly concentrated in rural and less developed markets due to limited access to productive resources. As already highlighted, access to technology significantly contributes to commercialized agriculture. However, the gendered nature of access to and use of agricultural technologies may further deteriorate the ability of women to participate in markets.

Access to markets by female farmers may be limited by both economic and cultural factors. Women have a higher opportunity cost for marketing time in relation to other household responsibilities which limits their ability to participate in markets. Djurfeldt et al. (2013) showed that commercialization of grains among smallholder farmers is biased along gender dimension with increased commercialization skewed towards male farmers.

2.3. Institutional Support Services and Commercialization

Institutional support services refer to organizational facilities and inputs that greatly contribute to agricultural production. According to Oluoch-Kosura (2010) institutional support services are crucial in integrating smallholder farmers into the economy. Wobst et al. (2004) identified roads, irrigation system, research, extension, financial services and technology as some of the institutional support services needed to actualize growth of the agricultural sector.

Agricultural productivity can be increased if poor farmers have access to productive inputs, improved varieties and irrigation system. They must also have easy access to research and extension services so as to effectively use adopted technology (Seth, 2009). As highlighted by Aheibwe (2013) empowerment of the rural poor households is necessary but not sufficient to contribute to rural development. Improving efficiency and effectiveness along the agricultural value chain through these support services enhances benefits and food security (Asian Development Bank, 2012). The World Bank (2007) noted that smallholder farmers' access to institutional support services especially for agriculture is still limited.

Institutional support services play a fundamental role in transforming agriculture from subsistence to commercial orientation; by increasing access to, extension services, credit, infrastructure and irrigation facilities (Asian Development Bank, 2012; Hagos and Geta, 2016). Public and private partnerships are key for ensuring access to institutional support services (Jayne et al., 2011). The SSA countries need to clearly and consistently implement strategies that are meant to reduce poverty and increase agricultural growth and productivity which in turn incentivizes investments from the private sector. These investments, especially those aligned to support services greatly contribute to having functional input and output markets.

Poor infrastructure and poor market linkages are some of the challenges faced by smallholder farmers in their bid to participate in markets (Sharma et al., 2012). Efficient government policies have the potential of ensuring smooth transition from subsistence to market oriented agriculture. Policies that SSA need to prioritize so as to increase agricultural commercialization include policies on; transport and communication infrastructure; secured property rights and access to other support services such as financial services (Gebremedhin et al., 2009). The FAO (2010) identifies institutional support services as requisites for market

access and participation. The Asian Productivity Organization (2004) observed that reforms are needed for support services offered by the government to encourage smallholder farmers to participate in markets in Asian and Pacific countries. Like some Asian countries, Kenya is also a developing economy thus these reforms could also positively influence market access. These reforms include; equitable access to irrigation water, restructuring of extension services and ensure efficient credit delivery mechanisms.

2.4 A Review of Knowledge Gaps on Market Participation

Different studies have analyzed market participation decisions among smallholder farmers in different agricultural value chains (Omiti et al. 2009; Achandi and Mujawamariya, 2016; Osmani and Hossain, 2015 and Sebatta et al. 2014). It is worth noting that all these studies used a combination of socio-economic characteristics (age, gender, income level, and ownership of transport equipment), market specific factors such as; distance to the market, output prices and access to market information and farm specific factors (land size, location of the land and land tenure systems) in their analysis. Further, some of the studies consider agricultural commercialization as one stage of only making the decision to commercialize, thus their analysis only focusses on the determinants of the decision on whether or not the households participate in the market. Moreover, those studies that incorporated both stages of commercialization (decision to participate and amount of output sold) do not take into account engendering their analysis as well as results and discussions.

Contrary to the previous studies that generally focus on socio-economic, market and farm specific factors, the current study sought to exclusively explore the effects of gender and institutional support services on market participation on a gendered approach.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Conceptual Framework

Market participation by smallholder farmers is determined by access to institutional support services as shown in Figure 2. These services have an influence on farmers' decision and degree of commercialization.

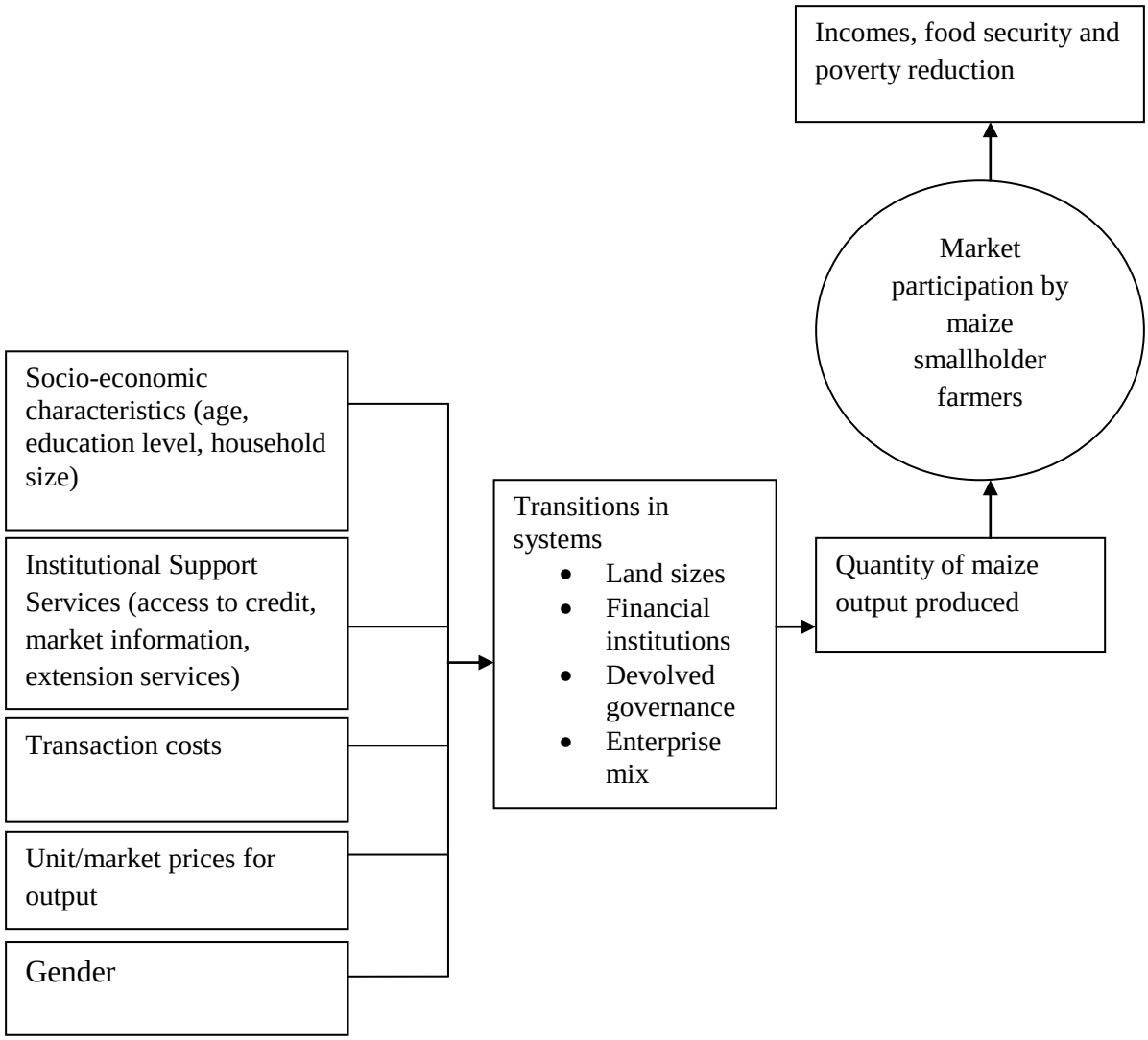

Figure 2: Illustration of the Conceptual Framework

Source: Adapted from Gebremedhin and Jaleta (2010).

Access to institutional support services increases level of market participation by farmers. This leads to increased incomes, food security and poverty eradication. Farmers who have access to extension services get information regarding improved high yielding varieties, access to market information and training on how to mitigate risk factors associated with production. Increased productivity increases marketable surplus. Access to credit increases a household's ability to participate in both input and output markets. Maize farmers who have access to credit have a higher access to productive resources which increases production.

Factors such as size of the household, prices, transaction costs and gender determines the decision of whether or not to participate in markets for maize smallholder farmers. For instance; size of the household determines how much of maize that has been produced will be used for subsistence and what proportion will be commercialized. A large household negatively contributes to commercialization by increasing demand for domestic consumption hence reducing the marketable surplus available for the household, leading to low incomes, which leads to lack of access to factors of production. This leads to low productivity, which leaves the household with lack of maize surplus to be marketed.

Gender is also expected to affect commercialization decisions among households. MHHs are expected to be more market oriented as opposed to FHHs. Access to productive resources is biased along gender dimensions with women being disadvantaged thus MHHs which have higher access to these resources are expected to be more commercialized as opposed to their female counterparts.

It is also important to consider different transitions occurring in the study sites that determine how gender and institutional support services affect commercialization. Changes in land sizes, enterprise mix, governance, population sizes and access to support services (credit, extension) are some of the transitions that have been experienced by smallholder farmers in

the study sites in recent years. It is important to empirically understand and document how these transitions affect commercialization.

3.2 Theoretical Framework

An ideal farming household in Kenya produces output that can be used either for subsistence and/or commercial purposes. A household that participates in production uses both inputs produced on the farm and those purchased from the market. Every household is faced with a problem of optimization with regards to participating in both input and output markets. Separable and non-separable models have been used to model household's optimization problems. However, due to the dominance of market failures in developing countries, non-separable household models, which maximize utility as the objective function are extensively used (Mather et al., 2011).

The study used an agricultural household model following Key et al. (2000) and Azam (2012). A household is assumed to produce a range of outputs that can be consumed and/or marketed. Households use inputs (purchased and/or owned), thus it is faced with a utility maximization problem. A rational household is assumed to maximize utility by choosing goods at a certain level to; produce (O_i), consume (C_i), buy (N_i), sell (S_i) and use as inputs (X_i). The household is then expected to maximize utility subject to a number of constraints (income, production technology and resources). Assuming that we have perfect markets (zero transaction costs) the household is thus faced with the following constrained optimization problem as a market participant (Azam et al., 2012):

$$\max u\left(C_i, Z^c\right) \quad \text{.....(1)}$$

Subject to

$$\left.\begin{array}{ll} \sum_{i=1}^{j} p_i^m s_i + B \geq \sum_{i=1}^{j} p_i^m N_i & \text{Income constraint} \\ O_i + E_i + N_i \geq X_i + C_i + S_i & \text{Resource Constraint} \\ G(O, X, Z_q) = 0 & \text{Production Technology Constraint} \\ C_i, O_i, X_i, N_i, S_i \geq 0 & \text{Non-negativity constraints} \end{array}\right\} \quad \text{.....(2)}$$

Where:

P_i^m is the market price, E_i is the household endowment in a good, B represents exogenous income, Z^c and Z_q respectively illustrate household and technology attributes.

The constraints represented by Equation 2 states that total revenue and total transfers should be greater than or equal to expenditures. Quantities of a good that are consumed, used as an input and/or sold should not exceed total output produced, household endowment in the good and amount of goods purchased. Technology employed in production and it is an illustration of the relationship between inputs and outputs.

The perfect market assumption however does not hold in the real world. More than often, developing countries are engulfed with market failure. So as to confer with the real world scenario in modelling a utility maximization problem of a market participant there is need to include proportional and fixed transaction costs. Fixed transaction costs (T_i^{fs}) refers to costs incurred by households participating in the market irrespective of the total amount of marketed goods. Whereas (T_i^{ps}) proportional transaction costs are costs incurred depending on the amount of goods that are commercialized. Economic agents who buy goods from the market are also faced with transaction costs, in this case fixed transaction costs are

represented by (T_i^{fn}) whereas (T_i^{pn}) shows proportional transaction costs for the same group. Including transaction costs in the cash constraints equation transforms it into:

$$\sum_{i=1}^{j}\left[\left(P_i^m - \delta_i T_i^{ps}\right)S_i - \delta_i T_i^{fs}\right] \geq \sum_{i=1}^{j}\left[N_i\left(P_i^m + \Psi_i T_i^{pn}\right) + \Psi_i T_i^{fn}\right] \quad \text{.....(3)}$$

From Equation 3, if a household sells in the market then δ_i = 1 and 0 if otherwise. Consequently Ψ_i = 1 if the household participates in the market as a buyer and 0 if otherwise. Including transaction costs for sellers in the market reduces the market price by both proportional and fixed transaction costs. For those participating in the market as buyers, transaction costs have an inverse relationship in that they increase the market price faced by a household.

A langragian function can be derived from the optimization problem and solution of the first order conditions yields the following equation for output and input market participants (Goetz, 1992).

$$L = U(C_i, Z^c) + \lambda_1\left\{\sum_{i=1}^{J}\left[S_i\left(P_i^m - \delta_i T_i^{ps}\right) - \delta_i T_i^{fs}\right] + B - \sum_{i=1}^{j}\left[N_i\left(P_i^m + \Psi_i T_i^{pn}\right) + \Psi_i T_i^{fn}\right]\right\} +$$

$$\sum_{i=1}^{J}\lambda_2\left(O_i + E_i + N_i - X_i - C_i - S_i\right) + \lambda_3 G\left(O, X, Z_q\right) \quad \text{.....(4)}$$

λ_1, λ_2 and λ_3 are Langrange multipliers for income constraint, resource balance and technology constraints, respectively.

Following Muricho (2015), the decision on whether or not a household participates in the market and the degree of commercialization can be modelled as follows:

$$O_{si} = O\left(T_i^{fs}, T_i^{ps}, P_i^{m}, Z_q, Z^{c}, E_i, B \right) \quad \text{.....(5)}$$

$$O_s = O\left(P_i^{m} - T_i^{ps}, Z_q \right) \quad \text{.....(6)}$$

Equation 5 shows the household's decision to participate or not in the market, while Equation 6 shows the household degree of commercialization.

3.3 Sampling Procedure

A three multi-stage sampling procedure was used to identify the respective counties and farmers to be interviewed (Kuno, 1976). In the first stage, Bungoma, Kakamega and Trans-Nzoia Counties were purposively selected due to high volumes of maize production. In the second stage, Bungoma Central, Kiminini and Lugari sub-counties were selected respectively from the 3 counties. These three sub counties were purposively selected due to their proximity to large markets. In the third stage, respective wards were visited in the sub-counties with the help of Sub-county Agricultural office. Respondents were selected using systematic random sampling to avoid biased responses.

The sample size for this study was determined using the Cochran (1963) formula. This formula is specified below:

$$n = \frac{Z^2 pq}{e^2} \quad \text{..... (7)}$$

Where n is the sample size, Z is the desired confidence level, e is the desired level of precision, p show maximum variance and q is 1 – p. The study used a confidence level of 95% and a 5% level of precision. P was assumed to take the value of 0.5 since variation level among maize smallholder farmers was unknown. The sample size was calculated as follows:

$$n = \frac{(1.96)^2(0.5)(0.5)}{(0.05)^2}$$

$$= 385$$

Due to budget limitation this number was reduced and a total of 301 respondents were interviewed. This sample size is identical to previous market participation studies that used samples slightly below or above 300 respondents (for instance, Gebremedhin and Jaleta, 2012; Reyes et al., 2012; Sebatta et al., 2014. Based on the varying population distribution in the 3 counties, the respective samples were proportionately drawn from contiguous sub-counties at the borders, but bearing diverse farm transitions of interest. A total of 301 respondents were randomly sampled and interviewed: 40% from Trans-nzoia County, 33% from Kakamega County and the rest from Bungoma County. The sample sizes were allocated proportionate to population sizes of the respective counties (KNBS, 2009).

3.4 Data Needs and Data Collection Methods

The study is based on primary survey data. The study used one of the counties (Bungoma) that was initially interviewed by CIMMYT and incorporated two other counties (Kakamega and Trans – Nzoia) in Western Kenya. These counties were incorporated due to the economic importance of maize to livelihoods in these counties. Further this study, focused on commercialization and gender issues that were initially omitted in the Sustainable Intensification of Maize-Legume Cropping Systems for Food Security in Eastern and Southern Africa (SIMLESA) project by CIMMYT. A Focus Group Discussion (FGD) was held in Bungoma County so as to obtain meaningful insights from different stakeholders regarding changing land sizes, nutrition patterns, consumer demand patterns, maize production, use and commercialization, historical trends (emerging changes, drivers of those changes and implications) on farm transitions and emerging effects and outcomes, changing

gender roles and implications to resource use and livelihoods at community level. Participants of this focus group included, 13 farmers (7 male and 6 female), 1 county agricultural extension officer, 2 heads of farmer groups and 1 maize traders. The reason for having participants from different backgrounds was to holistically discuss issues related to maize production and marketing. The insights from the FGD were used to improve the survey questionnaire design. It helped in including questions that were initially ignored and also broadening range of alternatives for closed questions. FGD was important for obtaining respondents' experiences about the issue in question. As noted by Freitas et al. (1998) the insights from the FGD helped to inform results obtained from the study and comprehensively understand the issues so as to effectively inform policy.

Semi-structured questionnaires were used to collect data on household characteristics, institutional support services, asset ownership, farming transitions and marketing information. Further, as recommended by Minhat (2015) face-to-face interviews were conducted to allow for validation of answers by enumerators. Out of the total 301 questionnaires, 297 were used for analysis, while 4 questionnaires were dropped due to incomplete data.

3.5 Empirical Data Analysis

3.5.1 Gendered Characterization of Smallholder Farm Transitions, Farmers' Access to Institutional Services and Maize Marketing

The first objective was achieved through descriptive analysis so as to obtain means and frequencies on land sizes, total amount of maize produced and sold, access to support services, farm transitions over the past decade and distribution of plot decisions within the household. These statistics were presented in tables, charts and graphs.

3.5.2 Analysis of Effects of Gender and Institutional Support Services on Choice of Marketing Channels

The MNL model was used to analyze the relationship between gender, institutional support services and choice of market channel. In line with Wooldridge (2002) the choice of MNL model was motivated by the nature of the dependent variable, which was unordered and had more than two possible outcomes; farm gate, institutional markets, brokers/middlemen and open-air market were the outcomes that were analysed in this study.

Let Y_i represent the choice of market channel by a household, conditional on a set of explanatory variables (gender and institutional support services) X_i. The MNL model for choosing a market channel was specified as follows (Wooldridge, 2002; Green, 2003):

$$p(y = j / X) = \frac{\exp\left(X\beta_j\right)}{1 + \sum_{h=1}^{j} \exp\left(X\beta_h\right)}, \quad j = 0,1,2,3 \quad \text{.....8}$$

Where β_j is the vector of coefficient of explanatory variables X, the base outcome vector coefficient is represented by β_h, j represents the unordered alternatives and y shows the choices.

In this study, market channels in which farmers are expected to commercialize their maize are four; farm gate, broker, open air market and institutional markets. The base outcome for this study was open-air market.

The log of odds-ratios of selecting each alternative from the equation above can be calculated as:

$$In\left[\frac{p_{ij}}{p_{ik}}\right] = X_i^{'}\left(\beta_j - \beta_k\right) = X_i^{'}\beta_j \quad if\ k = 0 \text{ .....9}$$

From equation 8, although it is tempting to interpret the coefficient β_j with the jth outcome, this will be misleading, because sometimes the coefficients will have a different sign from the marginal effects. It is appropriate to obtain marginal effects of each exogenous variable dependent on the probability that a choice is made (Green, 2003). The marginal effects for each explanatory variable were calculated as:

$$\frac{\partial p_j}{\partial X_i} = p_j\left[\beta_j - \sum_{k=0}^{j} P_k\beta_k\right] = p_j\left[\beta_j - \bar{\beta}\right] \text{ .....10}$$

3.5.3 Evaluation of Effects of Gender and Institutional Support Services on Amount of Maize Sold

The Tobit, triple and double hurdle and two-step Heckman models are mostly used in analysis of factors and extent of market participation. The Tobit model is used to show the relationship between a dependent variable that is either censored or truncated and a set of independent variables. According to Wooldridge (2010), the Tobit model is limited in that it assumes the independent variables have the same effect on both decision and intensity of market participation. Another drawback of this model is that it treats non-market participants as if they purposively chose not to participate even though lack of access to markets could be a potential reason for their non-commercialization.

This study applied a two-step Heckman model because of its ability to relax the assumption of the Tobit model by allowing a vector of explanatory variables to differently determine the decision and level of market participation (Green, 2011; Wooldridge, 2002). The two-step

Heckman model assumes that independent variables might differently affect the decision and level of market participation.

Following Vance and Buchheim (2005) the two-step Heckman model was specified as follows. The first step is referred to as the selection equation, which defines a binary choice indication where the household falls. It involves using a probit model to determine the likelihood that a household participated in the market. Let $C_{imaize}=1$ represent a household that sold maize whereas $C_{imaize}=0$ is otherwise. This first step is specified as follows:

$$C^{*}_{imaize}=\beta X_i+U_i \quad \ldots\ldots 11$$

$$C_{imaize}=1 \text{ if } C^{*}_{imaize}>0 \text{ and } C_{imaize}=0 \text{ if } C^{*}_{imaize}\leq 0 \quad \ldots\ldots 12$$

Where C^{*}_{imaize} is a latent variable showing household satisfaction from commercialization. C_{imaize} is an indicator for market participation which takes the value of one for a household that sold maize, X_i defines the characteristics of the household, β is the parameter coefficients to be estimated and U_i is the error term with normal distribution.

The second step involves estimating an Ordinary Least Square (OLS) regression of the amount of maize sold conditional on $C_{imaize} = 1$ against independent variables as shown below:

$$Y_i=X_i\beta+\varepsilon_i \quad \ldots\ldots 13$$

Where Y_i is the total amount of maize sold in Kilograms, X_i is a vector of explanatory variables that determines intensity of participation, β is a vector of coefficients and ε_i is the

error term. Due to correlation of the error terms between OLS and probit regression biased estimates are generated during estimation in the second step withcorr (u,ε). An Inverse Mills Ratio (IMR) that is calculated from the probit model is introduced to the regression model so as to correct for this bias. The mills ratio is included as an independent variable and the regression model extends to:

$$E\left(y_i / C_{imaize} = 1, x_i\right) = \beta' x_i + \rho\sigma_\varepsilon\lambda_i \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 14$$

Where x_i shows a vector of independent variables used to calculate the level of market participation after bias correction, β' is a vector of parameter coefficients to be estimated, σ_ε and σ_u represent random error terms of the outcome and selection equations respectively. λ_i shows the IMR.

3.6 Description of Variables and their Expected Signs

Gender of the household head was expected to determine the household decision to participate in the market. This study expected MHHs to be more market oriented as compared to FHHs. This is because MHHs may have access to capital and information which greatly contributes to commercialization. Omiti et al. (2009) found same results in their analysis of market intensity for kale producers in Kenya. Gender of the household head was measured as a dummy variable.

Table 1: Measurement Units and Expected Signs for Independent Variables

Variable	Description	Unit of Measurement	Expected sign
Gender	Gender of the household head	Dummy (1= MHH, 0 = FHH)	+
Level of education	Number of years in formal education	Years	+
Household size	Number of people dependent on the household for food	Number	+/-
Asset index	Proxy for wealth level	An index	+
Access to extension services	Household access to extension services	Dummy (1= Yes 0 = No)	+
Group membership	Membership to farmer group	Dummy (1= Yes 0 = No)	+
Access to information	Household's access to market information	Dummy (1= Yes 0 = No)	+
Access to credit	Household access to credit services	Dummy (1= Yes 0 = No)	+
Poor prices	Failed to sell maize due to low prices than expected	Dummy (1= Yes 0 = No)	-
Distance to the market	Average distance to the market	Kilometres	_
Quantity of output	Average kilograms of maize harvested	Kilograms	+

Education level of the household head was captured as number of years a respondent spent in formal schooling. Household heads with a higher level of education are expected to be well informed about marketing channels and output prices as compared to those with a lower education level. Muricho et al. (2015) in their study found that education positively influences a household's decision of whether or not to participate in the market. This study hypothesized education level of the household head to positively influence amount of maize

sold. This is because educated household heads' may be knowledgeable about high yielding varieties and better management practices hence increasing marketable surplus.

The effect of household size on market participation is indeterminate. The size the household was determined by the number of people who depend on that household for food. It can either have a positive or inverse relationship. Large household sizes are expected to provide cheap labour for the household which increases the amount of marketable surplus. Further, large household sizes mean a higher dependency ration on the household for food consumption. This reduces the amount of output to be commercialized. Muricho (2015) found that size of the household has an inverse relationship with market participation. The size of the household was measured as a continuous variable to mean the number of people who are dependent on the household.

Ownership of assets was captured as a continuous variable to show if the household owns or does not own an asset. An index for wealth was derived from the assets owned by a household. Asset ownership expected to influence market participation by this study included; radio, land, storage facility and transport equipment. Alene et al. (2008) while studying smallholder market participation under transaction costs in Kenya found that ownership of transport equipment positively influences market participation. The study hypothesized similar results in that access to these assets increases household's orientation to the market. Another study by Barrett (2007) emphasizes the significance of capital assets on commercialization. Wealthy households with high asset endowment are more commercialized compared to household with fewer assets. This index was developed through Principal Component Analysis (PCA) in *STATA software*. Respondent were asked to give the current value of their assets, which was then weighted to generate an index that captured the wealth status of the household.

Access to extension services was captured by the number of times a household was visited by an extension officer over the last 12 months. Farmers with high visitation rates are expected to be informed of the new maize varieties and better production methods that positively contribute to market participation. Muricho (2015) found that farmers' access to extension services positively influenced household intensity of market participation. It was hypothesized that households with higher access to extension services will have higher market participation.

Membership in farmer groups increases the rate of commercialization among smallholder farmers (Fischer and Qaim, 2012). Access to social capital through farmer groups increases bargaining power for better output prices and access to inputs. This variable was measured as a dummy variable if a household belonged to any farmer group. A positive relationship between group membership and market participation was expected.

Access to information on prices and available markets before sale increases the amount of output sold by a household. This helps to inform a farmer's decision on when to sell the commodity and in which market. Komarek (2010) found that access to output prices positively determined market participation among banana smallholder farmers. A dummy variable was used to capture whether a household has access to market information or not. It was hypothesized that farmers with a higher access to market information will have high rates of market participation.

Access to credit by households was expected to increase their market orientation at both commercialization decisions and levels. It was captured as a dummy variable to indicate if the household had access to loans within the last 36 months. Access to credit enables households to purchase improved inputs and assets that are important for commercialization. Olwande and Mathenge (2012) found that households with higher credit access also had a

higher likelihood for commercialization. Hong and Hangson (2016) observes provision of credit among smallholder farmers has the potential to improve their incomes and productivity. Further, access to credit ensures farmers are able to purchase quality inputs at the right time, increasing their efficiency in production.

Market factors such as price of the output, quantity of the output and distance to the market were expected to significantly influence the household's decision to commercialize their produce. A study by Hagos and Geta (2016) found out that farmers who face relatively high output prices had an increased level of market participation. Hlongwane et al. (2014) in their study articulate that farmers who are connected to the market by good quality roads exhibit high degree of commercialization. Distance to the market inversely contributed to the household's decision to participate in the market for households located far away from the market (Achandi and Mujawamariya, 2016). Output price was measured in Kenyan shillings per kilogram of maize, distance to the market was a continuous variable captured in kilometres and transport costs was captured in Kenyan shillings for the distance the commodity is transported. Quantity of output produced was measured in kilograms, it was expected that higher quantities will increase commercialization levels. Martey et al. (2012) also found similar results on cassava farmers.

3.7 Model Diagnostics

3.7.1 Multicollinearity

Variance Inflation Factors (VIF) for the variables included in the MNL model were first calculated to check for multicollinearity in the data. According to Gujarati (2004) any variable with a VIF greater than 10 demonstrates presence of Multicollinearity. Results for

this test showed that there was no multicollinearity since no variable had a VIF greater than or equal to 10, the mean VIF was equal to 1.29 (Appendix 1).

3.7.2 Heteroscedasticity

Following Wooldrige (2010), Breusch-Pagan test was used to determine if the variance across the error terms were constant. The output below shows the result from this test, which was insignificant. The null hypothesis was rejected, meaning there was constant variance across the error terms in the MNL model.

chi2 (1) =1.48 at Prob > chi2 = 0.2245.

3.7.3 Test for Independence of Irrelevant Alternatives (IIA)

The Hausman test for IIA was applied to validate this assumption. Results showed that the condition of IIA was not violated and MNL was appropriate for this study (Appendix 2).

3.7.4 Assessing Goodness of fit of the MNL model

Results in Appendix 3 demonstrate that the model was well fitted since it had a McFadden's R^2 of 0.218 and prob>LR of 0.000 against the threshold R^2 of 0.20

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Socio-economic Profiles of Households by Gender

Table 2 shows different socio-economic characteristics of the households by gender and significant differences between FHHs and MHHs. Of the total respondents interviewed, 83% were MHHs and the rest were FHHs. The reason for having a small sample size for FHHs is that the study went beyond gender of the respondent and focused on gender of the decision maker.

Table 2: Socio-economic Characteristics of Households by Gender

Variable	FHHs (N=47)	MHHs (N=250)	Pooled sample (n=297)	Significant differences (p-value)
Average land under maize production (acres)	1.21[b]	2.00[a]	1.80	0.001**
Average maize harvested (kgs)	1100.20[b]	1901.60[a]	1771.20	0.004**
Average quantity of seeds used (kgs)	10.00[b]	16.20[a]	15.20	0.002**
Average quantity of fertilizer used (kgs)	84.10[b]	160.50[a]	148.00	0.002**
Average maize sold (kgs)	332.60[b]	1139.70[a]	1008.30	0.001**
Years of formal schooling of the household head	7.70[b]	9.30[a]	9.10	0.010**
Dependency ratio	6[b]	7[a]	6	0.151
Wealth index	11.2[b]	14[a]	13.6	0.003**
Average distance to the nearest market (KM)	3.7[b]	4.8[a]	4.6	0.005**
Market participation (% Yes)	55.00 [b]	61.00 [a]	60.00	0.400
Access to market information (% Yes)	85.00 [b]	88.00 [a]	88.00	0.660
Membership in development group (% Yes)	75.50[a]	62.00[b]	64.00	0.070*
Access to extension services (% Yes)	63.30[b]	74.60[a]	72.80	0.100*
Access to credit (% Yes)	50.00 [a]	46.40 [b]	46.80	0.743

Notes: ***, **, * significance levels at 1, 5 and 10 percent respectively.
The superscripts a & b denote statistical differences in ascending order of magnitude.
Source: Survey Data (2017).

There was a significant difference in the average land size under maize production between MHHs and FHHs. On average, MHHs had 0.71 acres more under maize production compared to FHHs. Koirala et al. (2015) made similar observation whereby they acknowledged key agricultural productive resources are dominated by men. Marenya et al. (2015) noted that despite the significant role played by women in agricultural production they are

disadvantaged in access to and use of land. FHHs harvested less kilograms of maize as compared to MHHs. On average MHHs had 800kg more of harvested maize as compared to FHHs. A study by Palacios-Lopez and Lopez (2015) found a gender productivity gap of about 4 to 40%. This can be attributed to discrepancies in access to and use of productive resources and support services by gender. A monograph by Meinzen-Dick et al. (2011) illustrated the differences in access to resources by gender are expected to affect productivity.

On average, men had 1.6 more years of schooling compared to women (Table 2). The FAO (2011) and Ngigi et al. (2016) found significant differences in education level between men and women with women being disadvantaged. This can be explained by the inequality in access to resources.

Results in Table 2 also show significant differences in quantities of inputs used (seeds and fertilizers) with MHHs using more compared to their female counterparts. This result can also be explained by the significant differences in wealth index among FHHs and their male counterparts. The MHHs had a higher wealth index hence they had ease of access to inputs as compared to women. These results are consistent with Larson et al. (2015) who found that FHHs were less likely to purchase fertilizer than MHHs.

Although in general, access to support services such as markets, marketing information, extension services and credit was high among maize farmers, there were observable differences along gender dimension. For instance; MHHs were more commercialized compared to FHHs. About 60% of MHHs sold their produce as compared to 55% of FHHs. These results concur with Fischer and Qaim (2012) who found that female farmers exhibit low levels of commercialization. This can be due to disparity in access to technological resources, which are key inputs in commercialized agriculture.

With reference to membership in development groups, women had significantly higher levels in comparison to men. About three quarters of women were members in development groups. In comparison, only two thirds of men were in development groups. Major reasons for collective action may be due to supporting one another, increase access to credit, forming table banking platforms and information sharing.

About three quarters of MHHs had access to extension services as compared to the FHHs. This means that women have poor access to new production methods and training, hence they will have low rates of technology adoption leading to low yields.

In terms of credit access, FHHs had a higher access as compared to their male counterparts. These results are contrary to the observations of Palacious-Lopez and Lopez (2015) who found credit market imperfections to affect FHHs more than MHHs. This can be explained by a higher rate of women in development groups than men. Further analysis of the results showed that majority of groups are used for savings and credit purposes.

4.2 Farm Transitions Over the Past Decade

More than half of the respondents acknowledged to have experienced farm transitions from 2007 – 2017 (Figure 3). Notably, land sizes among smallholder farmers have been reducing over the past decade. According to Jayne and Muyanga (2012) recent surveys have shown that land sizes are diminishing in Africa with very little or no possibility for expansion. One of the major factors attributed to this trend is population increase.

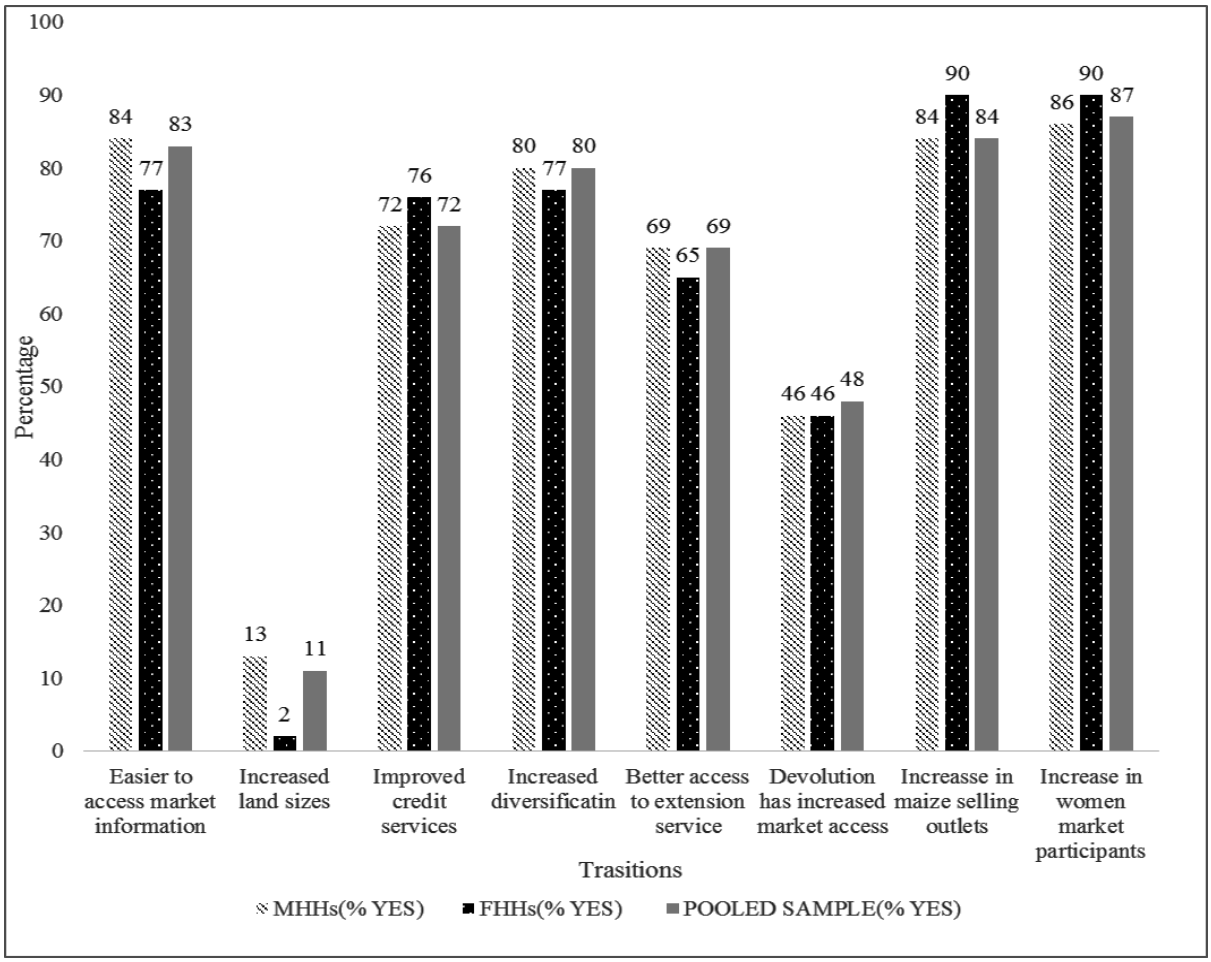

Figure 3: Farm Transitions Among Smallholder Farmers by Gender

Source: Survey Data (2017).

With reference to gender, there were no clear-cut differences across farm transitions over the past decade. It was observed that both FHHs and MHHs had experienced transitions in access to market information, land sizes, credit services, diversification, extension services, maize selling outlets and commercialization among women. However, it is important to note that decrease in land sizes among women was more pronounced than for their male counterparts. Only 2% of women experienced increase in land sizes over the last decade.

The analysis on the effect of transitions by gender is presented in Figure 4. Results showed that both male and female farmers have equally benefited from farm transitions over the past decade. However, contrary to the common narrative in literature female farmers have benefited more when it comes to commercialization.

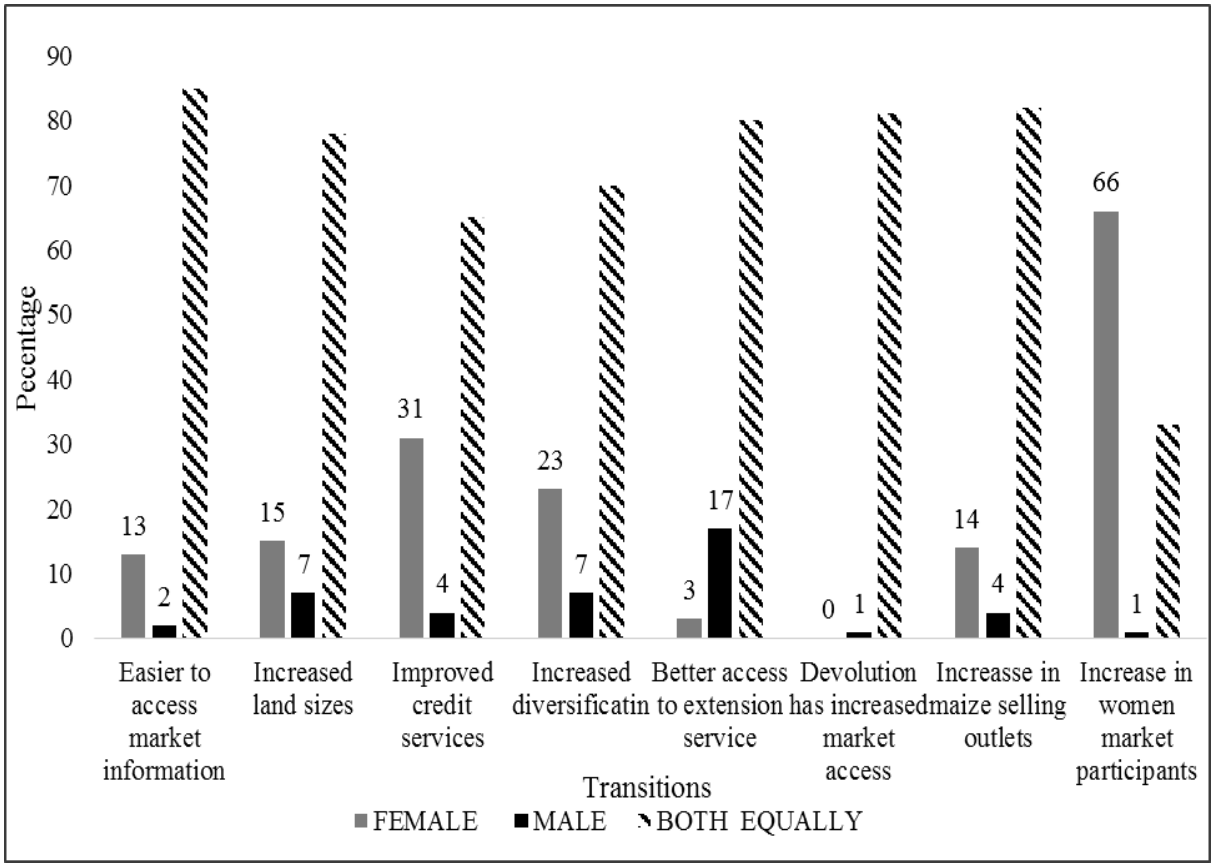

Figure 4: Effect of Transitions by Gender

Source: Survey Data (2017).

Further, results from Figure 4 show gendered differences of who benefited most by each farm transition. Women benefited/participated more as compared to men in access to marketing information, improved access to credit, diversified agriculture and market participation. These results are contrary to the findings of (Marenya et al., 2015; Meinzen-Dick, 2011; FAO 2011) who cited women to be more disadvantaged than men in access to productive resources and support services. Men still dominate in access to extension services. From the results, it can be concluded that recent farm transitions seem to encompass women who were initially neglected. However, it is important to find means to improve women's access to extension services.

4.3 Farmers' Access to Institutional Services along Gender Dimension

The institutional services described in this section include; market channels, access to inputs, group membership, access to credit and access to extension services. Figure 5 shows market channels used for commercializing maize by smallholder farmers.

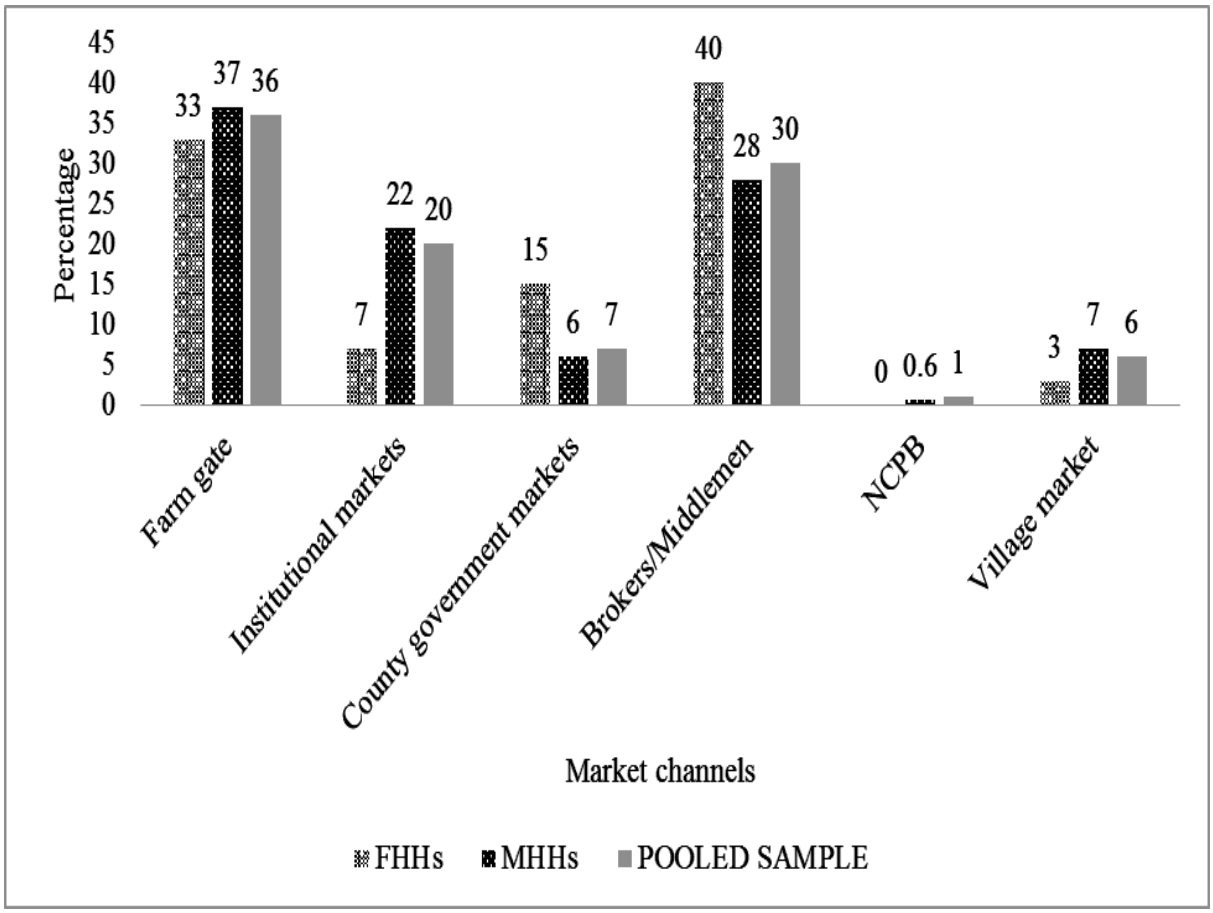

Figure 5: Choice of Market Channels by Gender

Source: Survey Data (2017).

Results showed that the most commonly used channels were brokers/middlemen, farm gate and institutional markets. Mutayoba (2015) showed that farmers prefer shorter channels with quick returns. Another reason for dominance of farm gate and brokers/middlemen channels can be due to low transaction costs and lack of barriers to entry. Institutional markets are mostly preferred for their structure of transactions. For example, a lot of farmers sold maize to schools to offset their children's fees. Further, institutional markets offered better prices in

comparison to other market channels. It was however important to note the levels of commercialization of staples is low across all channels.

Results showed an engendered pattern in choice of market channels, with observable differences in institutional markets, brokers/middlemen and county government markets. Majority of households selling through institutional markets were MHHs. This can be attributed to higher prices offered in institutional markets and the formality involved. Barriers to market access are more pronounced among female farmers in comparison to male farmers more so in modern markets (Oduol et al., 2014). Further, FHHs dominate in County government markets and brokers/middlemen channel. For the former; this may be attributed to the cultural norms where majority of people who sell at the market are women. For the latter, women may prefer it because of the short transactions involved and spot payments. Gendered patterns in access to and utilization of resources often translates to differences in participation and productivity in agricultural value chains (Me-Nsope and Larkins, 2016).

Figure 6 shows constraints faced in accessing seeds by maize smallholder farmers.

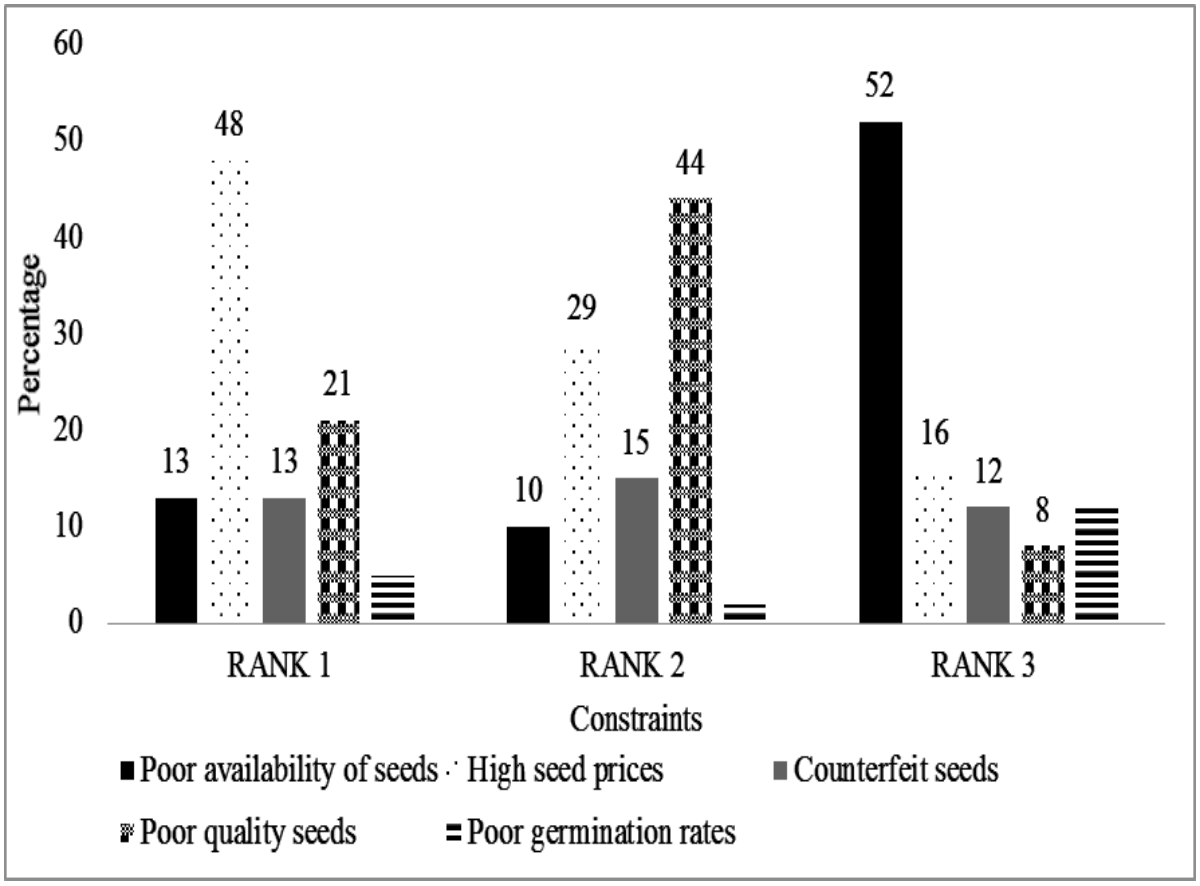

Figure 6: Constraints to Accessing Seeds Among Smallholder Farmers
Source: Survey Data (2017).

Results from Figure 6 show that close to half of the of the farmers interviewed cited high prices, poor quality seeds and poor availability of seeds as the major constraints faced while accessing maize seeds. Results in Figure 7 show that high fertilizer prices, poor availability of fertilizers and poor quality of fertilizer were highlighted as the major constraints in accessing fertilizer. Majority of the farmers iterated that they were sometimes forced to delay planting due to unavailability of fertilizers in agro vets. Further, sometimes fertilizer provided is of poor quality and doesn't boost development of the crop leading to lower yields.

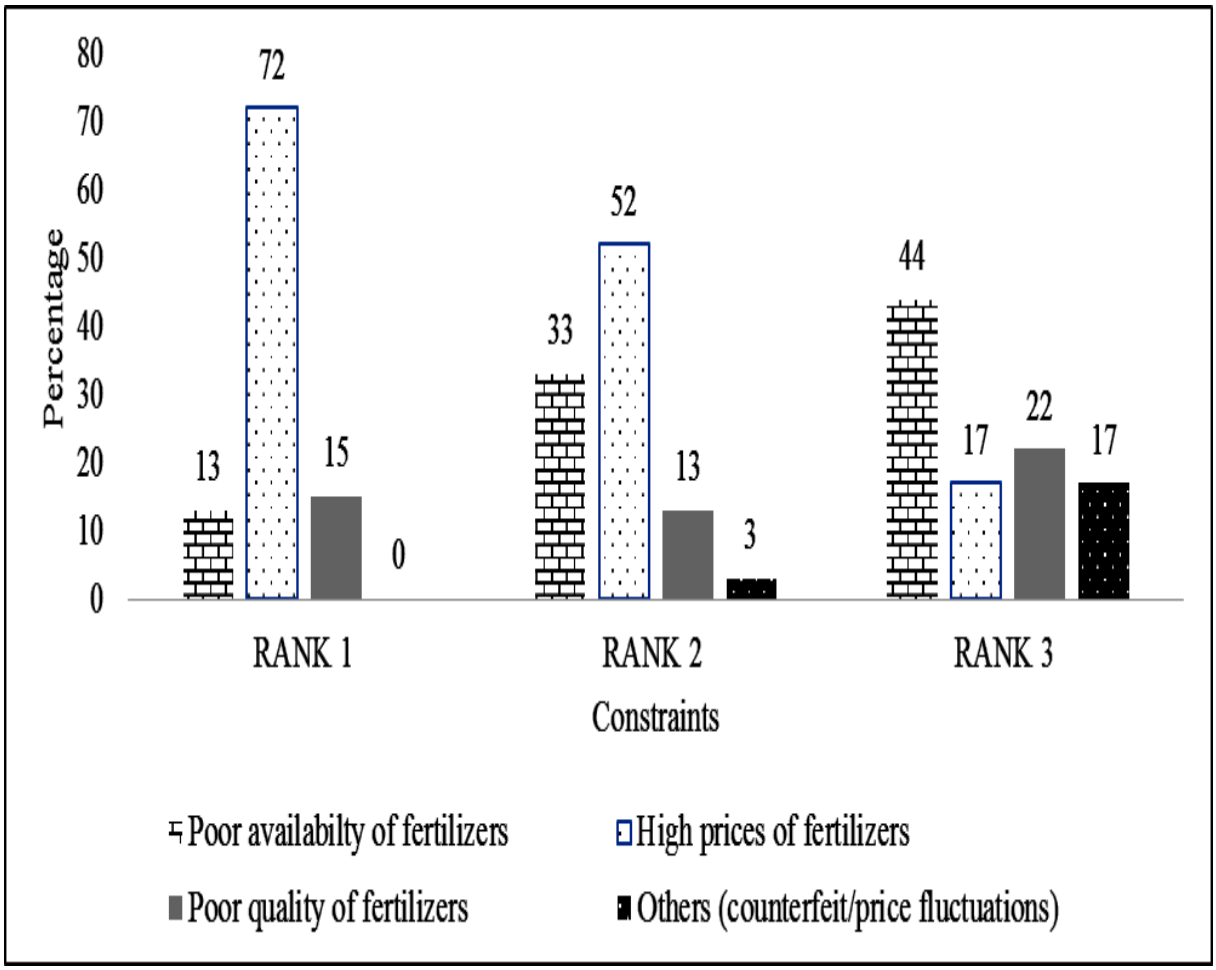

Figure 7: Constraints to Accessing Fertilizer Among Smallholder Farmers
Source: Survey Data (2017).

More than half of the respondents interviewed were in groups (Table 2). When disaggregated by gender, results show that about three quarters of women belong to development groups whereas about two thirds of their male counterparts were in these groups. According to Figure 8 majority of FHHs are members of SACCO/credit, One-Acre fund and table banking groups; while majority of MHHs were members in farmer and welfare groups. Major explanation for this trend among FHHs is because these groups link them to credit access and farming extension services which normally they are discriminated against. Fischer and Qaim (2012); World Bank (2009) observed that collective action improves access to productive assets and bargaining power during commercializing.

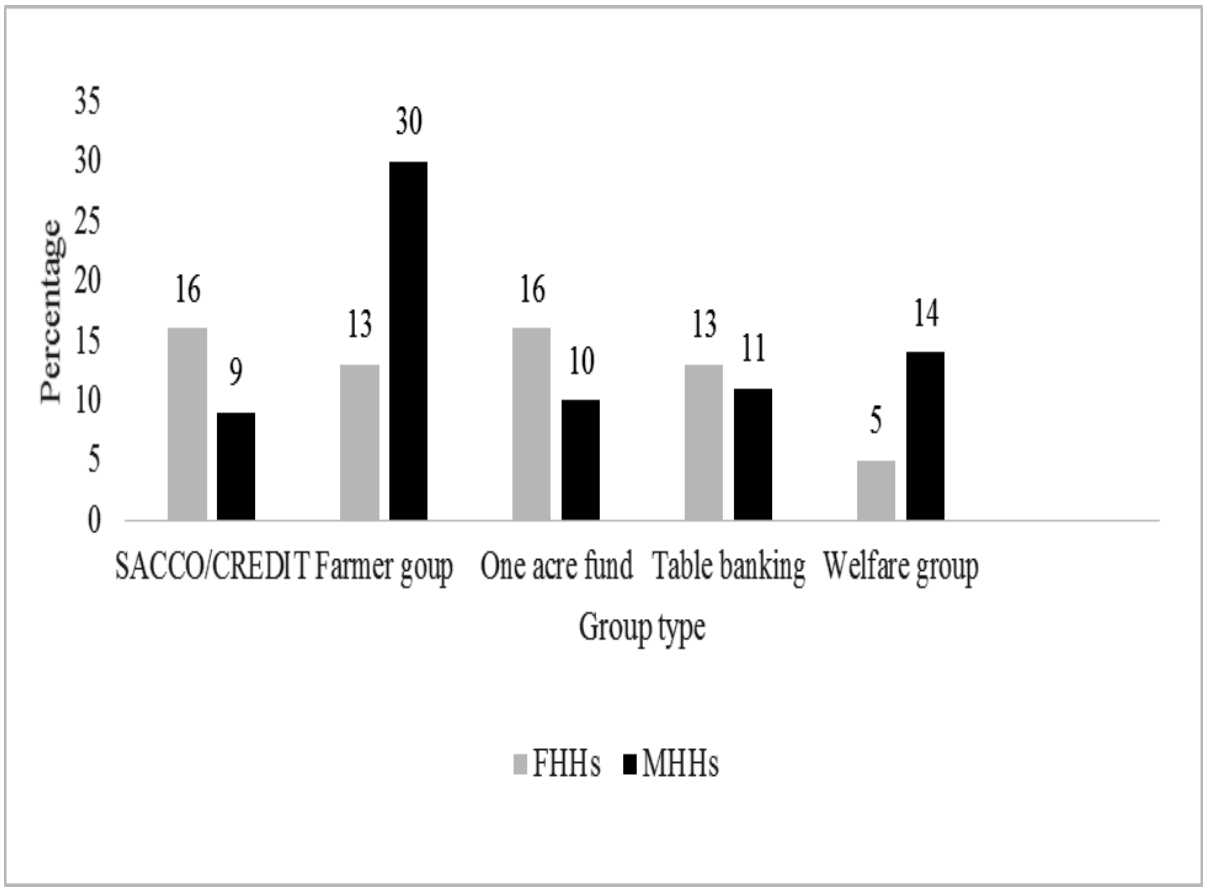

Figure 8: Group Membership by FHHs and MHHs

Source: Survey Data (2017).

Results from Figure 9 shows reasons for non-membership in development groups among respondents. An interesting observation highlighted by those who were not in groups was that they do not need groups. Lack of group, lack of money to pay for group membership subscription fee and corruption were also cited by other respondents as reasons for non-membership.

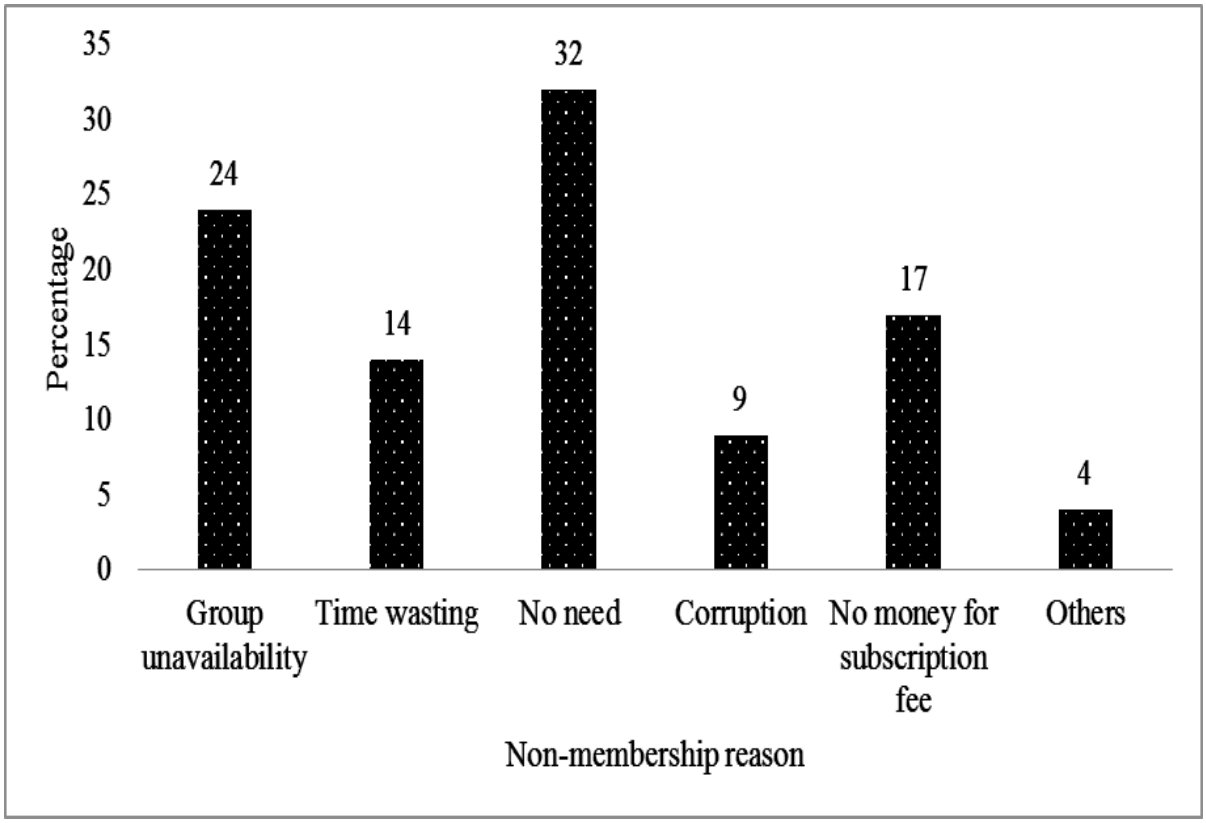

Figure 9: Reason for Group Non-membership Among Smallholder Maize Farmers
Source: Survey Data (2017).

Majority of smallholder farmers' access credit through informal lending mechanisms. The major sources of credit were merry-go round and neighbours or friends (Figure 10). Access of loans from formal institution (Banks) is still low. According to Atieno (2001), formal credit institutions are characterized by bureaucratic application procedures that limit access to credit. When disaggregated by gender, MHHs still dominate access of credit from different sources. However, it is interesting to note that there were more women accessing loans from banks as compared to men. Another key observation was that only MHHs participated in mobile money lending platform (M-shwari). An explanation for this might be due to biased access to information by gender. Probably, most FHHs were not aware of mobile money lending.

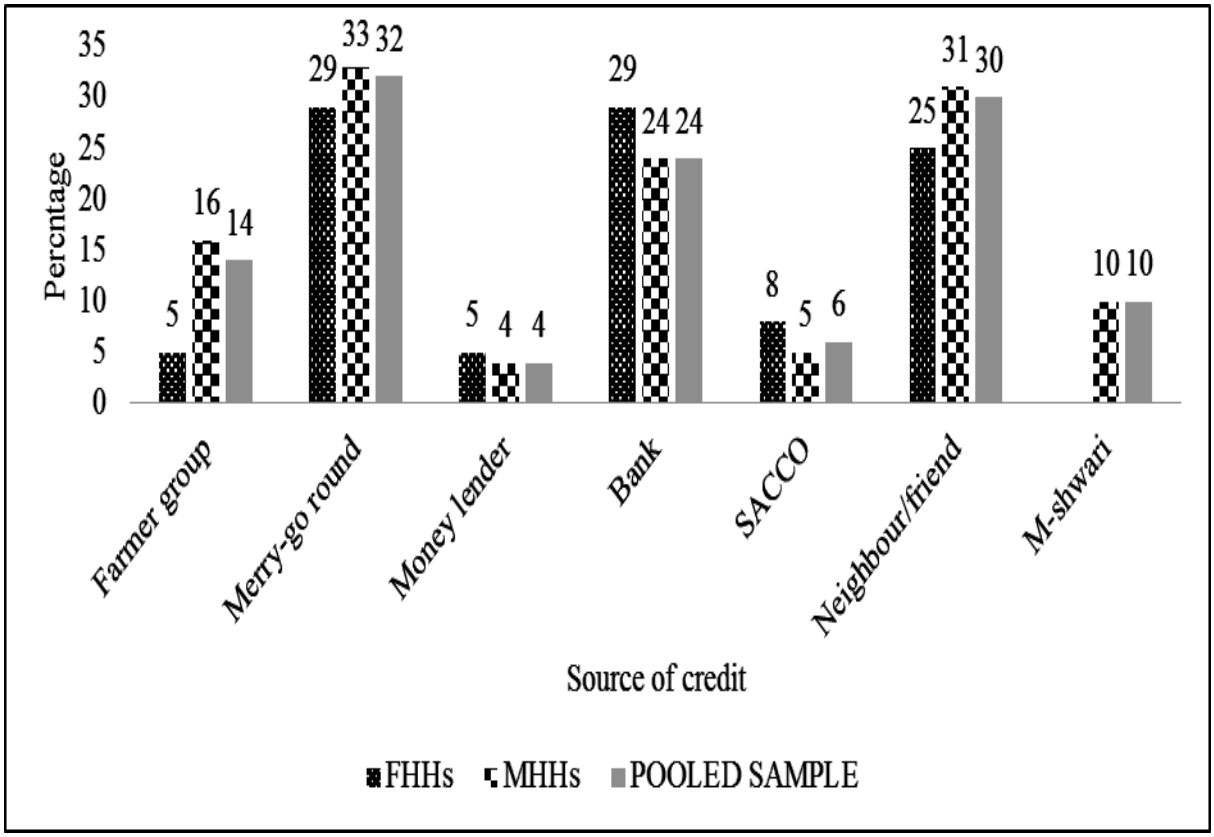

Figure 10: Source of Credit Among Smallholder Farmers by Gender

Source: Survey Data (2017).

Figure 11 presents reasons why maize smallholder famers did not apply for loans over the last three years.

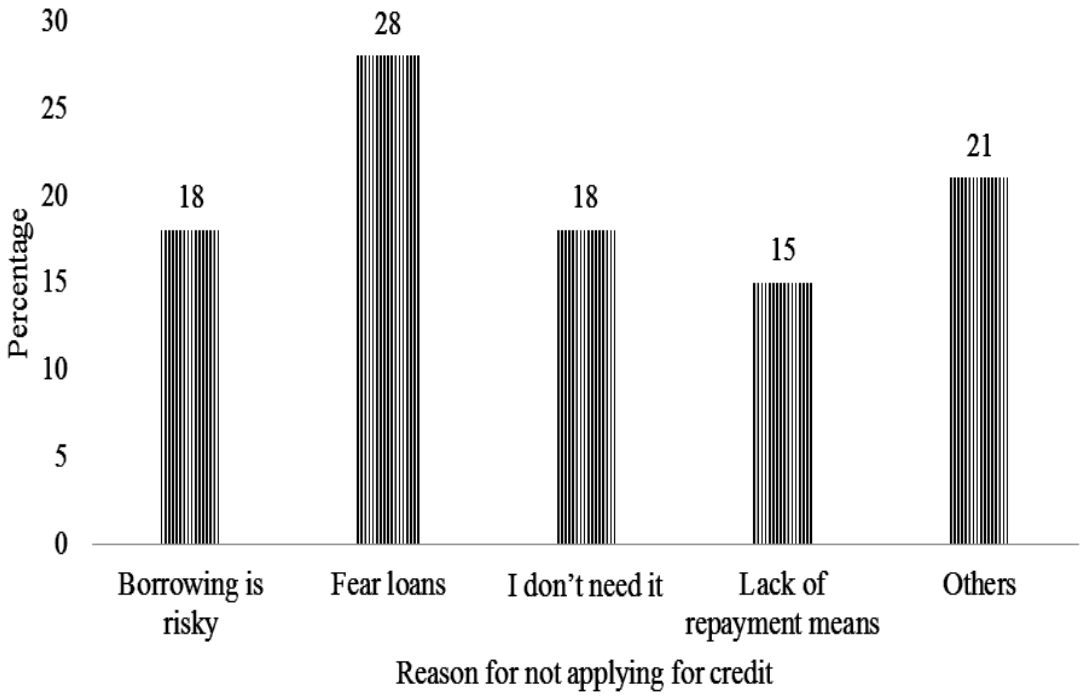

Figure 11: Reasons for not Applying for Credit Among Maize Smallholder Farmers

Source: Survey Data (2017).

For those who did not apply for credit some of the reasons highlighted were; fear of loans, lacking repayment means, borrowing is risky and don't need it as shown in Figure 11. Majority of respondents said that fear of loans was the main reason for not applying for credit. Insights from focus group discussion showed that this fear emanates from; harassment during repayment and auction of assets in case of repayment failure. Afande (2015) highlights poor repayment rates and collateral requirement as the major factors contributing to poor access to credit in Kenya.

Figure 12 illustrates access to extension services by maize smallholder farmers along gender dimensions.

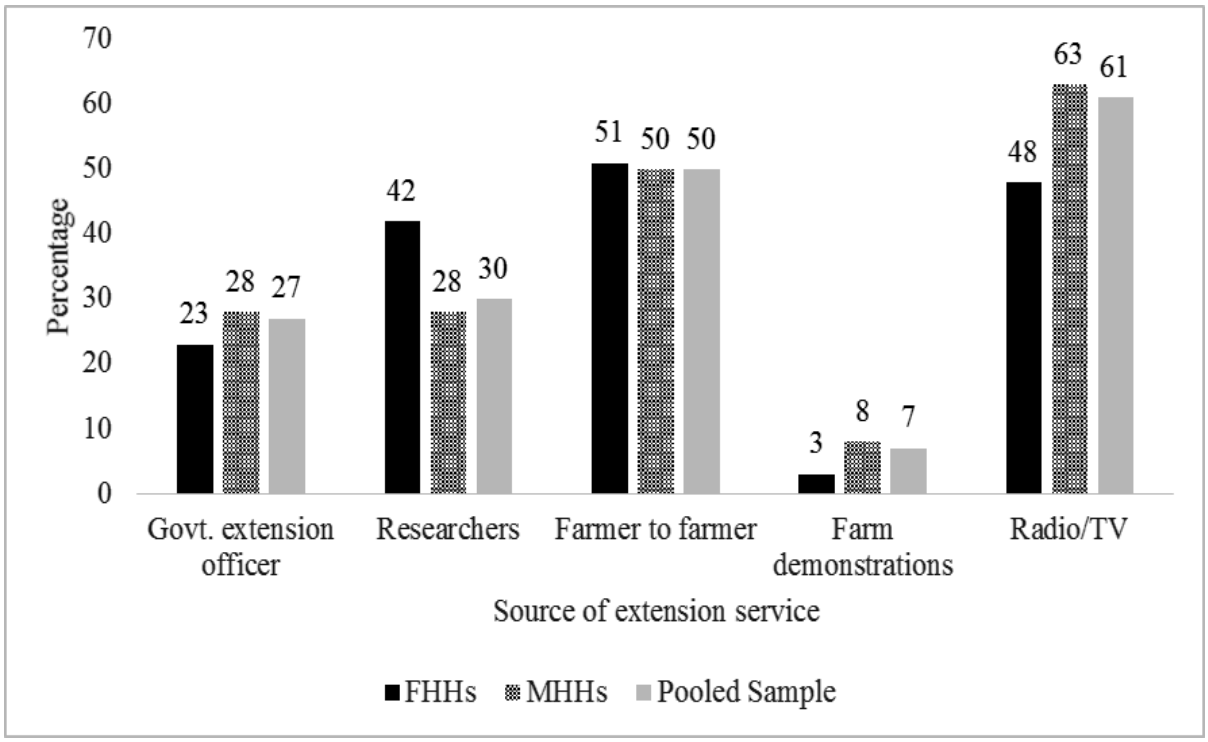

Figure 12: Sources of Extension Services by Gender
Source: Survey Data (2017).

As earlier shown in Table 2 close to three quarters of respondents accessed extension services. The frequently used channels were radio/television and farmer to farmer channels. The reason for this observation could be ease of access and convenience of these channels. MHHs still had a higher access across all channels except for researchers as opposed to their female counterparts. Notably, use of farm demonstration is still very low among all farmers. When analyzed by gender very few FHHs used this channel for extension services.

4.4 Household Decision on Plots and use of Support Services across Gender Dimension

This section highlights plot level decisions made by the household during the cropping season.

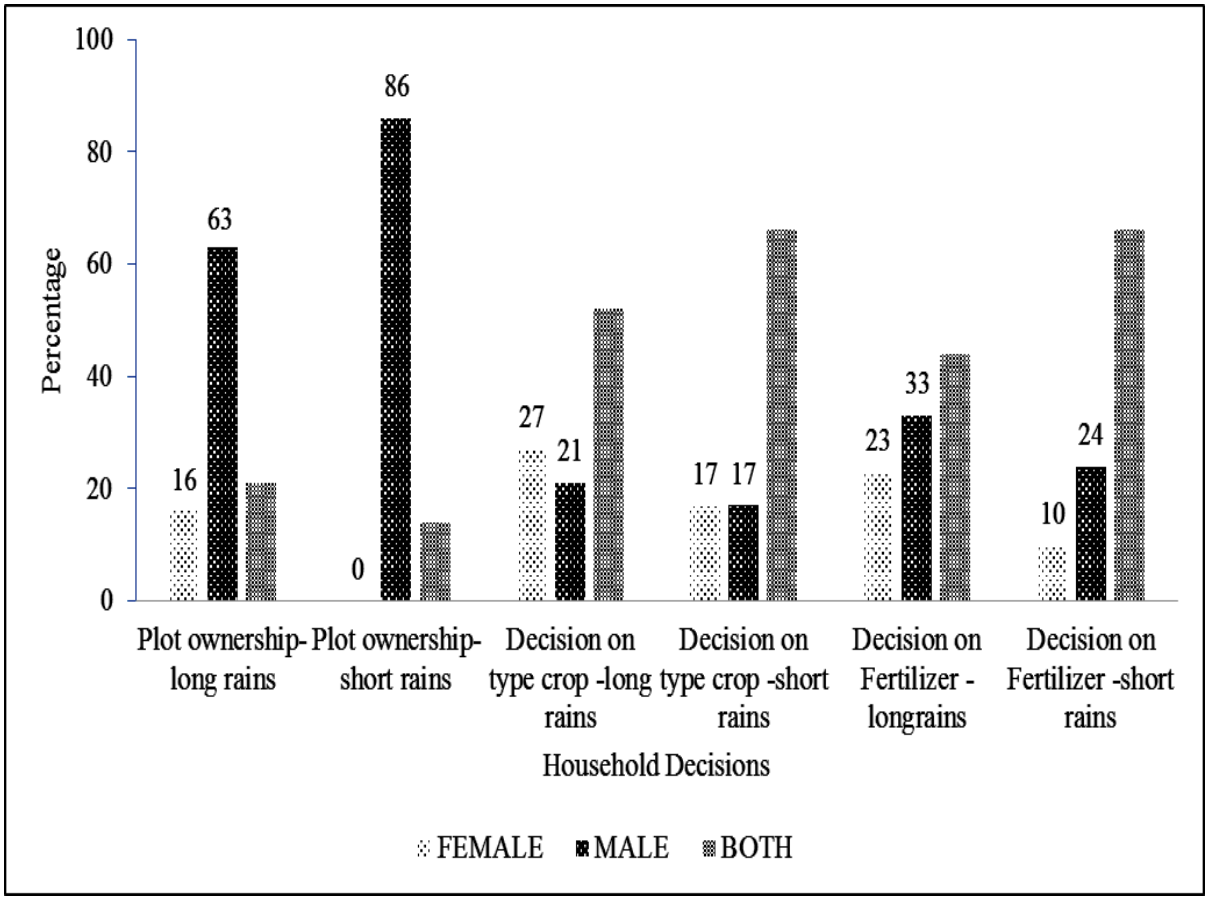

Figure 13: Plot Level Decisions Among Households by Gender

Source: Survey Data (2017).

From Figure 13, it is evident that both men and women were involved in majority of decisions at the plot level except in plot ownership which is dominated by men. These results can be explained by the fact that land ownership is defined by cultural norms which are skewed towards men. Empirical evidence affirms these results where men are found to own and cultivate more land as compared to their female counterparts (Alene et al., 2008).

4.5 Effect of Gender and Institutional Support Services on Choice of Market Channel

As discussed in section 4.3, four market channels were analysed namely farm gate, institutional markets, open air market and brokers/middlemen. As noted by Greene, (2003) MNL parameter estimates are hard to use in interpretation of results. Due to this weakness marginal effects were computed to identify the different market channel choices that were used by smallholder farmers for maize commercialization. Results for Marginal effects are presented in Table 3.

Table 3: Marginal Effects of Gender and Institutional Support Services on Choice of Market Channels (Open-air Markets Used as Base Outcome)

Market channel	**Farm gate**		**Institutional(schools, hospitals)**		**Brokers/ middlemen**	
Variable	**dy/dx**	**P>z**	**dy/dx**	**P>z**	**dy/dx**	**P>z**
Transport costs	-0.003**	0.049	-0.002	0.174	0.003***	0.014
Development group	0.201***	0.019	0.085	0.183	-0.212***	0.003
Access to credit	0.026	0.726	-0.206***	0.001	0.251***	0.000
Maize lost to risk factor	0.003	0.830	0.009	0.415	-0.036***	0.003
Household Asset Index	0.030***	0.000	-0.017**	0.035	-0.009	0.363
Trader trust	0.147**	0.030	-0.063	0.311	0.053	0.432
Poor prices	-0.115*	0.076	0.050	0.358	0.017	0.781
Years of formal schooling	-0.011	0.271	0.004	0.600	0.022***	0.011
Dependence number	-0.032***	0.005	0.018**	0.027	0.017	0.150
Duration stay	0.009	0.814	0.076*	0.096	-0.019	0.617
Distance to market	0.017*	0.062	0.009	0.274	-0.026**	0.038
Gender of household head	0.057	0.614	0.141	0.186	-0.120	0.135

Notes: ***, **, * significance levels at 1, 5 and 10 percent respectively.
Pseudo R^2 = 0.218
Source: Survey Data (2017).

Results showed that a unit increase in transportation costs reduced choice of farm gate but increased choice of brokers channel by 0.3% relative to open-air market. Results for farm gate market channel were contrary to findings of Mutayoba (2015) who found that farmers prefer shorter channels (farm gate) due to reduced transaction costs. The choice of broker over open air market channel due to increased transport costs was expected because most of

these costs are paid by the middlemen themselves as opposed to open air market where transport costs are incurred by the farmer.

Membership in development groups increases the probability of a farmer choosing farm gate by 20%. This can be explained by the fact that farmers would want to sell their maize as a group so as to have a stronger bargaining power for good prices. Most of this maize may be sold to stockists who come to take maize at one collection point as proposed by the farmers. Normally, stockists prefer buying large quantities. Further, farmers who were in groups had a higher probability of selling to open air market as opposed to brokers. This may be explained by the fact that group membership increases organization among members hence reducing level of exploitation from traders. Additionally, collective action helps farmers reduce transaction costs faced when accessing markets. Shiferaw et al. (2006) and Kirsten et al. (2008) emphasize the significance of collective action in agricultural production. Group membership increases access to technology and market information. Further, it increases bargaining power of smallholder farmers in different market outlets.

Credit access is associated with a lower likelihood of choosing institutional market over open air market. Results in Table 3 showed that access to credit reduce the probability of selling through institutional markets by 20%. This can be explained by the fact that majority of farmers used schools as an institutional market and were paid by deducting a similar amount of school fees for their children in the respective school. Farmers with higher credit access are assumed to be able to pay for their children school fees and do not necessarily have to sell maize to the school to offset this need. However, farmers with a higher credit access were more likely to sell to brokers relative to open-air markets. Access to credit increases the farmers' capacity of purchasing inputs hence they are able to produce more marketable surplus (Olwande and Mathenge, 2012).

Results showed that a one kilogram increase in the amount of maize lost due to risk factor was associated with 3.6% decrease in farmers' likelihood to sell through brokers. A valid explanation for these results is that maize loss reduces the amount of maize to be sold which decreases a farmers' decision for commercialization through any channel. Agricultural production depends on biotic and abiotic factors. This nature makes it more susceptible to production risks than any other sector (Hurley, 2010). Risk factors associated with production decreases the marketable surplus hence reduces likelihood of market participation.

An increase in wealth index (HAI) had a positive impact on selling through farm gate. A unit increase in wealth index increased the probability of selling through farm gate by 3% relative to open air market. Wealthy households have the ability to afford inputs which will enable them to produce high quantities of maize for sell. Majority of buyers at farm gate were maize aggregators/stockists who prefer buying from farmers with high quantities. On the other hand, wealthy households had a lower probability of participating in institutional markets compared to open air markets. These findings are contrary to those of Kirimi et al., (2013) who observed that wealthy households are able to deal with shocks and adopt technologies that will increase their production, hence they are expected to be more commercialized. Results showed that a unit increase in wealth index reduced the likelihood of selling through institutional markets by about 2%. A possible explanation for this observation is that majority of the households that sold through institutional markets sold to schools to offset school fees for their children, wealthy households may be able to offset this problem without necessarily selling their maize to the school.

Farmers' trust in traders was significantly associated with a higher likelihood of choosing farm gate as compared to open air market. The probability of choosing farm gate relative to

open air market increased by about 15% if the household trusts the trader. Most of the respondents were able to count the traders they trusted by names. Due to this they preferred selling to them rather than taking maize to the open air market to unfamiliar traders and buyers. Further, trust in traders gave farmers an assurance of their payment and minimal exploitation during commercialization. Trust between traders and farmers builds social capital and sometimes traders act as informal sources of credit to farmers during production (Muricho, 2015). This credit can then be used to access productive inputs, which increases production of marketable surplus.

Low prices than expected, reduced the probability of a farmer selling through farm gate channel by up to 11.5%. These results are consistent with the findings of Omiti et al. (2009) who noted that output price positively influence market participation decision among vegetable farmers in Kenya. This study further observed that farmers are discouraged to commercialize their produce due to low prices.

The number of years of formal schooling was significantly associated with a higher probability of choosing brokers. The likelihood of choosing brokers increased by 2.2% for a year increase in years spent in formal schooling. Gicheha et al. (2015) found the level of education of household head to have a positive effect on both the likelihood and intensity of market participation. This may be because educated households prefer quicker channels as opposed to open air market. The reason for this preference could be because highly educated households might have a lot of economic activities and do not have time to sell in open air markets.

Households with a higher dependence ratio had a lower likelihood of choosing farm gate as opposed to open air market. The probability of choosing farm gate decreased by 3.2% for a unit increase in the number of people depending on the household for food. As noted by

Martey et al. (2012), an increase in dependence ratio decreases the amount of maize available for commercialization. On the other hand, households with a higher dependence ratio had a higher likelihood of choosing institutional markets as opposed to open air market. Results in Table 2 above showed that a unit increase in dependence ratio increased the probability of choosing institutional markets by 1.8% this can be explained by the fact that a higher dependence ratio increases the labour force used in maize production hence increases amount of marketable surplus. Further, institutional markets need farmers who can supply large quantities and a higher dependence ratio provides labour that can help in production of these quantities.

Duration of stay in the current village had a positive effect on the likelihood of choosing institutional markets over open air market. A one year increase in the period that a farmer stayed in that village increased the probability of choosing institutional markets by 7.6%. A plausible explanation for this is that it is easier for local residents to obtain the supply tenders from the institutions as opposed to people who are new in the village.

Distance to the market was significantly and positively associated with choice of farm gate as opposed to open air market. A one kilometre increase in the distance to markets increased the probability of choosing farm gate market channel by 1.7%. Farmers who were closer to the market had a higher likelihood of choosing open air market channel opposed to brokers/middlemen. Results show that an increase in one kilometre of distance to the market reduced the likelihood a farmer choosing brokers as their channel by 2.6%. Increased distance to the market increases transport costs and farmers might prefer channels that do not require transaction costs to commercialize (Gani and Adeoti, 2011). Further, farmers who are closer to the market have lower transport costs hence a higher likelihood for market participation.

4.6 Effects of Gender and Institutional Support Services on Amount of Maize Sold

A two-step Heckman model was used to analyse the decision of the household to commercialize and the extent of commercialization. Results for this model are shown in Table 4.

Table 4: Two-step Heckman Model Results of Pooled Sample

	Market participation equation		Amount of maize sold equation	
Variables	**Coef.**	**dy/dx**	**Coef.**	**dy/dx**
Membership in development group	0.12	0.04	0.09	0.06
Total seeds and fertilizers	0.09	0.03	0.21***	0.19
Household asset index	0.02	0.01	0.03**	0.03
Total land under maze	0.32*	0.12	0.25***	0.17
Total maize harvested	0.86***	0.31	0.70***	0.48
Years of formal schooling	-0.01	0.00	0.04***	0.04
Dependence ratio	-0.07**	-0.03	-0.04**	-0.02
Access to extension service	0.16	0.06	-0.16	-0.20
Number of traders known	-0.22*	-0.08	-0.03	0.02
Gender of household head	0.17	0.06	0.27*	0.22
Trust in trader	0.12	0.04		
Access to credit	0.12	0.04		
Bungoma county	0.15	0.05		
Kakamega county	-0.26	-0.10		
_cons	-5.71		-0.49	

Notes: ***, **, * significance levels at 1, 5 and 10 percent respectively.
Source: Survey Data (2017).
N=297 (censored obs =116, uncensored obs =181)
RHO= 0.6990437
Sigma= .6757913
Lambda= .4724076
LR test of indep. eqns. (rho = 0): $chi^2(1) = 13.84$ Prob > $chi^2 = 0.0002$
Wald $chi^2(10) = 363.59$ Prob > $chi^2 = 0.0000$

Results from Table 4 show that the decision and level of market participation are strongly correlated (rho positive and greater than 0.65) and the Wald chi statistic is highly significant at 1%. These results confirm that the two processes are interdependent such that, the decision to participate in markets and intensity of market participation are interrelated and modelling them as separate processes would yield misleading results. The columns of Table 4 present

empirical findings on factors that affect farmer's decisions and level of market participation. In this first stage of the Heckman model, dependent variable equals to 1 if a farmer participates in the market and 0 otherwise. In the second stage the dependent variable is the amount of maize sold.

Amount of fertilizer and seeds used by a household was insignificant for the market participation decision but significantly affects the intensity of commercialization at 1%. A kilogram increase in the amount of inputs (seeds and fertilizer) used increased the amount of maize sold by 19%. This might be due to intensified use of improved inputs which leads to higher yields and more marketable surplus. Intensified use of improved inputs in production has been acknowledged for improving agricultural productivity (Ouma et al., 2006).

A unit increase in household asset index increased the intensity of maize sold by 3%. Wealthier households are expected to have access to inputs and transport facilities hence they are more commercialized in comparison to other households. Barret (2007) in his study showed that wealthier households had higher market participation as compared to other households.

Farmers with bigger land sizes under maize had a higher levels of market participation and intensity as opposed to those with smaller farms. Results showed that, a one acre increase in land under maize production increased the decision and amount of maize sold by 12% and 17%, respectively. Musah et al. (2014) found that farmers with big land sizes have the opportunity for surplus production.

The total amount of maize harvested by the household positively increased both the decision and level of market participation. A kilogram increase in the total amount of maize harvested by the household increased the probability of the decision to participate in the market by

31%. These findings emphasize relevance of increased productivity in commercialization and are consistent with the findings of Mather et al. (2011) and Chalwe (2011). Notably, the quantity of maize harvested had a higher effect on the level as compared to the decision of commercialization. Komarek (2010) found similar results when studying commercialization patterns, whereby the quantity of output harvested had an effect on both the decision and level of market participation.

Though insignificant in the decision to participate in maize markets, education level of the household head, had a positive and significant influence on the intensity of commercialization. This might be due to the fact that learned households were aware of the benefits associated with market participation (Lubungu et al. (2012). Marginal effects illustrated that a unit increase in the level of education of the household head increased the amount of maize sold by 4%. In addition to this, educated households may be well endowed with managerial and production skills which increases commercialization (Randela et al., 2008).

Results showed that dependency ratio had a negative and significant effect on both the household decision and level of commercialization. This may be due to the fact that households with higher dependency ratio may have difficulty producing beyond their subsistence needs for marketable surplus (Siziba et al., 2011). Marginal effects showed that a unit increase in the dependency ratio of the household decreased likelihood of commercialization by 3% and the amount of maize sold by 2%.

Despite having an insignificant effect on the decision of commercialization, gender of the household head had a positive and significant effect on the amount of maize sold. Marginal effects showed that MHHs sold 22% more in kilograms of maize compared to their FHHs. These results were expected since MHHs are expected to have more access to resources as

compared to FHHs. Given that females are constrained in access to land and extension service they will probably have low marketable surplus as opposed to their male counterparts (Quisumbing, 2014).

Contrary to expectation, the number of traders known decreased the likelihood of market participation. A unit increase in the number of traders known decreased the probability of market participation by 8%. This could be attributed to the fact that different traders may have different prices for maize purchase. The higher the number of traders known by the household, the higher the variation in market prices they receive making them to feel exploited thus discouraging commercialization.

4.7 Gendered Analysis of Effects of Institutional Support Services on Market Participation and Extent of Market Participation

Results in Table 5 show market participation decisions disaggregated by gender.

Table 5: Two-step Heckman Model Results for Gender Disaggregated Sample

	MHHs				FHHs			
	Market participation equation		Amount of maize sold equation		Market participation equation		Amount of maize sold equation	
Variables	Coef.	dy/ dx	Coef.	dy/ dx	Coef.	dy/ dx	Coef.	dy/ dx
Membership in development group	0.08	0.03	0.01	-0.01	-0.79	-0.18	0.31	0.31
Total seeds and fertilizers	0.06	0.02	0.22***	0.20	-0.42	-0.11	0.03	0.04
Household asset index	0.00	0.00	0.04**	0.04	1.27**	0.35	0.03	0.02
Total land under maze	0.33*	0.12	0.24**	0.16	3.83**	1.05	0.78***	0.77
Total maize harvested	0.85***	0.30	0.71***	0.49	-1.02	-0.28	0.52**	0.52
Years of formal schooling	-0.03	-0.01	0.03*	0.03	0.13	0.04	0.13***	0.13
Dependence ratio	-0.06	-0.02	-0.03	-0.02	-1.29**	-0.35	-0.14***	-0.13
Access to extension service	0.18	0.06	-0.09	-0.14	-1.01	-0.25	-0.79***	-0.79
Number of traders known	-0.25*	-0.09	-0.07	-0.01	-1.85**	-0.51	-0.07	-0.06
Access to credit	0.02	0.01			3.98**	0.90		
Trust in trader	0.04	0.01			6.29**	0.88		
Bungoma county	0.22	0.08			-4.96*	-0.99		
Kakamega county	-0.30	-0.11			-0.91	-0.29		
_cons	-5.07		-0.33		3.74		1.71	

Notes: ***, **, * significance levels at 1, 5 and 10 percent respectively.
Source: Survey Data (2017).

Total amount of seeds and fertilizer used had a positive and significant effect on the amount of maize sold among MHHs. An increase in a kilogram of inputs used increased the level of commercialization by 22%. Ouma et al. (2006) suggested that adoption of improved maize varieties and intensive use of fertilizer can increase agricultural yields and provide marketable surplus. Further, MHHs are poised to have greater access to agricultural inputs as opposed to their female counterparts.

Household asset index had a positive effect on the intensity of commercialization among MHHs and also on the decision of whether or not FHHs should participate in the market. Asset index is a proxy for wealth status of the household. Wealthy households are expected to have a higher access to productive resources as compared to their non-wealthy counterparts. A study by Siziba et al. (2011) highlight that increased access to resources by wealthy households' acts as an incentive to commercialize agriculture. Carter and Barret (2006) show that lack of assets may lead to lack of surplus production among farmers.

Total land under maize had a positive effect on commercialization decisions for both FHHs and MHHs. For MHHs, this determinant had a positive effect on both the intensity of commercialization and the decision to participate in the market. Land sizes affect allocation decisions for crops among farmers, if a farmer has bigger farm sizes they will allocate bigger allocation for production hence marketable surpluses. Balagtas et al. (2007) made identical observations while studying market participation. An increase in land size by 1 acre increased the intensity market participation between MHHs and FHHs by 16% and 77%, respectively. Jane and Muyanga (2012) observe that a lot of agricultural productivity in SSA is due to increased production areas.

The total amount of maize harvested had a positive and significant influence on both the decision and intensity for market participation among MHHs. This variable was also found to positively influence the intensity of commercialization among FHHs. Previous studies also made similar observations (Komarek, 2010; Mather et al. 2011) that higher output rates enable surplus production among farmers. In the current study, one kilogram increase in the amount of maize harvested increased the intensity of market participation among MHHs and FHHs by 49% and 52%, respectively.

A household head's trust in a trader was found to have a positive effect on commercialization intensity among FHHs. A possible explanation for this is that trust may be treated as a form of social capital. Trust is built due to frequent and consistent transactions between the two parties, this could lead to traders advancing households with soft loans which will be recovered during harvests (Muricho, 2015). Credit that is received by female farmers in advance can be used to increase productivity which produces more output for marketable surplus.

Level of education of both MHHs and FHHs had a positive effect on commercialization decisions. According to Lubung et al. (2012) and Keil et al. (2011) increased education levels leads to exploitation of marketing opportunities among smallholder farmer. In the current study, a year increase in the level of education increased the intensity of commercialization by 13% and 3% in FHHs and MHHs, respectively.

Dependency ratio had a significant and inverse effect to commercialization decisions for FHHs. Larger household sizes had higher consumption needs to meet which reduced surpluses for sell at the market (Martey et al., 2012; Siziba et al., 2011). Households only participate in markets if they produce more than they can consume. Higher dependency ratio leads to greater levels of consumption at the household level hence low levels of commercialization (Makhura et al., 2001). A unit increase in dependency ratio among FHHs decreased the decision and level of commercialization by 35% and 13%, respectively.

Access to credit by FHHs increased their level of commercialization. Women who had access to credit were 90% likely to participate in the market. This demonstrates that women are more likely to spend credit on agricultural purposes. Sindi (2008) observed that credit access increases farmers' access to productive inputs and assets which increases productivity surplus

for the market. Further, Fletschner and Kenney (2014) noted that women are good managers in comparison to men.

Access to extension services among FHHs reduced their intensity of commercialization. This observation was contrary to expectation, since it was hypothesized that a higher access to extension service will positively influence commercialization decisions. A study by Arias et al. (2013) observed that targeted extension messages had a positive impact in linking farmers to markets. In the current study, access to extension services among FHHs decreased the intensity of market participation by 79%. A possible explanation for these results could be that the messages shared by extension officers were not targeted to increasing agricultural commercialization.

Increase in the number of traders known had an inverse effect on market participation among FHHs and MHHs. Results indicate that a one unit increase in the number of traders known reduced the probability of market participation by 9% and 51% for MHHs and FHHs, respectively. This could be attributed to the fact that, the more the number of traders known by a household head the higher the variation in terms of selling prices experienced. This variation negatively affects a household's decision to commercialize their produce since they view it as exploitation from traders.

Though insignificant on commercialization patterns among MHHs, Bungoma County had a significant and inverse effect on the amount of maize sold among FHHs. These households sold 99% less kilograms of maize as opposed to FHHs from Trans-Nzoia County.

4.8 Effect of Transitions on the Amount of Maize Sold Among Smallholder Farmers

Descriptive analysis demonstrated that there were different commercialization patterns among farmers who experienced transitions as compared to those who did not. For instance, 87% of farmers who experienced infrastructure transitions were more commercialized as opposed to 84% who did not. Additionally, close to one half (48%) of farmers who experienced devolution transitions participated in the market as opposed to 43% who did not. Results in Table 6 illustrate the effect of farm transitions on commercialization decisions among maize smallholder farmers.

Table 6: Regression Results on the Effect of Infrastructure and Devolution Transitions on Commercialization (Amount of Maize Sold)

	Infrastructure transitions				**Devolution transitions**			
	Lack of improved access to all weather roads (n = 51)		**Improved access to all weather roads (n = 246)**		**Market facilities have not been established since devolution (n=160)**		**Market facilities have been established since devolution (n=137)**	
Variables	**Coef.**	**P>t**	**Coef.**	**P>t**	**Coef.**	**P>t**	**Coef.**	**P>t**
Development group	0.08	0.94	0.27	0.45	0.44	0.29	0.16	0.79
Total seeds and fertilizer used	-1.17*	0.06	0.39*	0.09	-0.04	0.87	0.45	0.21
Household Asset Index	0.06	0.62	0.09**	0.05	0.00	0.98	0.14**	0.03
Total land under maize	1.69*	0.08	0.08	0.79	-0.08	0.84	0.30	0.48
Total maize harvested	2.41***	0.01	1.74***	0.00	2.63***	0.00	1.32***	0.00
Trust traders	0.31	0.77	0.39	0.22	0.22	0.57	0.82*	0.10
Years of formal schooling	-0.01	0.92	0.00	0.96	0.04	0.49	-0.04	0.53
Dependence number	0.06	0.77	-0.13**	0.03	-0.16**	0.04	-0.09	0.30
Access to credit	2.03*	0.07	0.25	0.45	0.35	0.38	0.96*	0.08
Access to extension	-0.45	0.70	0.13	0.74	0.15	0.72	-0.16	0.80
Gender of household head	-1.26	0.38	0.52	0.24	0.55	0.31	0.46	0.48
Traders known	0.08	0.90	-0.60***	0.01	-0.30	0.31	-0.69**	0.04
_cons	-8.92	0.08	-10.31	0.00	-14.28	0.00	-8.02	0.00

Notes: ***, **, * significance levels at 1, 5 and 10 percent, respectively.
Source: Survey Data (2017).

4.8.1 Effect of Infrastructure Transitions (Access to All Weather Roads) on Commercialization

Results from Table 6 show the effect of transitions on commercialization decisions among smallholder farmers. Results showed that areas with improved infrastructure, access to inputs increased the amount of maize sold by 39% whereas in areas with poor infrastructure it reduced the amount of maize sold. A plausible explanation for these results is that improved infrastructure reduced delays in accessing inputs and ensures timely planting which led to improved yields. Access to road infrastructure had a positive impact on crop intensification (van de Walle, 2009).

Wealthy households in areas with improved infrastructure were more commercialized in comparison to those with poor infrastructure. A unit increase in asset index increased kilograms of maize sold by 9%. This is due to the fact that wealthy households have the capacity to purchase and/or invest in transport equipment. Having good access to roads with equipment for transport increases market participation among these households. Households with high access to assets are more oriented to the market (Randela et al., 2008).

An increase in land under maize production by one acre increased the amount of maize sold among farmers who had poor infrastructure. It is worth noting that big land sizes are necessary for increased yields. Thus, farmers with large maize plantations are likely to be more commercialized even with poor infrastructure because most traders prefer buying maize in large quantities. A report by IFAD (2014) documents that, having the capacity to produce large quantities is necessary in increasing access to markets.

Amount of maize harvested by farmers in areas with both poor and improved infrastructure had a positive effect on commercialization. Notably, results demonstrated that a one kilogram increase in the amount of maize harvested increased the amount of maize sold by 241% and

174% for farmers with poor infrastructure and those with improved infrastructure, respectively. Increased yields allow a household to have more output channelled to marketable surplus. The relatively higher coefficient among farmers with poor infrastructure can be due to the fact that farmers with good infrastructure might have a lot of restrictions in quantity and speed that regulates the amount of maize transported to the markets.

The positive and significant coefficient for access to credit among farmers with poor infrastructure shows that access to financial services increased the capacity of farmers to invest in improved inputs as well as transport mechanisms that will help increase commercialization. This is expected based on the fact that farmers cited high prices as one of the constraints in access to improved seeds. These results corroborate with those of Abdullah et al. (2017) who found that access to credit was positively related to welfare and access to inputs among farmers.

Both an increase in the number of dependents and traders known had a negative and significant effect on the amount of maize sold for farmers in areas with good infrastructure. The former results are highly expected since an increase in dependents increases consumption levels on the amount of maize harvested hence reducing marketable surplus. Contrary to expectations, an increase in the number of traders known decreased the amount of maize sold. This could be attributed to the fact that, the more households are aware of traders the more they know of middlemen exploitation which discourages them from commercializing their produce.

4.8.2 Effect of Devolution Transitions (Establishment of Market Facilities) on Commercialization

Household asset index had a positive and significant effect on the amount of maize sold for farmers in areas where new market facilities had been established since devolution. An increase in asset index by one unit increased the amount of maize sold by 14%. Increasing market facilities by County governments helped increase market access for smallholder farmers' hence increasing commercialization. Further, increased household asset index shows increase in assets and/or wealth, thus wealthy households have the ability to invest in productive resources such as improved seeds and fertilizers that help increase yields.

Amount of maize harvested had a positive and significant effect for farmers who had new market facilities established due to devolution as well as those who did not have new market facilities. Results highlight that increased output increased the amount of maize sold for farmers with and without devolution transitions.

Farmers who encountered devolution transitions, trusted in traders and had access to credit were more commercialized as opposed to their counterparts who did not have devolution transitions. Trust between farmers and traders enables farmers to gain a basis for transactions with traders. Through trust farmers are able to supply their output for pay at a later date as well as access soft loans from traders which will later be deducted from the sale of output to traders. Further, access to credit gave farmers in areas with devolution transitions an opportunity to invest in strategies for increasing yields so as to tap into the new markets introduced through devolution.

Results showed that, an increase in the number of traders known by one among farmers who experienced devolution transitions decreased the amount of maize sold by 69%. A valid explanation for these results could be due to collusion by traders. In some cases, traders

might collude and set low prices which could discourage farmers from participating in the market. Hence, there is a possibility of having an inverse relationship between the number of traders known and the amount of maize sold by farmers. Collusion by traders is disadvantageous to both farmers and consumers as they increase transactions costs associated with market participation (Robbins, 2003).

CHAPTER FIVE

5.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

The purpose of this study was to analyse the effect of gender and institutional determinants of smallholder maize farmers' market participation decisions in transitional systems in western Kenya. Results showed that there are gendered differences in access to institutional support services as well as benefits of transitions. The MHHs were found to be highly commercialized, had more access to market information, higher access to extension services and high productivity levels. On the other hand, FHHs had a higher access to development groups and credit. Results also showed that majority of the farmers equally benefited from farm transitions over the past decade. These transitions included; improved access to market information, improved credit services, increased diversification, and access to extension services, market access and increase in the number of women participating in the market. Gendered disaggregation however indicated that the benefits were biased with a positive effect towards FHHs.

Farm gate, institutional markets, open-air market and brokers/middlemen were found to be the major channels used by smallholder farmers to commercialize their maize. Average transport costs, membership in development group, access to credit, amount of maize lost due to risk factors, wealth index, level of education, poor prices, dependence ration and distance to the market were all found to have a significant effect on the choice of market channels. Market participation decisions and intensity of market participation were assessed using Heckman two-step model. Results showed that; amount of inputs used, amount of maize harvested, total land under maize, education level, trust in traders, dependence ration, credit and gender had a significant effect on decision and level of market participation. Farmers in

transitional systems are more commercialized as opposed to those under conventional systems. Further analysis showed that, increased access to inputs, asset index, quantity of maize harvested, trust in traders and access to credit had a positive effect on the amount of maize sold for farmers who either reported infrastructural or devolution transitions.

5.2 Conclusions

Results from this study validate the contribution of gender, institutional support services and other variables to agricultural commercialization. Socio-economic characteristics from this study show gender gaps in terms of wealth, access to credit, access to extension service, productivity, land under maize production, education level and commercialization. Notably, access to most of the institutional services is biased towards MHHs. These results show the need for engendering agricultural policies and strategies so as to increase equity in access to resources.

Total amount of inputs used, wealth index, total land under maize production gender of the household head, access to credit, education level and dependence ratio of households were found to have an effect on commercialization. These variables demonstrate that increased access to productive assets has an effect to market participation decisions. It is important to increase access to inputs. Additionally, adoption of intensified production methods is important so as to increase yield per unit area. Positive contribution of credit access on commercialization calls for increased supply of credit among smallholder farmers. More so, there is need to invest in farmer trainings so as to improve capacity and knowledge on benefits of commercialization.

Gendered analysis of market participation decisions clearly highlights observable differences among determinants for commercialization between FHHs and MHHs. Some variables affect

both male and female where as some only affect one gender group. For instance, wealth, education, total land under maize production, dependence ration and trust in traders had significant effects on both MHHs and FHHs but with different magnitudes. Access to credit and extension services were only found to be significantly influencing market participation decisions for FHHs. Total amount of inputs used, quantity of maize harvested and number on traders known were only found to significantly affect commercialization decisions among MHHs. This calls for innovative ways of accessing both credit and extension services among FHHs. For MHHs there is need to increase access to and use of inputs as well as application of intensified production methods and discouraging land fragmentation so as to increase output. Results on the effect of transitions on commercialization indicate the need to transform different agricultural systems so as to increase commercialization.

5.3 Policy Recommendations

Based on the findings from this study it is important for the respective County and National governments in Kenya to increase smallholder farmers access to support services such as; credit, extension services, education so as to improve their levels of market participation. Further; it is important to formulate and implement gender-sensitive policies that will appropriately address the challenges faced by each gender group. Additionally, these policies should be geared towards reducing the gender gap between male and female farmers. Female farmers' access to resources needs to be improved to increase productivity.

Access to productive resources demonstrated a positive influence on market participation hence there is need to increase farmers' access to these resources such as; land and inputs. Both farmers and financial institutions have a role to play in improving access to credit. For instance, financial institutions can employ strategies such as credit targeting and adoption of seasonal loans among financial institutions may help increase smallholder farmers access to

financial services. The former here refers to setting up a fund that is specifically meant for lending to agricultural activities, whereas the latter indicates creating loan products that are tailored to agricultural activities where the farmer makes seasonal payments. Additionally, farmers should be encouraged to seek for loans in groups since social capital is also considered as a form of collateral. This will help in increasing access to financial services especially among smallholder farmers with no collateral. However, it is important to uniquely employ these strategies meant to increase access to support services. For instance, there is need to redefine loan amounts to accommodate different farmer typologies. Further, financial institutions should create farmer accounts like the renowned business accounts whereby smallholder farmers' portfolio history can be determined using these accounts. Introduction of innovative ways of accessing information by the county governments and private extension agencies in dissemination of extension services can be an option in increasing the intensity of extension outreach to farmers. Incorporating Information Communication Technologies (ICTs) such as mobile phones, radio, and televisions in dissemination of agricultural information can greatly contribute to increasing farmers' access to information. This can be actualized by putting I place applications that farmers can use to access agricultural information. Also, informal sources of extension such as farmer to farmer should be encouraged. Due to increasing population pressure on land, it is impossible to increase land sizes among farmers. However, production intensification measures such as use of high yielding varieties and fertilizers need to be encouraged among farmers so as to increase output per unit area. An increase in productivity increases the quantity of marketable surplus among farming households.

Collective action is also found to affect choice of market channel; farmers should be encouraged to organise themselves in groups so as to increase their bargaining power and reduce exploitation by middlemen. Collective action also increases the amount of maize

available for sale, this gives farmer groups an opportunity to access high value markets that are normally interested in large quantities. There is also need to reorient the roles of farmer groups among smallholder farmers. Farmers need to be informed that their groups can be used for commercial objectives such as loans, savings, price negotiation apart from their usual festive orientation.

It is important to reduce the radius covered by farmers while accessing markets as this will improve commercialization trends. Additionally, the County as well as the National government should work together to ensure that infrastructure such as main and feeder roads are in good condition so as to increase farmers access to markets.

5.4 Contributions to Knowledge

This study showed the effect of gender and institutional support services on commercialization. It also highlighted the engendered nature of agricultural commercialization whereby some variables that affected MHHs did not affect FHHs in commercialization. Further, it contributes to literature on gender whereby it improves on previous research that focussed its gendered analysis on gender of the respondent rather than that of the decision maker. This study was also able to show various farm transitions over the past decade and their effect on commercialization decisions among smallholder farmers. It confirmed the gender disparities in terms of access to institutional support services and how these services affect commercialization. Further, it identified the effect of transitions on commercialization levels among smallholder farmers. These results can be used in terms of informing policies meant to increase smallholder farmers access to support services by making them gender sensitive. In addition to this, the results will be beneficial to both the County and National governments in terms of prioritizing policy meant to support transitions that support commercialization.

5.5 Areas for Further Research

Future research can focus on including plot level analysis in their research so as to better capture decisions of different farmer typologies at the plot level. This will improve the current results by highlighting the differences among female-managed and male-managed plots. Future research can also build on assessing impact of transitions basing their results on comparison of baseline data to current time data.

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APPENDICES

Appendix 1: Variance Inflation Factors

Variable (X_j)	VIF	Tolerance = 1/VIF
Distance to the market	1.67	0.60
Transport costs	1.65	0.61
Maize lost due to risk factor	1.39	0.72
Wealth index	1.37	0.73
Access to credit	1.34	0.75
Dependency ratio	1.30	0.77
Membership in group	1.30	0.77
Duration of stay	1.21	0.83
Trust in trader	1.12	0.89
Household type	1.09	0.92
Years of formal schooling	1.08	0.93
Poor prices	1.03	0.97
Mean VIF	**1.29**	

Appendix 2: Results of Hausman's Test for IIA

Omitted	chi2	df	P>chi2	evidence
2	-2.881	13	1.000	for Ho
3	-6.172	13	1.000	for Ho
4	2.894	13	0.998	for Ho

Ho: Odds (Outcome-J vs Outcome-K) are independent of other alternatives.

The test confirmed the validity of IIA assumption.

Appendix 3: Goodness of Fit Measures for Multinomial Logit

Log-Likelihood Intercept Only:	-235.317
Log-Likelihood Full Model:	-184.022
LR(36):	102.589
Prob > LR:	0.000
McFadden's R2:	0.218

The model fitted well with a McFadden's R^2 of 0.218 and prob>LR of 0.000

Appendix 4: Household Survey Questionnaire

UNIVERSITY OF NAIROBI

AN ANALYSIS OF GENDER AND INSTITUTIONAL DETERMINANTS OF SMALLHOLDER MAIZE FARMERS' MARKET PARTICIPATION DECISIONS IN TRANSITIONAL SYSTEMS IN WESTERN KENYA

MAY 2017

The University of Nairobi is carrying out research on Analysis of gender and institutional determinants of smallholder maize farmers' participation in markets in Western Kenya. The purpose of this study is to get views, experiences and suggestions of farmers on maize production, challenges involved, marketing of the produce and the different roles played by gender and institutional services in commercialization of maize. Respondents of this survey should be maize farmers who must be at least 18 years old. You have been randomly selected and your participation in this survey is voluntary. The findings of this study will be mainly used to inform policy on improving production and commercialization of maize along gender and institutional support services dimensions. The interview will require about 45 minutes to complete. I now request your permission to begin the interview. For further information please contact Dennis Etemesi on 0711861194

Respondent screening: Does your household **normally** grow maize? 0. NO_____ 1. Yes_____ . If **NO** terminate the interview

RESPONDENT ID.....

Enumerator Code..... Date of the interview.....

County (1=Trans-Nzoia, 2=Kakamega, 3=Bungoma)			
Sub-County (1=Kiminini, 2=Lugari, 3=Bungoma Central)			
Region (1= Rural, 2=Peri-urban)			
Location		Village	

1. Household Identification

Type of Household (1= Male Headed Household, 0=Female Headed Household)	
Name of the respondent	
Gender of the respondent (1=male 0= female)	
Relationship to household head? (1= hhold head, 2=spouse, 3=son/daughter, 4=son/daughter in-law, 5= grandson/daughter, 6= other (specify_____))	

2. LAND OWNERSHIP AND MAIZE PRODUCTION

What is the total land size owned during the last cropping season? (acres_____)

Plot ID	**Season** 1=long rains 0=short rains	**Plot in acres (cultivated)**	**Tenure of plot (**1=purchased, 2= Rent/leased, 3=inherited 4=gift 5=other,specify(_____)	**Who owns this plot:** (1=Male 2=Female 3=Both)	**Who mostly decides on the type of crops to grow:** (1=Male 2=Female 3=Both)	**Proportion of land under maize:** 1=25%, 2=50% 3=75%, 4=100%	**Do you Intercrop Maize with other crops:** 1= Yes 0=No	**If YES what crops:** 1=beans 2=soyabeans 3=ground nuts 4=cowpeas 5=other, specify(_____)	**Maize yield Quantity:** 1=90kg bag 2=70kg bag 3=50kg bag	**Unit**

3. INPUT USE (SEEDS)

Plot ID	**Season :** 1=long rains 0=short rains	**Variety of maize grown:** 0=local 1=improved 2=both	**Quantity of seeds used(kg)**	**Mode of acquisition:** 1=bought 0= non-bought	**If bought where is the source:** 1=agro-vets 2=seed company 3=open air market 4=Neighbour/other farmers 5=other, specify	**Mode of payment for the seed:** 1=cash 2=credit 3=both	**If non-bought:** 1=own saved 2=farmers to farmers exchange 3=gift from family/neighbour 4=other, specify	**Who decides on quantity to be bought:** 1=Male, 2=Female, 3=Both	**If bought:** How much did you pay per (Kg)	**Constraints faced in accessing seeds(rank 1 & 2):** 1= poor availability of improved seeds, 2=high prices of improved seed 3=presence of counterfeit seeds 4=poor quality seeds 5=other, specify	
										R1	**R2**

4. Did you use fertilizer during the last cropping season cropping (2016)? **1 Yes** **0 No** if **NO** skip to question 6

5. Fertilizer

Plot ID	**Season :** (1=long rains 0=short rains)	**Variety of maize grown:** 1=improved 0=local 3=both	**Type of fertilizer used :** (1=conventional 2=manure 3=both)	**Quantity of fertilizer used(kg) (**1=25kg bag 2=50kg bag 3=wheelbarrow 4=pickup 5=canter)	**Unit**	**Mode of acquisition :** 1=bought 0= non-bought	**If bought where is the source:** 1=agro-vets 2=trader/stockist 3=open air market	**Mode of payment for the fertilizer :** 1=cash 2=credit 3=subsidy 4=cash and subsidy	**If non-bought:** 1=own saved 2=farmers to farmers exchange 3=gift from family/neighbour	**Who decides on quantity to be bought:** 1=Male, 2=Female, 3=Both	**Constraints faced in accessing fertilizer (rank 1 & 2):** 1= poor availability of fertilizer, 2=high prices of fertilizer 3=Lack of credit to buy fertilizer 4=other, specify_____	
											R1	**R2**

6. Reasons for not using fertilizer? (1= expensive, 2= have fertile soils, 3= lack of accessibility, 4 = burns crops, 5. Other,specify_____)

7. Risks affecting maize production

Risk factor	**Did you encounter this risk factor in the last 5 planting seasons (**1=yes, 0=No**)**	**If yes how many times did it occur in the last 5 seasons**	**Did you put in place any strategies to prevent the risk factor before it happens (**1=Yes, 0=No**)**	**If YES What risk adaptation strategy did you put in place before risk occurrence:** 1=change crop varieties 2=early planting 3=crop diversification 4=Savings 5= change planting sites 6= increased seed rate 7=more of off-farm employment 8=None 9=other, specify	**Did you put in place any strategies to manage the risk factor after it happens (**1=Yes, 0=No**)**	**If YES What risk adaptation strategy did you put in place after risk occurrence** 1=change crop varieties 2=early planting 3=crop diversification 4=replanting 5=Migration 5= Borrowing 6= increased seed rate 7=more of off-farm employment 8=None 9=other, specify	**What proportion of maize yield did you loose due to this risk factors (**1=25%, 2=50%, 3=7%, 4=100**)**
Drought							
Too much rain/floods							
Crop pests/diseases							
Hail storms							
Theft of assets/crops							

8. Marketing

Did you sell maize after the last cropping season (2016)? (1=Yes, 0=No)____. If you sell please provide the details in the table below: ***if NO skip to question 9***

Type of market	Do you sell (1=Yes, 0=No)	Which of these market channels do you consider your **MAIN** marketing channel	Quantity of maize sold in during last season (1=90kg bag 2=70kg bag 3=50kg bag)	Unit	Price per Unit	Who is responsible for sale decisions (1=Male 2=Female 3= Both)	Period to payment after selling, weeks (zero if immediately)	Mode of payment: 1= cash 2= credit 3=both	Who transports maize to this channel: 1=Male 2=Female 3= Both)	Do you have a contract with the buyer of this channel: 1= Yes 2=No	If **YES** what are the terms of this contract: 1= Pay immediately 2= pay after some duration 3=advance of inputs + cash 4= Other, specify(_____)	Mode of transport to the market (1=bicycle, 2=hired truck, 3=public transport, 4= donkey, 5=back/head load, 6=wheelbarrow, 7= other (specify))	What quantities are transported per trip: (1=90kg bag 2=70kg bag 3=50kg bag)	transport costs	cess tax	Distance to the market from the household	Who decides on what is done with the market proceeds: (1=Male 2=Female 3= Both)
Farm gate																	
Institutional markets (schools, hospitals)																	
County government market																	
Brokers /middlemen																	
NCPB																	
Village market																	

9. What is the **main reason** for lack of market participation? (1=not enough to sell, 2=high marketing costs, 3=not interested, 4= Lack of buyers, 5=Poor prices, 6=Other, specfy_____-)

10. Did you get market information before you decided to sell the crop? (1=Yes, 0=No)

11. If ***yes*** was your **MAIN** source of information? (1= farmer coop/groups, 2=neighbor farmers, 3=seed traders/ agrovets, 4=research centre,

5=extension service, 6=radio/TV, 7=mobile phone, 8=other, specify)

12. Have you ever failed to sell maize due to lack of buyers? (1=Yes, 0=No)

13. Have you ever failed to sell maize due to poor prices? (1=Yes, 0=No)

14. Distance to the nearest MAIN MARKET from residence in (KM)_____

15. Number of months road to MAIN MARKET is passable by cars in a year_____

16. Average transport cost to and from the Nearest main market per person_____

17. Crop storage

Do you store maize after a season's harvest (1=yes, 0=No) if yes fill details in the table below:

Cropping season: 1=long rains 0=short rains	Quantity stored last season (1=90kg bag 2=70kg bag 3=50kg bag)	Unit	Method of storage (1=local granary, 2= modern store, 3=sacks, 4=wooden store) 5=other, specify	Duration of storage	Main purpose of storage (1= for food, 2=to get better price, 3=for seed, 4=Due to lack of buyers 5=other, specify_____)	Estimated quantity of storage loss (1=90kg bag 2=70kg bag 3=50kg bag)	Unit	Cause of storage loss(1=pest damage, 2=moisture loss, 3=rotting, 4=theft,5 other)	Storage control measure 1=none 2=chemical preservatives (actelic) 3=ash 4=smoking 5=other, specify

INSTITUTIONAL SUPPORT SERVICES

18. Social capital and credit access

Are you a member of any development group since 2014? (1= Yes 0= No) if **YES** please fill the details in the table below: If **NO** skip to Q.19

Type of group	Member to group(1=Yes, 0=No)	If yes duration of membership	If yes Who made the decision to join this development group: 1=Male, 2=Female, 3=Both	What is the most **(ONE)**important group function: 1=produce marketing 2=input access 3=savings and credit 4=farmer trainings 5=transport services 6=other, specify	Role in the group: 1=official 0=ordinary member	Are you still a member now: 1=Yes, 0=No	If **NO,** reasons for leaving group: 1=group was not profitable 2=poor mgt & corrupt officials 3=unable to pay annual subscription fee 4=group ceased to exit 5.=other, specify
Women group							
SACCO/credit group							
Farmer coops/input supply							
Producer and marketing groups							
Youth group							

19. If you are **NOT** a member of any development group/organization, why not? (1=Not available, 2=time wasting, 3=Doesn't want to be a member, 4=corruption in the group, 5=other, specify_____)

20. Duration of stay in the current village in years? .....

21. Number of traders you know who can buy your grain? .....

22. Generally speaking can you say that most traders can be trusted?

(1=strongly disagree, 2=Disagree, 3=Neutral, 4=agree, 5=strongly agree)

Extension services

23. During the last cropping season did you access extension services? (1=Yes, 0=No) if **YES** fill details in the table below

Source	Did you receive extension service from this source: (1= Yes, 0=No)	Frequency over the last 12 months	What kind of information did you receive from this source: 1=pests and diseases, 2=markets & prices, 3=government initiatives, 4= good agricultural practices, 5= other, specify(_____)	Was this information timely (1= Yes, 0=No)	Was this information reliable (1= Yes, 0=No)	Was this information helpful/relevant in your agricultural activities (1= Yes, 0=No)	Who requested for this information: 1=male 2=Female 3=both 4=extension/agent from source own intitative
Extension officer (govt)							
Researchers							
Farmer to farmer							
Farm Demonstrations							
Print media (magazines)							
Tv/radio							
Out grower (seed companies)							

Credit services

24. Have you ever applied for credit over the last three years? (1=Yes, 0=No) if **YES** in Q.24 please fill in the details in table below: **NO** skip to Q.25

Source of Credit	Did you get it. (1=Yes, 0=No)	**If YES** how was it received? 1=as a group, 2=Individual	**If YES** who applied for this credit: 1=Male 2=Female 3=Both	**IF YES** what proportion of the credit applied for did you get: 1=1/4, 2=1/2, 3=3/4, 4=all	**Main** use of credit: 1=farm inputs 2=school fees 3=food 4=land 5=livestock 6=offset a problem one had 7=other, specify_____	**Did you use ALL of this credit for the intended purpose:** 1= Yes 0=No	**If NO, how else did you use this credit:** 1=farm inputs 2=school fees 3=food 4=land 5=livestock 6=offset a problem one had 7=Farm implements/equipment 8=non -farm business/trade 9=buy livestock 10=other, specify_____	**If NO** why did you not get the requested amount(**MAIN**): 1=high default rate 2=lacked guarantors 3=didn't adhere to all requirements 4=lacked collateral 5=couldn't access lender 6=Age limit 7=don't know 8=Other(specify)	Have you started repaying this loan? (1=Yes, 0=No)	If **YES** What proportion have you repaid: 1=1/4, 2=1/2, 3=3/4, 4=all
Farmer group/cooperative										
Merry go Round										
Money Lender										
Bank										
Sacco										
Relative										
Neighbor/friend										
Other (pecify)										

25. If you did not apply for credit what was the **main** reason? (1=high interests rate, 2=lacked collateral, 3=too much paper work, 4=borrowing is risky, 5=expected to be rejected so I dint try it, 6=fear loans, 7= I don't need it 8. Other. Specify_____)

26. FARMING TRANSITIONS

To what extent do you agree with the following statements regarding transitions over the past decade? (***Recall from 2007***)

TRANSITIONS	**Do you agree with this statement:** 1=Yes 0=No	**To what extent do you agree with this statement:** 1=strongly agree 2=Agree 3=Slightly agree 4=Disagree	**What implications have these changes had in your farming and livelihood:** 1=improved 2= None 3=decreased	**In your opinion who has this change affected the most:** 1=male 2=Female 3=Both equally
It is easier to transport commodities to the market				
It is easy to obtain market information before sale of products				
Sizes for cultivated lands have increased				
Sizes of cultivated lands have decreased				
Access to credit services has improved				
Farmers have sought alternative income generating activities apart from agriculture				
Accessibility to all weather roads has improved				
Devolution governments have improved access to markets				
Access to extension services has improved				
It is easier to acquire farming inputs and implements				
Number of maize selling outlets has increased				
Number of farmers selling maize has increased				
We have more women participating in agricultural markets for maize				

27. HOUSEHOLD ASSET OWNERSHIP

ASSET NAME	DO YOU HAVE THIS ASSET (1=Yes 0=No)	NUMBER CURRENTLY OWNED	CURRENT VALUE (KSHS)	WHO decides its use(1=Male, 2=Female, 3=both)
1.Ox-plough				
2.Ox-cart				
3.radio				
4. television				
5. Mobile phone				
6. wheelbarrow				
7.Mortocycle				
8. pick-up				
9.machete				
10.hoe				
11. car/pickup				
12tractor				
13slasher				
14Spraypump				
15.Shovels				

SOCIO-DEMOGRAPHICS

28. Respondent's MAIN occupation? (1=farmer, 2=civil servant, 3=student, 4=teacher, 5=trader, 6=tailor, 7=bodaboda, 8=casual labourer (Juakali), 9=other, specify_____)

29. Respondents age in years?_____

30. How many people live and depend on the household for food on a daily basis?_____

31. Number of years of formal schooling for respondent _____

THANK YOU FOR YOUR TIME.