ECONOMIC ANALYSIS OF SMALLHOLDER FARMERS' PARTICIPATION IN DOMESTIC HIGH-VALUE MARKETS FOR INDIGENOUS VEGETABLES IN SIAYA COUNTY, KENYA

By

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DECLARATION AND APPROVAL

Declaration

This thesis is my original work and has not been presented in any university for the award of a degree.

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DEDICATION

This work is dedicated to my lovely parents Mr. and Mrs. Ogweno for the encouragement and support. I dedicate it to my wonderful family and friends for their prayers and motivation.

ACKNOWLEDGMENT

First, I acknowledge God for giving me the strength, knowledge and wisdom to pursue this degree in Agricultural and Applied Economics as well as giving me endurance to withstand the challenges, which I came across.

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ABSTRACT

Supermarkets and other high value markets are rapidly expanding, offering lucrative prices for suppliers of fresh produce. Participation in high value markets holds potential for raising smallholder farmers' income and reducing poverty in rural areas. However, access to such markets has been a challenge to many smallholder farmers. Despite a growing literature on farmers' participation in supermarkets, there is limited documentation on the analysis of smallholder African Indigenous Vegetables (AIVs) farmers' involvement in Kenya. Besides that, there is no literature on other emerging high value domestic markets such as hospitals, schools and hotels. In order to address this knowledge gap, this study examined the factors that influence smallholder AIVs farmers' participation in such markets in rural Kenya. In order to address this knowledge gap, the present study analyzed data from a random sample of 150 AIVs farmers in Siaya County, Kenya. Descriptive methods were used to characterize smallholders while a binary logit model was applied to assess factors that influence market participation. The results showed that production is dominated by female farmers using conventional farming methods and inputs. The traditional marketing system is dominant with less than 13% of the farmers selling their vegetables to high value markets. The results of the logit model show that the years in formal education, household income, price, output and access to credit had a positive and significant influence on farmers' participation in high value markets. However, distance had a negative influence on market participation. Based on these findings, the study recommends policy interventions targeting investments on access to non-restricted credit especially from group-based informal member schemes. Moreover, interventions targeting enhanced access to better production technologies of AIVs would be a milestone in improving quality and quantity of output.

Key words: AIVs; smallholder farmers; high value markets; Kenya.

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LIST OF ACRONYMS

AERC	African Economic Research Consortium
AIVs	African Indigenous Vegetables
AVRDC	Asian Vegetable Resource and Development Centre
EPZ	Export Processing Zone
FAO	Food and Agriculture Organization of the United Nations
FGD	Focus Group Discussion
FFVs	Fresh Fruits and Vegetables
GDP	Gross Domestic Product
GoK	Government of Kenya
HCDA	Horticultural Crops Development Authority
IAAE	International Association of Agricultural Economists
IPGRI	International Plant Genetic Resource Institute
KAPAP	Kenya Agricultural Productivity and Agribusiness Project
KHCP	Kenya Horticultural Competitiveness Project
KNBS	Kenya National Bureau of Statistics
MoA	Ministry of Agriculture (Kenya)
PAI	Population Action International
SSA	Sub-Saharan Africa
USAID	United States Agency for International Development

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Kenya's horticultural industry is among the leading contributors to the agricultural Growth Domestic Product (GDP) at 36% per annum, with an average growth of 15-20% per annum (Republic of Kenya, 2012). Close to 4.5 million people are employed by the sector directly in production, processing and marketing. It also provides raw materials to the agro-processing industry (Horticultural Crop Development Authority (HCDA), 2009). The sub sector is ranked third in terms of foreign exchange earnings after tourism and tea (United States Agency for International Development (USAID), 2012).

Kenya's tropical and temperate climate is conducive for the production of a wide variety of fruits, vegetables and flowers, with vegetable production registering the highest growth (HCDA, 2009). Fruit and vegetable production is dominated by smallholder farmers who account for 80%. Flower production is dominated by medium and large scale producers who account for 72% of the output. The flowers produced are mainly for export, while the fruits and vegetables are mostly for local consumption with a few for export. According to the Republic of Kenya (2012), only 4% of the horticultural produce is exported.

Tschirley et al. (2004) argue that though the export horticulture market is substantial and important, the domestic market is much larger, affects more people and has shown more absolute growth. The domestic market value for all fresh fruits and vegetables (FFVs) in

Kenya has been estimated to be four to five times greater than the value in international export markets (USAID, 2013). However, the export market has been given far much attention than the domestic market in terms of research and support mechanisms due to foreign exchange earnings (Tschirley and Ayieko, 2008).

Indigenous vegetables commonly referred to as AIVs have become an important aspect of Kenya's horticultural production because of their nutritious and medicinal value. According to the International Plant Genetic Resource Institute (IPGRI, 2004), AIVs have 13 times more iron and 57 times more vitamins than exotic vegetables. They are also easily accessible and provide millions of consumers with healthy nutrients such as vitamins, minerals, anti-oxidants and even anti-cancer factors needed to maintain health (Abukutsa, 2007).

Production of AIVs supports about 60% of rural households with food and as a source of income (Muhanji et al., 2011). The most popular AIVs produced and marketed in Kenya are Amaranthas, Nightshade, Spider plant, Cowpea and *Crotalaria* referred to in the various local languages as *Terere, Managu, Sergeti, Kunde* and *Mitoo,* respectively (Irungu et al., 2007; Maundu et al., 1999). Due to increased awareness of healthy food habits among households, demand for AIVs has considerably increased in both formal and informal markets (Ngugi et al., 2007). However, the supply has not kept pace with the rising demand.

In addition, there has been an emergence of domestic high value markets for fresh produce. These markets offer higher prices compared to traditional markets; the most common one being supermarkets. For instance, over a decade ago, Neven and Reardon (2004) observed that supermarkets were growing at an annual rate of 18% and had gained a 20% share of

urban food market. Generally, supermarkets create a reliable, fast growing, year-round market for producers and could become major contributors to the successes in African agriculture (Gabre-Madhin and Haggblade, 2003). Other high value markets like hotels, schools and hospitals have also sprang up in rural and urban areas creating market for suppliers of fresh produce. However, a majority of smallholders have not taken up the initiative to supply their vegetables in such markets. Haggblade et al., (2012) note that in the domestic market, 55% of FFVs produced by smallholder farmers are sold to open air markets, while 33% to kiosks and groceries; only 4% is supplied to supermarkets and other high value markets.

The USAID (2013) notes that the dominance of the traditional domestic marketing system is as a result of constrained production. Smallholder farmers are faced with various challenges in the production of AIVs. One of them is climate change that has resulted to inconsistent weather patterns and consequently led to fluctuation of output price. In addition to this, other challenges such as information asymmetry, lack of access to credit facilities, poor handling of produce and poor infrastructure have constrained the production capacity of smallholders. The farmers have therefore failed to reap the potential income from the sale of AIVs. Unless proper strategies are put in place to manage these challenges, the competitiveness of smallholder farmers in high value markets would be impeded (Asian Vegetable Resource and Development Centre (AVRDC), 2006).

1.2 Statement of the Research Problem

High value markets offer higher prices on comparable terms to traditional markets in the domestic arena. Smallholders' access to high value markets would be an incentive to shift from subsistence to commercial farming. However, rural smallholder farmers have not taken up the initiative to supply their AIVs to the domestic high value markets. Instead, well developed private companies have profitably managed to supply fresh produce in domestic high value markets. For instance, Ngugi et al. (2007) found that the '*Fresh an Juici'* company had been contracted by major supermarket stores in Kenya to supply fresh produce. Neven et al. (2006) adds that supermarkets have had more benefits for urban consumers (in terms of variety, consistent supply, safer and higher quality food), but the net effect on rural producers is minimal. The result of these being high rates of poverty and food insecurity among the producers.

Previous studies on the domestic high value markets in Kenya have highlighted on how production and marketing system can be improved, its competitiveness, challenges, opportunities and lessons for the future (Neven and Reardon 2004; Tschirley et al., 2006; Neven et al., 2009). There exists literature on the rise and expansion of supermarkets, present opportunities for growth and the share they are gaining in the agribusiness sector. The literature points out on the complexity of supermarkets' procurement system, desired high quality of produce and the provision of income opportunities for farmers who participate in the supply chain (Neven et al., 2006; Ngugi et al., 2007; Rao et al., 2012). However, the studies have over emphasized on participation in supermarket channels but none of them has discussed other emerging high value markets like hotels and schools

(Neven and Reardon, 2004; Rao and Qaim, 2010). Further, none of these studies has analyzed factors that influence smallholder farmers of AIVs participation in such markets.

There is literature on socio-economic characteristics of smallholder farmers of AIVs in Kenya (Mwaura et.,al 2013). However, there is limited information on the production and marketing characteristics of smallholder farmers. Understanding smallholder farmers is a crucial point in coming up with key interventions that facilitate production. To the best of my knowledge, there is no study that has been carried out on how smallholder farmers market AIVs in Siaya County. This study aims at contributing to the aforementioned knowledge gaps by analyzing factors that influence smallholder participation in high value markets for AIVs.

1.3 Objective of the Study

The main objective of this study was to analyze smallholder farmers' participation in the domestic high value markets for indigenous vegetables in Siaya County, Kenya

The specific objectives were:

i. To characterize production and marketing of AIVs by smallholder farmers
ii. To determine factors that influence smallholder farmers' participation in the domestic high value markets for AIVs

1.4 Research Hypothesis

H_o: $B_n = 0$

H_1: $B_n \neq 0$

H_o is the null hypothesis to test whether the independent variables (B_n) have no significant effect on the dependent variable (high value market participation). H_1 is the alternative that will be accepted in case the variables have a significant effect. The symbol ≠ denotes that the significance can be two-sided; a positive or a negative. The hypothesis was based on what previous studies on determinants of market participation have revealed. Socio-economic, farm-level and institutional factors have been identified to influence market participation. Socio-economic factors include gender, age, education and household income. On the other hand, farm level factors include farm size, farm output and distance of the farm from the market. Lastly, institutional factors include output price, access to extension services, access to market information, membership to a group and access to credit facilities. This study will empirically test the influence of some of these variables on market participation.

1.5 Justification of the Study

The study provides important information on the production and marketing characteristics of smallholder farmers of AIVs in rural Kenya. It also gives an insight on the factors that influence their participation in the domestic high value markets for AIVs, challenges and opportunities. This information will benefit various stakeholders along the AIVs value chain. Most importantly, it may provide vital information to smallholders on the needs of the domestic high value markets in terms of meeting required quality standards. This will enable them improve on their production, hence increase returns from the sale of their produce. The United Nations (UN) Sustainable Development Goal (SDG) number one is to eradicate poverty; improving farmers' income would be a milestone in achieving this goal.

According to Republic of Kenya (2012) close to 85% of FFVs consumed in rural areas (Siaya county included) is sourced from neighbouring counties. This shows that there is a big market opportunity for locally produced FFVs. The information from the study could assist the government to manage the challenges faced by smallholder farmers in marketing AIVs. This would help in coming up with interventions that can improve the domestic marketing system. Expanding the domestic market for fresh produce can assist smallholder farmers transform their production into profitable enterprises.

The study can also benefit organizations undertaking projects on improving production and market access of AIVs in Kenya with relevant information. For example, the Kenya Horticultural Competitiveness Project (KHCP) that was initiated by the USAID in 2012 and the Kenya Agricultural Productivity and Agri-business Project (KAPAP) that was initiated by the World Bank in 2005. The information from this study could assist such organizations in coming up with new strategies for improving production and marketing of AIVs in future projects.

1.6 Study Area

Siaya county as shown in Figure 1 was chosen as the study area with an emphasis on three Sub Counties namely; Bondo, Gem and Rarieda. According to the 2009 Kenyan census, the area has a population of 885,762 people. The area was specifically chosen because it is characterized by high production of AIVs due to its proximity to Lake Victoria and River Yala. The area experiences a modified equatorial climate with two rainfall seasons; annual rainfall of between 1170mm and 1450mm with relatively high temperatures ranging from 15-30^{0}C. The United Nation's Food and Agriculture Organization (FAO, 2007), notes that

AIVs thrive best in an environment with mean temperatures ranging from 15^0C to 31^0C. Thus, the climatic conditions in Siaya County are conducive for the production of AIVs.

The effects of climate change have been greatly felt by households in the area, for example, drastic reduction in Lake Victoria's water levels. In addition, overexploitation of fish resources has led to a decline and depletion of fish stocks; the result being high rates of poverty and food insecurity (Population Action International [PAI], 2012). It is estimated that 38% of the population lives below the poverty line (Kenya National Bureau of Statistics [KNBS], 2012). As a result, most of the households have resorted to production of AIVs in order to sustain their livelihoods. The Republic of Kenya (2012) documents that the area is characterized by small-scale vegetable farmers vulnerable to environmental degradation and climate change.

The County is ranked 17^{th} in terms of infrastructure development, about 51% of the roads in the region can be termed as good/fair (Republic of Kenya, 2012). The existence of good infrastructure has made transportation of commodities easier. In addition, there are ongoing projects like KAPAP and KHCP in the region that are striving to enhance marketing of AIVs by smallholder farmers. There also exists a processing factory for AIVs in the area that was set up to improve the shelf life of the vegetables through value addition. Unfortunately, it has failed to achieve its goal because it requires substantial capital investment and skilled labour which the area lacks. Poor management of the processing plant has also partially contributed to its collapse.

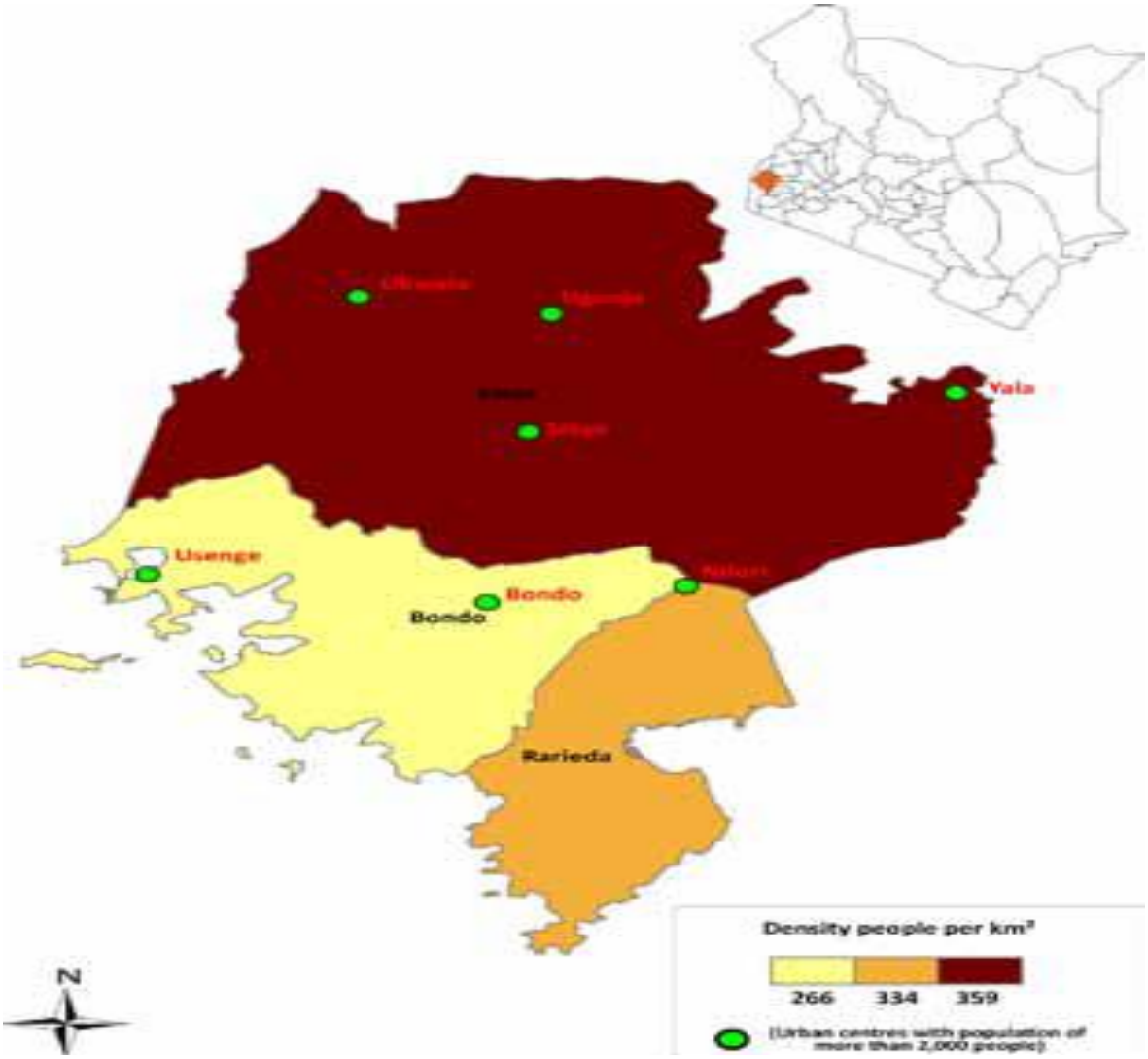

Figure 1: Map of Siaya County

Source: Republic of Kenya (2013)

1.7 Organization of the Thesis

Chapter one provides an overview of the role of horticulture as a sub-sector in agriculture and the importance of AIVs production as its component. It also provides an insight on various domestic markets and their significance in eradicating poverty among smallholder farmers. The problem being investigated, objectives to be achieved and importance of the

study are also discussed here. Chapter two entails a review of literature on AIVs production, consumption and value chain dynamics. Studies on market participation have also been reviewed in this chapter. Chapter three includes a detailed discussion of the conceptual and theoretical framework on which the study is based. Sampling procedure, data collection methods as well as analysis methods are also described here. Chapter four presents the results followed by chapter five that highlights the main conclusion and policy recommendations.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Trends in AIVs Production and Consumption

Over the last decade, in Sub-Saharan Africa (SSA), a number of research and development initiatives have been conducted on AIVs. In the context of environmental sustainability, food security, poverty eradication, health and nutrition, the interest on AIVs production is likely to continue growing in the coming decades (AVRDC, 2006).

Globally, AIVs production is based on conventional traditional production practices; very few producers apply recommended agricultural practices such as improved seed varieties, irrigation and integrated pest management (Chagomoka et al., 2014). Production of the vegetables is carried out in rural and peri-urban areas of most cities. For instance, AIVs are produced in peri-urban areas in cities like Accra (Ghana), Yaoundé (Cameroon), Kampala (Uganda), Abidjan (Côte d'Ivoire), Nairobi (Kenya) and Cotonou (Benin) (Gockowski et al., 2003). However, in a city like Dar-es-Salaam (Tanzania) AIVs production is done within the urban areas.

The species of AIVs produced varies across regions and countries due to differences in culture and ecology. Some species may therefore have widespread geographical distribution and could be important food to some communities but deemed inedible by others (Maundu and Imbumi, 2003). In West and Central African countries, the most common and popular AIVs are pumpkin leaves and wild spinach; in East and Southern Africa the African nightshade and spider plant predominate (Shackleton et al., 2009). In

Kenya, the most popular varieties are African nightshade, cow pea, amaranth and spider plant (Abukutsa 2006; Mwaura et al., 2013).

Despite the existence of diverse varieties of AIVs in SSA, a general decrease has been observed in their production; Kenya is no exception. Muhanji et al. (2011) argues that the annual supply of 2500 tonnes of AIVs cannot meet the annual demand of 3600-4500 tones. Inadequate production technologies affect the quantity and quality of output and consequently low supply of AIVs. In addition to this, critical bottle necks that hamper the growth of AIVs should be dealt with. Among them include; lack of access to high quality seeds, high perishability and post-harvest losses, weak linkages between supply chain actors, lack of reliable market information and support systems and lack of mechanisms to set prices (Lenne and Ward 2010; Lyatuu et al., 2009). Schippers (2000) highlights that most of the studies on AIVs have focused on production and commercial importance, while less comprehensive data is available on consumption. Therefore, very little is known about the actual quantities of AIVs consumed.

Shackleton et al. (2009) notes that since AIVs are considered as a relish and are always a side dish accompanying other food (mostly starchy), the amount consumed can be rather small. For example, in Tanzania, it was estimated that on average, about 270g of vegetables was consumed per person per day in two rural and one urban district (Keding et al., 2007). However, Maundu (1997) emphasizes that with urbanization, AIVs consumption in African societies has undergone substantial changes. These changes will be rapid as long as growth of urban cities continues to escalate. In SSA, urbanization continues to register the highest levels worldwide (World Bank, 2005). As depicted in Figure 2, consumption in different African countries is higher in urban compared to rural areas although the differences are

relatively small; except in Burundi and Kenya, where vegetable consumption in urban areas seems particularly high (Ruel et al., 2005). Kaplinsky (2000) suggests that the link between production and consumption of most commodities can be explained better by a value chain framework.

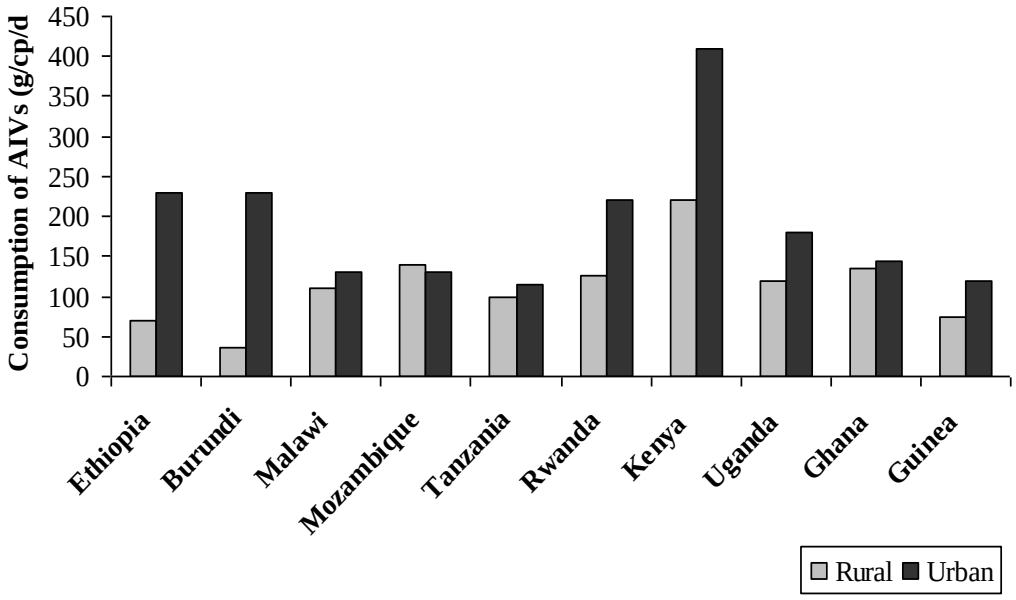

Figure 2: Vegetable Consumption of AIVs in Africa's Rural - Urban Areas

Source: Ruel et al. (2005).

2.2 Value Chain Dynamics for AIVs

A value chain comprises the full range of activities and services required to bring a product or service from its conception to sale in its final markets. According to Kaplinsky and Morris (2001), it comprises the different phases of production (involving a combination of physical transformation) by various service providers and delivery to the final consumer. The value chain can also be described as the quality enhancement of a product at different stages of transfer. The ultimate goal is to deliver maximum value to the end user for the least possible total cost. Chagomoka et al. (2014) observed that though AIVs have a high

market potential, less attention has been given to their value chains. There is therefore need to understand the interactions among various actors along the AIVs value chain. These interactions could assist in coming up with cost effective ways of adding value to AIVs hence improve marketing efficiency.

The concept of value chain provides a useful framework to understand and link all the steps in production, transformation and distribution of a commodity or a group of commodities. According to Bolwig et al. (2008), value chain analysis requires the assessment of the types and locations of all the actors in the chain, the linkages between them and the dynamics of inclusion and exclusion. Moreover, value chain analysis has been used to identify relevant stakeholders for planning and formulation of policies and programs. It has also been used to identify enterprises that contribute to production, services and required institutional support (Baker, 2006).

This study adopted the generic definition by Kaplinsky and Morris (2001) and contextualized AIVs value chain as the full range of activities required to bring AIVs to final consumers. The AIVs value chain in Kenya has been distinctively mapped with various actors, activities and linkages. Generally, AIVs are characterized by minimal utilization of inputs (Muhanji et al., 2011). Very few purchased inputs are used (especially agrochemicals) because the vegetables are less susceptible to attacks by pests and diseases compared to exotic vegetables. Abukutsa (2007) states that there are no adequate input suppliers especially for seeds. Thus, the seed support system for AIVs is informal and constitutes production from farmers' own fields or from open air markets within the locality.

Weinberger and Msuya (2004) state that smallholder farmers are important actors in the value chain hence should not be underestimated. This is because in SSA, more smallholders may be cultivating AIVs than commercial producers. For example, in Tanzania, 40% of smallholder farmers are engaged in the cultivation of AIVs, while only 25% of large-scale farmers are engaged in cultivation. In Kenya, HCDA (2009) noted that 80% of FFVs in Kenya are produced by smallholder farmers thus they are prioritized when it comes to production interventions

AIVs are distributed through formal and informal markets which are both relevant to all value chain actors. According to Muhanji et al. (2011), formal markets are those with formalized transaction systems and clear market institutions such as supermarkets, institutions and hotels. Informal markets on the other hand are undesignated areas near farming communities or in peri-urban areas where door to door and roadside markets exist. They are characterized by several market players, lacking market information and formal market institution with very few or no transaction documents. Important to note is that informal markets are major outlets for AIVs in Kenya. Haggblade et al., (2012) note that 55% of FFVs produced by smallholders are sold to open air markets, 33 % to retail kiosks; only 4% find their way to supermarkets and other high value markets. Dijkstra et al. (1999) explains that the FFVs domestic market is served by various channels because the market is vertically disintegrated. Disintegration occurs when existing actors transfer functions to new actors specializing in these functions. Professional traders then enter the channel acting as mediators between farmers and consumers who then differentiate into wholesale and retail traders. Moreover, smallholder farmers mostly prefer transferring functions to wholesalers and retailers because distribution and transaction costs are too high.

Farmer groups have become an important component of the value chain. Karanja et al. (2012) concurs that groups are essential for farmers in terms of capacity building. Moreover, the groups provide mechanisms for information sharing and facilitate access to financial services for savings and credit. Processing of the vegetables is minimal because of the complexity of equipment required. However, the processing capacity in Kenya has yielded products such as *simshade, simco and simama.* These contain a mixture of simsim and nightshade, cowpea and amaranthus respectively (Ayua and Omwara, 2013; Habwe and Walingo, 2008). Constraints such as high fertilizer prices, poor seed quality, lack of access to credit to acquire inputs, drought, pests and low soil fertility continue to strain the production capacity of AIVs (Weller and Simon, 2014). The AIVs value chain is as illustrated in Figure 3.

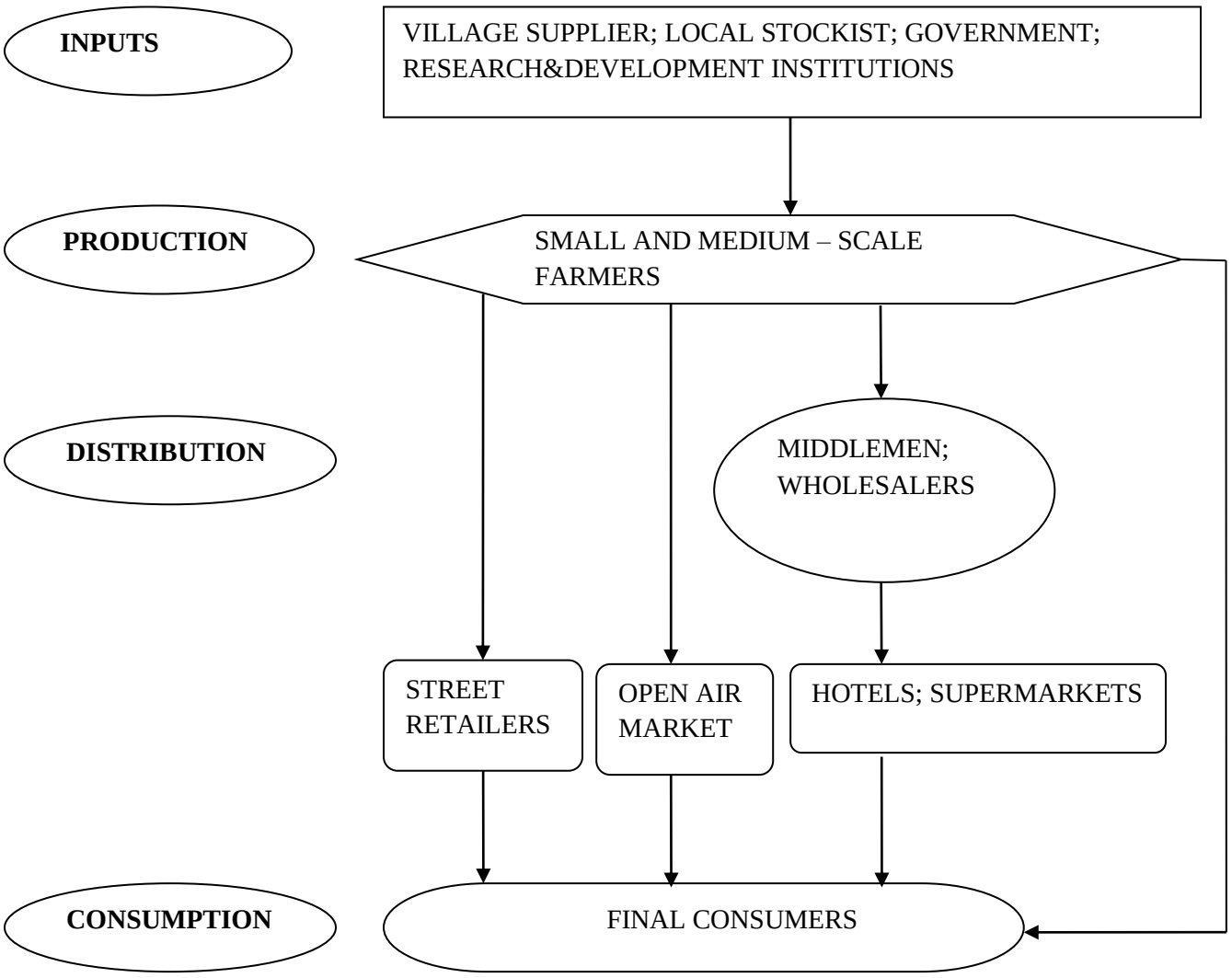

Figure 3: AIVs Value Chain Map

Source: Chagomoka et al. (2014).

2.3. A Review of Knowledge Gaps on AIVs

Several issues regarding AIVs in Kenya have been assessed. For instance, the issue of increased consumption of AIVs by households due to their nutritional and medicinal value has been captured (AVRDC, 2010). The priority species of AIVs produced and marketed in Kenya have been mentioned. The major production constraints especially the poor seed support system has also been discussed (Abukutsa, 2007; Irungu et al., 2007; Maundu et al., 1999). On issues of gender, the contribution of AIVs on well being of households has also been documented (Mwaura et al., 2013). There is also a description of a few processing and preservation methods of AIVs (Ayua and Omwara, 2013; Habwe and Walingo, 2008). However, there exists very little information on the marketing of AIVs.

For example, Ngugi et al. (2006) in a study seeking to analyze access to high value markets by smallholder farmers of AIVs in Central Kenya used a cost benefit analysis. The study concluded that farmers selling their vegetables in high value markets make between 30% and 70% more profit compared to farmers selling in the local markets. Also farmers who are members to farmer groups realize high margins than the non-group members. However, the study was a descriptive one with more emphasis on farmer groups as the major determinant of market access and participation. The current study included other determinants of market participation in scientific literature such age, gender, distance to market, household income and farming experience (Otieno et al., 2009; Moyo, 2010; Gani and Adeoti, 2011).

Otieno et al. (2009) also did a study on market participation by vegetable farmers in Kenya. The study concluded that price significantly motivates farmers to increase percentage of

vegetable output sold in both rural and peri-urban areas, while geographical distance reduces the percentage of vegetable output sold. Although the study highlighted various aspects of vegetable market participation, it was not clear to what extent it influenced AIVs since other vegetables like kales and tomatoes were included. The current study endeavoured to specifically analyze the determinants of market participation for AIVs.

Rao and Qaim, (2011) in an effort to determine the impact of supermarket revolution on poverty among vegetable farmers in central Kenya used an endogenous switching regression. The study found that those farmers who supplied to supermarkets had higher incomes compared to those who used other market channels. The analysis however focused on both exotic and AIVs thus it is not clear which of the vegetables benefited from supermarket sales.

Other studies that have analyzed determinants of market participation include; Alemu et al. (2011) who conducted a study on the determinants of vegetable channel selection in Ethiopia. The results revealed that the longer the distance to the capital city the more the involvement of vegetable growers on open markets in the nearest market centers. Gani and Adeoti (2011) also analyzed market participation and rural poverty among farmers in Nigeria. The results of the logit regression showed that market information, output size, extension visits, family size, education level and co-operative membership were positive and significant in explaining market participation. Distance to the market had a negative but significant influence on market participation. The study however was not specific to any crop as it analyzed market participation in general.

Despite the many studies on AIVs in Kenya, there is still a lot to be covered. For instance, there is still missing information on the factors that influence smallholder farmers' participation in high value markets. This is the gap that this study sought to fill.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Conceptual Framework

Access to high value markets has been a major challenge to many smallholder farmers of AIVs. As illustrated in Figure 4, participation in these markets is dependent on institutional, socio-economic and farm level factors.

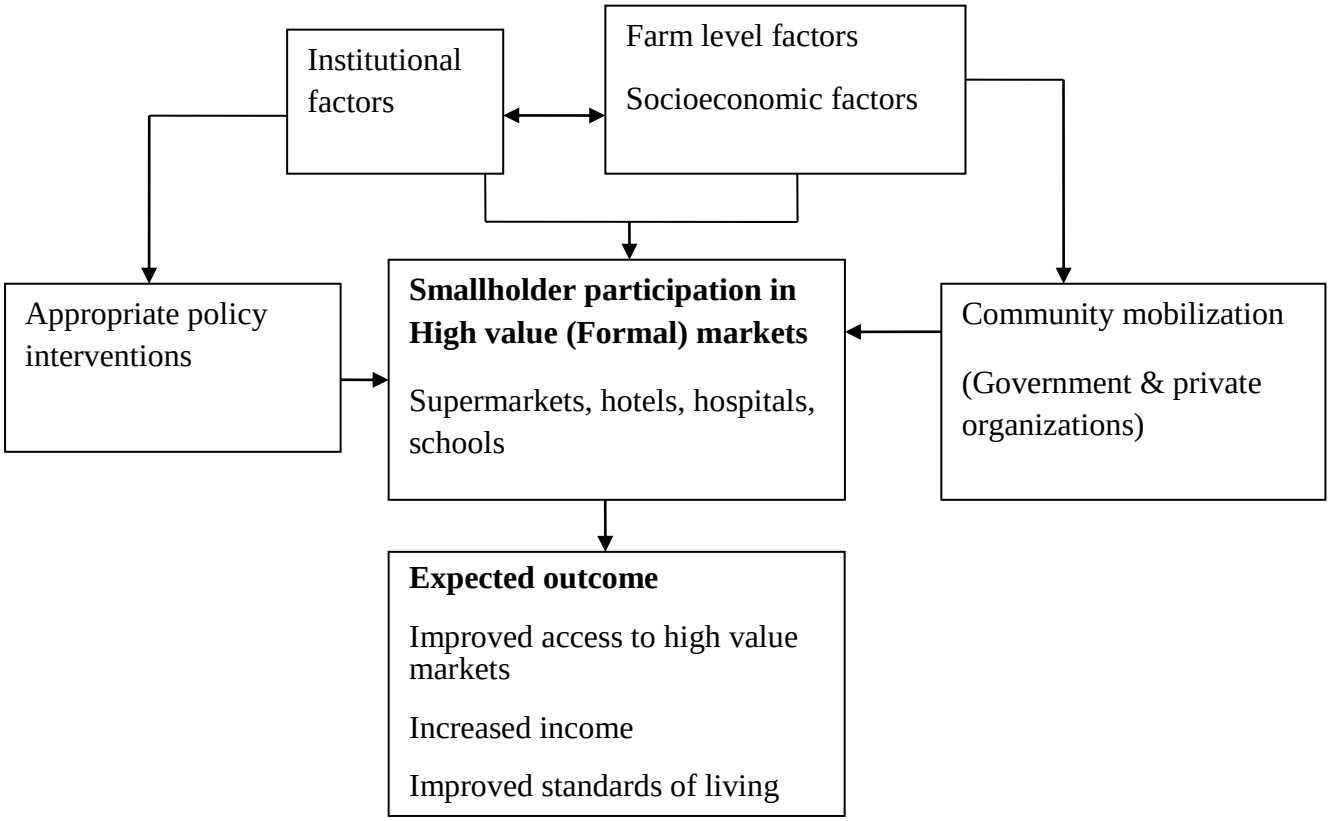

Figure 4: Conceptual Framework of Smallholder Farmers' Market Participation

Source: Author's Conceptualization

As discussed in Chapter 1, there has been rapid expansion of high value markets in rural areas that offer lucrative prices for suppliers of FFVs. The research issue is that smallholder farmers have not taken up the initiative to supply their vegetables to these markets. Their

participation is influenced by institutional, socio-economic and farm level factors. According to Ellis (2000), institutional factors are an important consideration as they explain why households behave differently. They include price, access to credit facilities, market information, membership to a group and extension services. Mwaura et al. (2013) notes that socio-economic factors are those individual attributes that help households become more productive and enhance marketing of AIVs. They can be categorized as physical capital and human capital, they include; income, age, gender, household size, education and farming experience. On the other hand, farm specific factors are those linked directly to the farm such as farm size, output and distance to market.

It is therefore important for interventions to be made to ensure smallholder farmers are included in these profitable chains. This will boost their returns hence an improvement in their standards of living. Appropriate policy interventions need to target institutional factors to improve smallholder farmers' participation in high value markets. Community mobilization influences socio-economic and farm level factors that could motivate smallholder farmers' participation.

3.2 Theoretical Framework

The study is based on the random utility model (RUM), which is founded on the assumption that an individual will make a choice that yields the highest utility (Greene, 2002). We can assume that a farmer *i* chooses from a set of mutually exclusive marketing outlets for his/her vegetables, $j = 1, 2\ldots\ldots n$. The farmer obtains a certain level of utility (U_{ij}) from each alternative outlet chosen. The principle underlying the farmer's choice is that he/she chooses the outcome that maximizes the utility. The farmer will therefore make profit based on the utility achieved by selling vegetables to a certain marketing outlet.

We do not observe the farmer's utility, but instead observe some attributes of the alternatives from the decision he/she made. A farmer with specific attributes therefore associates an average utility level with each alternative market outlet choice. The farmer's attributes may be socio-economic, physical, technical plus institutional factors. Hence, the utility is decomposed into two distinct parts; deterministic (V_{ij}) and random (ε_{ij}) components;

$$U_{ij} = V_{ij} + \varepsilon_{ij} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Since ε_{ij} is not observed, the farmer's choice of a marketing outlet cannot be predicted exactly. Instead, the probability of choosing any particular outlet is derived. We cannot observe directly the utilities but the choice made by the farmer reveals which one provides the greatest utility (Greene, 2000). A farmer will therefore select a market outlet $j = 1$ if;

$$U_{ik} > U_{ij} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

Where U_{ik} denotes a random utility associated with the market outlet $j=k$

3.3 Sampling Procedure and Data Collection

A multistage sampling technique was used because of its advantage of greatly reducing the variation of the estimate while collecting less data (Allen et al., 2002). Siaya county has seven Sub counties and the production of AIV's has been a widespread activity in the area. Three Sub counties Ugenya, Bondo and Gem were purposively chosen based on the following criteria; (i) AIVs are intensively grown by households (ii) There were ongoing projects to enhance production and marketing of the vegetables (iii) Farmers are selling the vegetables as an income generating activity. Each Sub county is further demarcated into administrative units known as Divisions. The sampling was done in three stages, first, in each Sub county, the Divisions where AIVs producers are concentrated were identified by the help of government extension staff. In the second stage, farmers who sell their produce in various

markets, both informal and formal were obtained. In the last stage, farmers were randomly selected for interviews.

According to Israel (1992), there are three methods that can be used to determine a sample size for a study; (i) using a census for a small population, (i) calculation using a formula based on a population (iii) imitating the sample size of similar studies. Consistent with previous studies on market participation, this study used a sample size of 150 (Chalwe, 2011; Moyo, 2010; Baloyi, 2010; Gani and Adeoti, 2011). The sample size was used because carrying out a census was costly and time consuming while calculation required a population whose information was unavailable and unclear. The sample size was distributed among the three Sub counties that were chosen depending on the intensity of vegetables as grown in the area.

The study used both primary and secondary data. Primary data was collected using structured questionnaires by conducting face-to-face interviews with the sample of smallholder farmers growing indigenous vegetables (*see Appendix 1*). A focus group discussion (FGD) was carried out with key informants and various actors along the indigenous vegetable value chain (*see Appendix 2*). These included representatives of farmer groups, supermarkets, hospitals, hotels, schools, market vendors and government extension staff. Secondary data was obtained from the MoA offices in the region, HCDA and the USAID that has carried out projects (KHCP) in the area since 2003 to help identify smallholder farmers of AIVs.

3.4 Data Analysis

The questionnaire data was captured in SPSS and Microsoft Excel. Descriptive and econometric analysis were undertaken on the data using STATA version 11 and SPSS Version 16 computer packages. The data from the FGD was analyzed qualitatively.

The first objective of the study was achieved using descriptive statistics to characterize general socioeconomic, production and marketing characteristics as well as the constraints faced by farmers. This involved the computation of means, frequencies, and percentages that were presented in charts, tables and graphs.

Smallholder participation in high value markets was estimated using the binary logit model. This answered the second objective of the study.

3.4. 1 Diagnostic Tests

A number of diagnostic tests were performed,these are described below.

3.4.1.1 Multicollinearity

Multicollinearity is a high degree of linear dependency among independent variables. It occurs when a large number of independent variables are incorporated in a regression model some of which might have the same effect on the dependent variable (Wooldridge, 2002). Multicollinearity causes coefficients of independent variables to have high standard errors and low significant levels. As a result, the coefficients may have a wrong or implausible magnitude thus cannot be estimated with accuracy (Greene, 2000). In this study, it was tested using the variance inflation factor (VIF). Following Gujarati (2004), VIF was calculated as follows;

VIF= 1/ (1-R_j^2); where R_j^2 denotes the coefficient of determination between the explanatory variables, the larger the value of R_j^2 the higher the value of VIF implying higher collinearity between variables.

According to Greene (2002), if the VIF is greater than 5 then correlation among independent variables is high. The mean VIF was 1.45 with the independent variables having a VIF of between 1.05 and 2.39 (*see Appendix 3*). Since all the VIF's were less than 5, it shows there was no multicollinearity hence their inclusion in the model.

3.4.1.2 Goodness of Fit

Most researchers look at a statistic value ranging from 0 to 1 to gauge the overall strength of a given model. While 0 predicts a weak strength, values close to 1 predict a perfect fit. The R^2 for regression models has been used as a standard measure for goodness of fit (Draper and Smith, 1998). While many different R^2 have been described over the years, McKelvey and Zavoina, (1975) define it as the proportion of the variance of the latent variable that is explained by the covariate. The goodness-of-fit of a model can be assessed using Pseudo R^2 and probability of joint significance and adjusted R^2 values for OLS model; the Pseudo R^2 value ranges from 0 to 1 with higher values indicating a good fit of the model (Maddala, 1983). In this study, the pseudo R^2 value was 65 % and Pro> Chi square = 0.000 indicating the fitness of the model (*Appendix 4*).

3.4.1.3 Heteroskedasticity

Heteroskedasticity occurs when the variance of the dependent variable varies across the data. This means that the conditional variance of Y_i increases as X increases (Gujarati, 2004). The problem associated with heteroskedasticity is that an estimator is inefficient. The Breusch-Pagan statistics are standard tests of the presence of heteroskedasticity (Baum et al., 2003). Hence, in this study heteroskedasticity was tested using Breusch-Pagan statistics. In this study, there was no evidence of heteroskedasticity since there was no significant p- value (*see Appendix 5*).

3.4.2 Empirical Model Estimation

The decision of a farmer to supply vegetables to a high value market can be modelled as a choice between two alternatives; whereby a farmer can make a choice of participating or not participating. The random variable *Y* is a binary choice that takes the value of 1=participate and 0=otherwise. Both probit and logit models can be used when the choice from outcomes are two (McFadden, 1977). However, logit is more preferred than probit model because of its mathematical simplicity. It is therefore efficient because it provides a closed form for underlying choice probabilities, thus simplifying computations (Greene, 2002).

Following McFadden (1974), since the dependant variable Y is discrete; the probability that farmer ***i*** participates in any one high value market can be modelled as;

$$\Pr(Y_{ij} = \text{Participation}) = \exp(\beta X_i) / 1 + \exp(\beta X_i) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3)$$

The subscripts *i* and *j* denote farmer and farmer participation in high value markets (1=participate, 0=otherwise) respectively. Equation (3) is the reduced form of the binary logit model, where the *xi* is the vector of explanatory variables (socioeconomic, institutional and farm specific factors) for the *i*th farmer.

The probability that farmer ***i*** does not participate in high value markets can therefore be modelled as;

$$\Pr(Y_{ij} = \text{Non participation}) = 1/ 1 + \exp(\beta X_i) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (4)$$

Additionally, marginal effects were estimated to measure effects of changes in any explanatory variable on the predicted probability of participation in high value markets, while holding other explanatory variables constant.

Several studies have concluded that market participation may be explained by a number of factors that may in turn depend on the nature of individual characteristics. Table 1 shows a summary of the expected outcomes of the explanatory variables used in the model. The explanatory variables included in the model are discussed in detail below.

Gender *(GEND)*: This was coded as a dummy variable. It takes the value of 1 for male farmers and 0 for female farmers. Gender was included because AIVs production is considered to be a female dominated enterprise (Shiundu and Oniang'o, 2007). However, according to World Bank (2005) female farmers in SSA find it hard to access and maintain high value market niche. This is because they are faced with a couple of challanges including lack of access to productive resources and lower mobility owing to their cultural roles and responsibilities. Following this explanation, AIVs farmers in rural Kenya are expected to be in a similar predicament hence, gender was expected to have a positive relationship with market participation.

Age *(AGE)*: Age was measured in years as a continuous variable. Previous studies have shown different results on age when it comes to market participation. For instance, according to Mathenge et al. (2010) the age of farmers has a positive effect on market participation of smallholders in Kenya. This may be due to the fact that older farmers have more experience than young farmers marketing or have social networks formed over a period of time. On the other hand, Neven et al. (2006) found that age does not have a statistically significant effect on the probability of a farmer entering the supermarket channel (high value market). Following these two observations, the influence of age on high value market participation in Kenya was of empirical interest.

Years of schooling *(YEARSCHOOL)*: It was measured as a continuous variable as the number of years spent in formal education by the farmer at the time of the interview. Gani and Adeoti (2011) argue that a farmer's market participation decision is positively influenced by the level of education. This can be explained by the fact that farmers with more years of formal education have a higher ability to accept new ideas and innovations hence are willing to supply their produce in high value markets. Following this argument, years of schooling was expected to have a positive influence on high value market participation.

Household income *(HH_INCME)*: It was measured as a continuous variable showing the amount of income (in Kenya Shillings) obtained by a household in other activities other than production of AIVs. This income may strengthen production of AIVs or make the household reluctant to produce more AIVs and generate more income. Martey et al. (2012) found that an increase in off-farm income increased market participation of farmers in Ghana. Contrary to this, Mwaura et al. (2013) found a decrease in the quantity of AIVs sold in Kenya for households with higher incomes. Following these arguments, the effect of household income was subject to empirical verification.

Farm size *(FARMSIZ)*: The variable was estimated as a continuous variable representing the total land size occupied by a farmer in hectares. According to Neven et al. (2006) the probability of a farmer participating in the supermarket channel increases as the farm size increases. Similarly, Martey et al. (2012) argues that food crop market participation increases as farm size increases. The reason is that an increase in farm size provides opportunity to increase surplus production for sale and hence more income In the present study, farm size was expected to have a positive influence on market participation.

Output *(OUTPUT)*: Measured as the quantity of AIVs produced in Kilograms, the variable was measured as a continuous variable. According to Chalwe (2011) an increase in output is a motivation to produce and sell more and produce more that ultimately increases income. An increase in the quantity of AIVs produced by a farmer was expected to have a positive correlation with high value market participation. This is because of the consistent volumes required by high value markets (Reardon et al., 2003).

Distance to market *(MRKTDIST)*: This variable was measured as a continuous variable in Kilometers. Distance from farm to market has been found to have a negative influence on market participation. Longer distances and poor roads to point of sale discourage farmers'

market participation (Gebremedhin and Jaleta, 2010; Gani and Adeoti, 2011). Therefore, distance to the market was expected to have a negative influence on market participation.

Price *(PRICE)*: This was a continuous variable that was measured in terms of the amount paid in Kenya shillings per Kilogram of vegetable supplied. Price has a positive and significant influence on market participation. This is because higher prices motivate producers to sell more output in order to generate more income. Also, in order for sales to increase, output price must be an incentive (Goetz, 1992; Otieno et al., 2009; Moyo, 2010). Generally, AIVs are expensive to purchase thus any marketing outlet offering higher prices to farmers should be an incentive to participate in it. The variable was therefore hypothesized to have a positive influence on high value market participation.

Access to extension services *(EXTSERVICE)*: This was taken as a dummy variable whereby a value of 1 was assigned if the farmer had been visited by an extension agent over the past 12 months and a value of 0 otherwise. The extent to which extension services influence market participation varies. For instance Alemu et al. (2011) concluded that extension services had a negative and significant influence on market participation. This is because extension agents provided assistance more on the production than marketing side. Gani and Adeoti (2011) however argue that farmers who have contact with extension agents are more likely to have knowledge about production, quality and information on markets and output prices. Extension services therefore have a positive effect on market participation. The expected effect of this variable on high value market participation in this study was indeterminate.

Access to market information *(MRKTINFO)*: This was coded as a dummy variable and was hypothesized to positively influence market participation. The market information considered was information on prices, demand, quality, buyers, and other relevant information that could contribute to a farmer's decision to participate in the high value

markets. Bienabe et al. (2004) suggest that market information is positive and significant in influencing market participation. This is because market information is important to enable farmers in making informed decisions on what to grow, right harvesting season and selling price.

Membership to a group *(GRPMEMBRSHP)*: This was coded as a dummy variable, which took the value of 1 if the farmer was a member of a group and 0 otherwise. This variable was anticipated to affect market participation positively. This is because groups help them access high value markets, enable them to provide continuous supply of the product and they are also able to diversify their markets. Also Alene et al. (2008) showed that membership to farmer groups/organizations significantly increase the probability of market participation for selling households in Kenya. Furthermore, groups increase the bargaining power of smallholder farmers thus shielding them from over exploitation (Ngugi et al., 2007).

Access to credit facilities *(CRDTACCESS)*: This was coded as a dummy variable taking a value of 1 if the household had access to credit and 0 otherwise. Access to credit was anticipated to have a positive influence on market participation. This is because it improves the financial capacity of producers to buy more improved production inputs, thereby increasing production which would in turn increase market participation. Alene et al. (2008) argues that limited access to credit constrains farmers' ability to buy agricultural inputs, which in turn reduces farmers' market participation in Kenya. Randela et al. (2008) also found that access to credit had a positive and significant effect on producers' likelihood to participate in high value cotton markets. The measurement units and expected signs of these variables are summarized in Table 1.

Table 1: Measurement Units and Expected Signs for Independent Variables

VARIABLE	DESCRIPTION	UNIT OF MEASUREMENT	EXECTED SIGN
AGE	Age of farmer	Years	+/-
CRDTACCESS	Access to credit	Dummy (1=Yes 0=No)	+
DISTANCE	Distance from farm to market	Kilometres	–
EXTSERVCE	Visit by extension agents	Dummy (1=Yes 0=No)	+/-
FARMSIZ	Size of farm	Hectares	+
GENDER	Gender of farmer	Dummy (1=Yes 0=No)	+
GRPMEMBRSHP	Membership to a farmer group	Dummy (1=Yes 0=No)	+
MRKTINFO	Access to market information	Dummy (1=Yes 0=No)	+
OUTPUT	Output of AIVs per season	Kilograms	+
PRICE	Unit price of output	Kenya Shillings	+
HH_INCME	Household income	Kenya Shillings	+/-
YEARSCHL	Number of years in formal education	Years	+

Source: Survey Data, 2015

The model was empirically specified as:

$$HVAL\_PART = \beta_0 + \beta_1 AGE + \beta_2 GENDER + \beta_3 YEARSCHL + \beta_4 HH\_INCME + \beta_5 FARMSIZ + \beta_6 OUTPUT + \beta_7 MRKTDIST + \beta_8 PRICE + \beta_9 EXTSERVCE + \beta_{10} MRKTINFO + \beta_{11} GROUPMEMBRSHP + \beta_{12} CRDTACCESS + \varepsilon \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (5)$$

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Characterization of Smallholder Farmers of AIVs

Characterizing smallholder farmers helps in classifying farm households into similar or different groups for which targeted development interventions can be recommended.

4.1.1 Characteristics of the Farmers and their Households

The socio-economic characteristics of the farmers are presented in Table 2.

Table 2: Sample Characteristics

Household characteristics	**Pooled** **n = 150**
Gender of respondents (% female)	61.0
Average age (years)	41.0
Average years of schooling	7.9
Average household size	6.0
Marital status (% of farmers married)	86.0
Farming experience (years)	7.9
Average monthly income (Kenya Shillings)	6,778.0
Primary activity (% of farmers)	71.6
Average land size (Ha)	1.7
Ownership of cell phone (% of farmers)	30.0

Source: Survey Data (2015)

More than half of the respondents were women. This implies that AIVs production is a female dominated activity. These results are similar with Davis (2006) who observed that generally women dominate in both production and marketing of AIVs. Also, Willem et al. (2007) found that there has been an increase in women awareness regarding AIVs as it has helped diversify their food baskets. This has also encouraged more of them to participate in production.

The average age of the farmers was 41 years with close to half of them in the age group of 33-47 years. This implies that few young people have embraced production of AIVs. These findings are in agreement with Oladede (2011) who observed that production of AIVs is mostly carried out by older people. This is because old people are preservers of culture especially when it comes to food. Similarly, William et al. (2007) found that the increase in awareness of these vegetables over the years has helped the few young farmers to actively contribute in production.

The mean number of years of formal education was approximately 8 years with nearly 70% of the farmers having attained primary education. This implies that the producers of AIVs in the area are not sufficiently endowed with human capital which might affect the knowledge regarding high value markets. The Republic of Kenya (2012) records that in Siaya County; the population with primary education is estimated to be less than four fifths. The average household size among the farmers was 6 members with more than 80% being married. Most of the farmers have a farming experience of close to 8 years. This means that the production of AIVs has been embraced in the region over the past decade.

While the production of AIVs is a primary activity for slightly more than 70% of the farmers, the estimated average monthly household income was Ksh. 7,000.Very few of the farmers are involved in other economic activities, for instance, less than 18% own small businesses like

kiosks. This means that the producers are spending more of their time and resources in farming but their returns are minimal. The findings concur with those of Rao and Qaim (2012) which showed that vegetable returns may be minimal, however higher returns could be realized by reallocating resources from other economic activities.

Slightly more than 70% of the farmers own farms ranging from 0 - 2 ha, the average land size being 1.6ha. According to Republic of Kenya (2012), the average farm size for smallholder farmers in Siaya County ranges from 0 – 6 ha. Also Abukutsa (2007) noted that AIVs are mostly grown on small-scale in a mixture with other food crops. Less than one third of the farmers own cell phones. This means that it is difficult to convey information to the farmers when need arises. This is similar to Republic of Kenya (2012) which documented that Information Communication Technology has not been fully embraced in the County.

4. 1.2 Production Characteristics of AIVs Farmers

About four fifths of the farmers grow at least two varieties of AIVs on their farms. The farmers prefer growing different varieties of AIVs because each of them has its advantage. Figure 5 shows the popularity of the vegetables as grown by the farmers in the area.

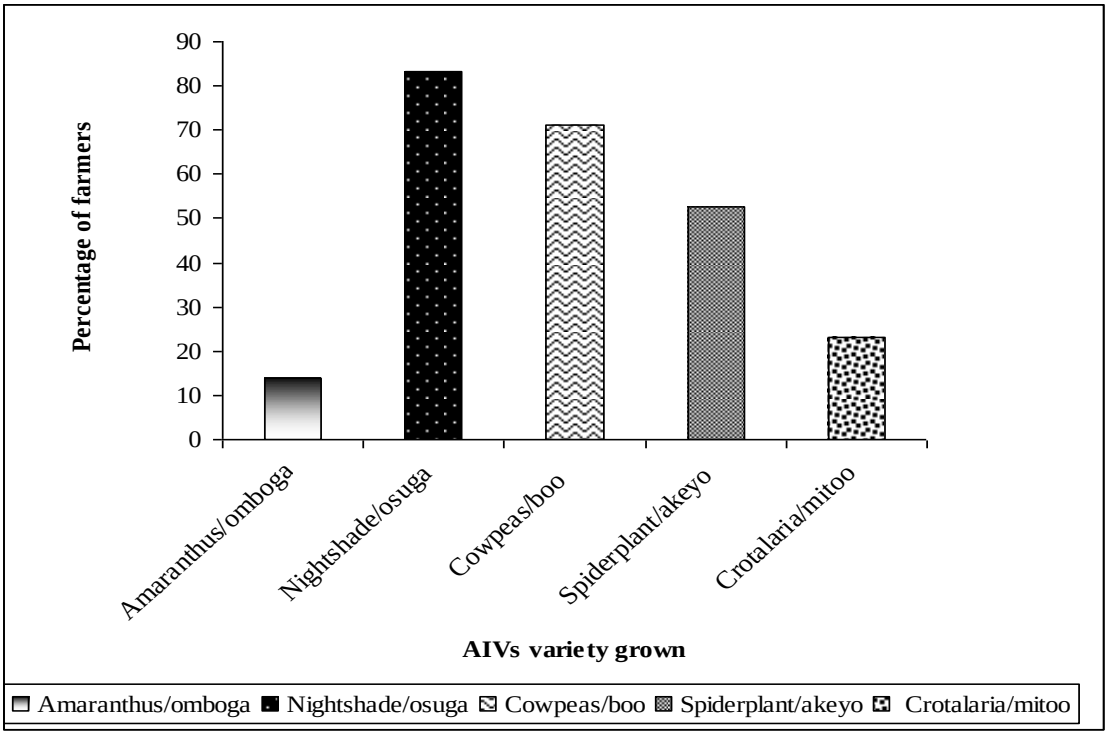

Figure 5: Popularity of AIVs produced and marketed by Farmers

Source: Survey Data (2015).

Generally, the vegetables are grown in the area because of their nutritional and medicinal value coupled with their unique taste as compared to exotic vegetables (e.g. kales). The vegetables also prevent diseases like hypertension and stomach aches as they contain diverse nutrients required by the body. They are also believed to be immune boosters. Furthermore, the local weather is conducive for their growth and they are less prone to diseases like blight and wilts.

However, slightly more than four fifths of the farmers grow nightshade because it has a higher demand in the area hence fetches higher prices. It also has a longer production lifespan thus can be harvested continuously for up to 6 months. This is closely followed by cowpeas, which is grown by over two-thirds of the farmers because it also has a longer lifespan; it can be harvested continuously for 3 to 4 months. In addition, it is cheaper to produce as compared to the other vegetables.

The production characteristics of the farmers are as shown in Table 3.

Table 3: Production Characteristics of AIVs Farmers

Input use	**Pooled n = 150**
Land under AIVs production (% of total land size)	19.6
Output (Kg/Ha)	654.1
Jembes/Hoes (% of farmers)	96.7
Family labor (% of farmers)	53.3
Manure (% of farmers)	74.3
Pesticides/insecticides (% of farmers)	19.3
Rain-fed irrigation (% of farmers)	53.0
Average Distance to Lake/River (Km)	1.5
Access to extension services (% of farmers)	34.6
Input purchase (% of farmers)	
Local stockist	47.3
Agrovet store	26.7
Others	26.0

Source: Survey Data (2015).

The average land size under AIVs production was less than a fifth of the total land size owned by the farmers. Nearly two-thirds of land is allocated to field crops such as maize with close to 18% being set aside for rearing livestock. These findings are similar to Abukutsa (2007) who found that many smallholder farmers allocated less than 30% of their total land for AIVs production. This is because AIVs are mostly grown in a mixed cropping system with other crops. For instance, cowpeas are frequently grown in a mixed cropping system

with maize for the purpose of minimizing nitrogen deficiency. The average output in a given production season is about 650Kg/Ha; production is carried out using conventional methods of farming. Almost all the farmers use jembes/hoes for land preparation; this is because it is less costly to acquire jembes/hoes. These findings conform to those of Chagomoka et al. (2014) who found that AIVs production in most developing countries is done using conventional methods. This is because AIVs were discovered as wild crops and there domestication began a few decades ago; therefore proper production technologies have not been put forth.

Despite the fact that close to 90% of the farms are approximately 2 kilometres to the lake/river, irrigation is mainly rain-fed. Slightly more than half of the farmers rely on rain-fed irrigation. This means that the farmers maximize on production mostly during the rainy season hence low or no production during dry season which likely affects supply. This finding confirm to Shiundu and Oniang'o (2007) who found that AIVs production is mostly rain-fed leading to overproduction during the rainy season and scarcity during dry seasons. Slightly more than half of the farmers employ family labor on their farms. This is because labourers are paid per day and since AIVs production is a labor intensive enterprise it is less costly to involve family members.

Less than a quarter of the farmers use pesticides on their farms while almost three quarters use farmyard manure. The low use of pesticides by most farmers is attributed to the fact that AIVs are less susceptible to attacks by pests and diseases that commonly affect exotic vegetables (Abukutsa, 2007). Mnyambo (2009) also found that most smallholder farmers of AIVs use farmyard manure alone on their farms as they are less costly and friendly to the environment. The author however added that most farmers are not aware of recommended application rates of manure and AIVs grown with a combination of inorganic fertilizers produced higher yields.

Less than two fifths of the farmers have been visited by agricultural extension officers over the last one year. The government extension officers who are endowed with production information no longer make random visits to individual farms. During the FGD, it was noted that extension agents no longer make random visits to farms advising farmers, rather, they only visit when they are called upon. This finding is consistent with Republic of Kenya (2012) who concluded that extension services in Kenya are at the verge of extinction. For this reason, slightly over two-thirds of the farmers rely on indigenous knowledge on production practices. Muhanji et al. (2011) concurs that a lot of indigenous knowledge on AIVs production does exist and implores on researchers, scientists and extension agents have just to promote and conserve it. Close to half of the farmers purchase inputs like jembes/hoes from local stockists in village markets and kiosks. This is because the inputs are cheaper and farmers can purchase whatever quantities they need at any given time. They can also purchase on credit, a privilege that agrovet stores do not offer.

Like any other farming enterprise, AIVs production is faced with various challenges. As shown in Figure 6, slightly more than two thirds of the farmers experience various forms of climate change. During the rainy season, flooding is a common phenomenon while in the dry season drought was predominant. The PAI (2012) notes that smallholder farmers in Siaya have been adversely affected by the receding water levels of Lake Victoria, a dire consequence of climate change.

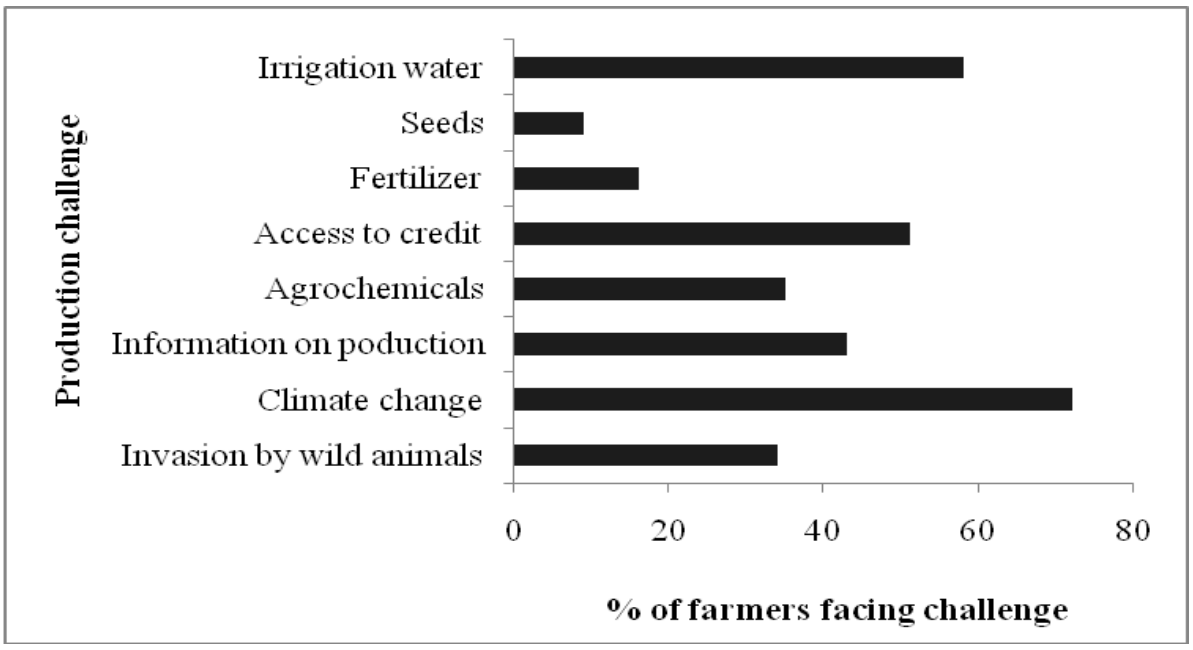

Figure 6: Production Challenges of AIVs

Source: Survey Data (2015).

As discussed earlier, production is mainly rain fed. However, more than half of the farmers have a challenge of accessing irrigation water from the lake and river especially during the dry season. Only less than a fifth of the farmers own irrigation pumps, this is because it is costly to acquire and maintain them. Close to half of the farmers do not have access to credit facilities. About 60% of farmers rely on their own savings to cater for production of AIVs. This implies that it is difficult to acquire inputs required for production hence production becomes strenuous. Information on the best production practices is also another challenge to

the farmers. The study earlier found out that access to extension services by the farmers was poor thus most of the knowledge on production is indigenous knowledge.

Slightly more than one third of the farmers encounter invasion by wild animals on their farms. This is because the lake is home to animals like hippopotamus that stray on farms destroying crops. Fertilizer was not much a challenge because a majority of producers used farmyard manure for their production. Seeds were also not much of a challenge as most farmers used or recycled seeds from previous seasons. Karanja et al. (2012) also found that majority of AIVs farmers use seeds saved from their own previous crop. The author however argued that such seeds have problems of purity with mean germination rates rarely exceeding half.

4.1.3 Characterizing Marketing of AIVs

The study revealed that there are various marketing outlets used by the farmers in selling their vegetables. This is as summarized in Figure 7. The preference of the marketing outlet used by a farmer is primarily based on the percentage of the vegetable output sold to the outlet.

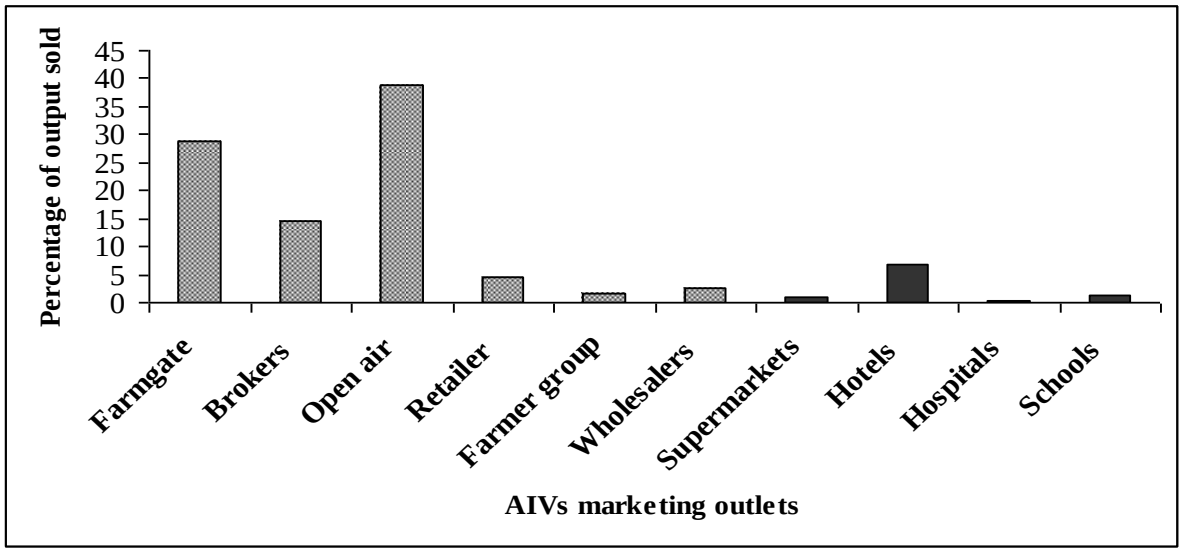

Figure 7: Percentage of Vegetable output sold in various Marketing Outlets

Source: Survey Data (2015)

Coupled with that, there are also reasons as to why a farmer would prefer one outlet over the other. The results show that the traditional marketing system dominates with over four-fifth of the farmers selling their produce. This is consistent to the observation by the USAID (2013) that the traditional marketing system dominates in FFVs value chains in developing countries.

Among these outlets, the open air market that accounts for over a third of the total vegetable output sold. This is because of the timely and regular payment from the buyers. Moreover, it offers better prices for the vegetables in comparable terms to the other traditional marketing outlets. The farm gate is also preferred accounting for another third of the output sold. Farmers find the farm gate convenient as it saves them time and transaction costs. This is because the buyers mostly collect the vegetables from the farms. There is also the aspect of familiarity/trust between the buyers and farmers as the buyers frequent the farms from time to time. However, about 13% of the farmers who sell AIVs in high value markets are attracted to the outlets by the lucrative prices offered for the produce.

Various reasons were stated by farmers explaining their lack of participation in high value markets as summarized in Table 4.

Table 4: Reasons why Farmers do not sell AIVs in High-value Markets

Reason	**Percentage of farmers giving reason**			
	Supermarkets	**Hotels**	**Hospitals**	**Schools**
Strict on quality	97.3	91.2	58.8	42.3
Consistency in supply	75.8	41.6	52.7	29.3
Variety of produce	90.6	46.7	22.9	51.7
Require large quantities	98.7	96.3	96.6	95.9
Delay in payment	95.9	31.4	94.6	91.2
Contractual agreement	94.6	28.5	34.5	44.2
Long distance	85.3	32.1	45.9	21.8

Source: Survey Data (2015).

Most farmers agree that all the outlets have stringent quality requirements for the vegetables but it was found that supermarkets and hotels are strict on quality than hospitals and schools. Ideally, the quality checks are on a visual basis. Some of the quality checks the vegetables go through include; no spots/holes, cleanliness of the vegetables (no dust/mud or contamination), fresh and flourishing leaves, color (dark green) and dry leaves (wet ones easily deteriorate).

Supermarkets are keen on consistent supply as compared to the other high value outlets because they stock the vegetables three times a week irrespective of the season. The other outlets can however regulate the quantities ordered during scarcity. Since supermarkets offer a wide variety of fresh produce for their customers, they prefer purchasing from suppliers who sell a variety of products as it saves them time of looking for a different supplier for each produce they need. For this reason, one of the supermarket stores (*Tuskys*) has contracted a

fresh produce farm called *Shirganesh* for all of its fresh produce supplies. All the outlets require large volumes of vegetable supply which most of the farmers cannot afford to supply given their individual output.

According to Neven and Reardon (2004), supermarkets have very complex procurement systems. This means that it takes time for payments to be processed. For instance, the study found that farmers who supplied to supermarkets can be paid after 2 to 3 months of produce delivery. Most of the schools and hospitals where farmers sell AIVs are public institutions and procurement is done on a quarter year basis, which means suppliers can wait for over 3 months to be paid. Given their financial capability, most farmers cannot wait this long for returns. However, hotels are a bit lenient on their payment as they mostly pay within a fortnight. Another hindrance for smallholders in supplying to supermarkets is the existence of contractual agreements. The other high value outlets are not so much focused on contracts thus can change suppliers from time to time. Distance was found to be a challenge for selling AIVs especially to supermarkets. This prompted more farmers to sell in hospitals, hotels and schools which are closer to them at estimated distances of 9, 5.5 and 2.7 kilometres respectively.

Apart from the above mentioned reasons for market preference, the study further analyzed some institutional characteristics that influence marketing of AIVs. This is as summarized in Table 5.

Table 5: Institutional Characteristics of AIVs Farmers

Institutional characteristics	**Pooled**
	n= 150
Average price (Ksh/kg)	17.9[a]
Access to credit (% of farmers)	41.3
Access to market information (% of farmers)	49.3[b]
Source of market information (% of farmers)	
Buyers	35.3
Other farmers	28.7
Media (Radio)	20.0
Other sources	16.0
Group membership (% of farmers)	56.0
Average distance from farm to market (Km)	2.5

Note: The superscript *a* and *b* denote statistical significant differences between high value market participants and non-participants at 1% and 5% level respectively. At the time of survey Ksh 90 was equivalent to 1 USD

Source: Survey Data (2015).

Farmers in the study area sell their vegetables at an average price of 20Ksh/Kg. A statistical significant difference was observed between prices offered in high value and traditional markets. The price offered in high value markets is almost 2.5 times more than that offered in traditional markets. This implies that higher prices are likely to influence high value market participation. Otieno et al. (2009) also found that price significantly motivates intensity of market participation. During the FGD in the present study, it was noted that prices for vegetables in both high value and traditional markets remain constant both in high and low seasons of production. However, the quantity packaged varies in traditional markets but remains constant in high value markets.

Less than half of the farmers have access to credit facilities. Close to two fifths of the farmers derive the capital used for production from individual savings, while only an eighth of them access credit from financial institutions especially cooperatives. This is consistent with the observation by the World Bank (2005) that many smallholder farmers in developing countries are not favored by financial institutions in the distribution of credit services. As a result, they lack capital to expand their farming enterprises. The Republic of Kenya (2012) observed that within the study site, access to credit is hindered by limited micro credit institutions, limited collateral for loans and high interest rates among others.

Close to half of the farmers have access to prior market information regarding price and demand for the AIVs. More than a quarter of the farmers receive information from buyers, which is at times unreliable. Djalalou et al. (2012) argues that access to timely, accurate and up-to-date market information is fundamental for commodity marketing. Slightly more than half of the farmers belong to formal group; half of the groups being agricultural. Ngugi et al. (2007) found that group membership for smallholder farmers of AIVs strengthens their bargaining power. Some of the benefits accrued from being in the groups are as shown in Figure 8.

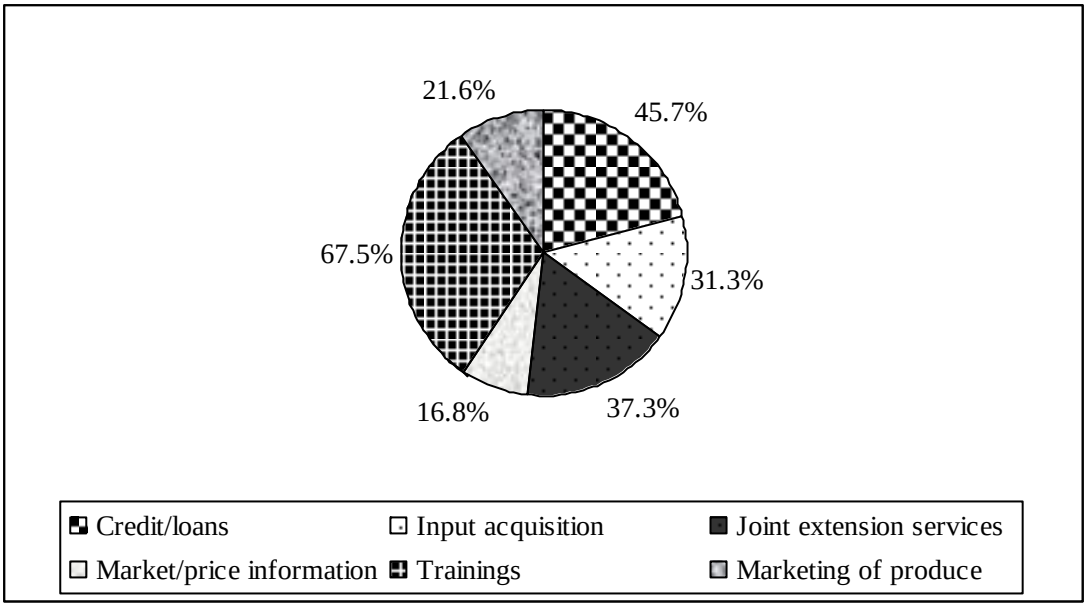

Figure 8: Benefits of Group Membership

Source: Survey Data (2015)

The farmers face various marketing challenges as shown in Figure 9.

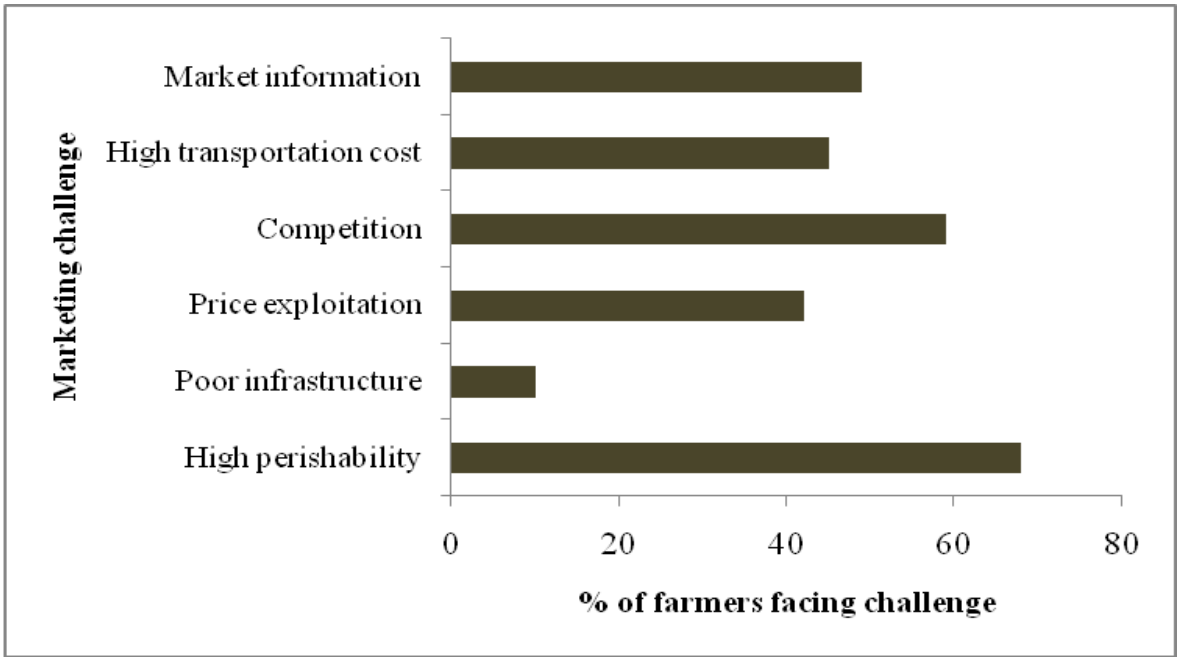

Figure 9: Challenges in marketing AIVs

Source: Survey Data (2015).

More than two thirds of the farmers face the problem of perishability. This is because less than one-tenth of the farmers own modern storage facilities with close to three fifths using baskets, crates and sacks for storage. These storage methods do not fully guarantee the freshness of AIVs for longer periods. Value addition at the farm level is therefore very minimal as illustrated in Table 6.

Table 6: Value Addition activities carried out by Farmers

Value Addition Activity	**Percent of farmers practicing activity**
Sun drying	2.7
Fermenting	1.3
Sprinkling water	36.0
Packaging	30.7
Cool air drying	28.0
Blanching	1.3
Total	**100**

Source: Survey Data (2015).

Andika (2013) suggests that value addition is important for AIVs as it makes them more attractive, increases their availability in low production seasons and can improve income of the farmers greatly. However, farmers in the study area reported that value addition was very costly. The most popular value addition activity among the farmers is sprinkling water on vegetables in order to maintain their freshness. In addition, water is readily available in the area; it is less costly and the activity consumes less time. This is closely followed by packaging which is done in different quantities of polythene bags. The farmers feel that packaged vegetables are more attractive to customers than unpacked ones. However, this is done to vegetables that are ready for sale because stuffing them in polythene bags without cool storage facilities for an unknown period of time makes the vegetables deteriorate easily. Cool air drying is done mostly by farmers who have failed to sell all their vegetables and

anticipate selling them the next day. The procedure involves spreading the vegetables under a shed and letting cool air penetrate through. This is mostly done early in the morning before sunrise or late in the evening after sunset. This also helps vegetables maintain their freshness.

Another marketing challenge is competition. More than half of the farmers face competition in the market place especially from medium and large-scale producers as well as brokers. The farmers argue that their competitors are well informed on how the market operates and are also endowed in terms of capital and assets. Less than half of the farmers have access to market information. Slightly more than a quarter of the farmers receive market information from their buyers which a majority of them agree is unreliable as it serves the interests of the buyers. Various studies have found access to market information an important variable influencing marketing of agricultural produce (Djalalou et al., 2012; Bahta and Bauer, 2007).

High transportation costs also discourage most farmers from marketing their vegetables in high end markets. For instance it costs an average of Ksh 800 to transport one sack of AIVs to the nearest school. Price exploitation is another challenge faced by the farmers. The study found that there was no agreed price for the vegetables, rather almost all the farmers negotiated with their buyers on the selling price. This means that they are vulnerable to exploitation as it depends on a farmers bargaining capability.

4.2 Factors influencing Smallholder Farmers' participation in High-value Markets

The results of the study show that the model explained 65% of the variations in the likelihood of AIVs smallholder farmers' participation in high value markets. The estimated probability was greater than the chi-square value (Probability > Chi-square = 0.0000). This implies that all the model parameters were jointly significant in explaining the dependent variable at less than 1% significance level, indicating the goodness-of-fit of the model. The binary logit model results on high value market participation are shown in Table 7.

Table 7: Binary logit estimates of factors influencing smallholder farmers' participation in high value markets

Variable	Co-efficient	Std. Error	p-value	Marginal effects
GEND	0.912	0.020	0.301	-0.016
AGE	0.371	0.014	0.687	0.005
YEARSCHL	5.348**	0.045	0.017	0.074
HH_INCME	3.487***	0.152	0.000	0.218
FARMSIZ	0.946	0.014	0.679	0.030
OUTPUT	0.115**	0.010	0.005	0.045
MARKTDIST	-1.067**	0.056	0.019	-0.057
PRICE	0.395***	0.002	0.000	0.110
EXTSERVCE	1.543	0.008	0.328	0.004
MRKTINFO	0.189	0.003	0.892	0.000
GRPMEMBRSHP	0.005	0.000	0.910	0.000
CRDTACCESS	0.465*	0.005	0.093	0.003

Log likelihood = -31.93; Pseudo R^2= 0.6527; LR Chi square = 105.79; Probability > Chi square = 0.000; n = 150

Note: ***, **, * = significant at 1%, 5% and 10% respectively

Source: Survey Data (2015).

The level of significance of each explanatory variable was tested using the null hypothesis which states that; explanatory variables have no significant effect on high value market participation. The *p*-values which show the lowest level at which the null hypothesis can be rejected were used (Gujarati, 2004).

As expected, years of schooling was found to have a positive influence on market participation at 5% level of significance. This implies that farmers who have attained more years of formal education are more likely to participate in high value markets. The marginal

effects show that an additional year in school increases probability of participating in high value markets by slightly more than 7%. This is because farmers with more years of formal education are more equipped with knowledge on favorable market opportunities. They are therefore likely to accept new ideas and innovations hence are willing to supply their produce to value markets. This is similar to the results of Gani and Adeoti (2011) which showed a positive significant relationship between education and market participation.

Household income was found to be positive and significant in influencing market participation at 1% level. This implies that farmers with higher household income are more likely to participate in high value markets. The results of the marginal effect show that an additional unit of sales income increases probability of participating in high value markets by over 20 %. This could be because farmers with higher income devote more of their resources to AIVs production in order to gain higher returns. These results agree with those of Mwaura et al. (2013) who found that AIVs farmers with higher income are likely to invest more of their resources in production in order to sell more and generate more income.

As expected, the quantity of output was a positive and significant factor in influencing high value market participation at 5% level. This implies that participants in high value markets produced more quantities of vegetables as compared to non participants. The marginal effect shows that an additional unit of output increases the probability of participating in high value markets by about 5%. This can be explained by the growing demand of AIVs over the years prompting farmers to produce more in order to meet the demand. These results concur with Chalwe (2011) who found that higher output was a motivation to increased market participation. The author further argues that the higher the produce the higher the farmer's motivation to sell more and generate more income. As expected, distance from the market was found to be negative and significant in influencing high value market participation at 5% level. This implies that the further the farmer is to a high value market, the least likely he/she

will participate. The results of the marginal effect show that a unit increase in distance reduces the probability of participating in high value markets by more than 5%. This is because longer distances discourage market participation due to the costs involved in transportation. Alemu et al. (2011) concurs that the further the distance from other markets, the more the involvement of vegetable growers in open markets in the nearest centers.

As anticipated, price was found to be positive and significant in influencing market participation at 1% level. This is an indicator that price is among driving factors that encourages participation in high value markets. The marginal effect show that a unit increase in price increases probability of selling in high value markets by over 10%. This is because a farmer is more likely to sell their produce to high value markets because they need to increase their income. Ngugi et al. (2007) noted that the price of vegetables supplied in high value markets is relatively higher. Moreover, those farmers who supplied their vegetables to these high value markets made 30% more profit compared to farmers who sold in local markets.

Also as expected, access to credit was positive and significant in influencing participation in high value markets at 10% level of significance. This means that farmers who have access to credit are more likely to participate in high value markets. The marginal effects indicate that those farmers with access to credit are more likely to participate in high value markets by less than 1%. This is because access to credit enables farmers to purchase agricultural inputs which increase production hence marketable surplus. This can also be explained by the findings of Randela et al. (2008) who found that access to credit has a positive and significant impact on producers' likelihood to participate in high value cotton markets because availability of credit reduces transaction costs both in input and output markets.

Gender had a positive, but insignificant influence on market participation. This implies that there is no gender bias as both men and women have the same market opportunities. It may

further imply that market opportunities exist but households have their own market preferences which they are more conversant with. This is in contrast with World Bank (2005) who found that women in most developing countries do not have access to resources and opportunities that would enable them move from subsistence agriculture to higher value chains compared to men.

Age was insignificant in influencing market participation. Neven et al. (2006) also found that age was statistically insignificant in explaining the probability of smallholder farmers' participation in supermarket channels (high value market). Farm size was found to be insignificant in influencing market participation. This could be explained by the fact that the study focused on the same category of farmers (smallholders) who have an almost uniform land size. The study found that close to 80% of the farmers owned land sizes of between 0-2 hectares. Hallensleben (2012) argues that the size of the land cultivated does not necessarily reveal the output and amount of money that can be made from the production rather it depends on how efficient land is used. Access to extension services was also insignificant. This can be explained by the fact that that extension services are more inclined to production aspects. Alemu et al. (2011) also agrees that extension agents provide assistance more on the production side than on the marketing side hence access to extension services have no significant effect on market participation.

Also, group membership that was expected to be positive and significant in influencing market participation turned out to be insignificant. This findings contrast Ngugi et al. (2007) who found that group membership had a positive influence on high value market participation. This is because groups helped them access high value chain markets, enabled them to provide continuous supply of the product and they were also able to diversify their markets. The implication could be that most farmers belong to a group but collective action within most of the groups might be weak. Further, it can imply that there are other benefits

associated with group membership other than marketing. Gebremedhin et al. (2002) agrees that collective action within groups is influenced by the institutional factors which include government policies, cultural values, social capital and property rights among others. Further, the size of the group, characteristics of the group experiencing a common problem as well as constraints faced by individual group members will influence collective action.

Access to market information was expected to have a positive and significant influence on high value market participation but the results were insignificant. The results contrast Bahta and Bauer (2007) who found that market information had a positive and significant in influence on market participation. These contrasts in findings suggest uniform access to market information by the farmers. It could also imply that farmers have information which is not reliable. Aysheshm (2007) argues that in sesame marketing, access to market information was not a problem; rather, it was the quality of information accessed by the farmers that was misleading. Djalalou et al. (2012) also concurs that timely up-to-date market information could enhance the quality of produce hence increase incomes for actors along the value chain.

CHAPTER FIVE

5.0 SUMMARY, CONCLUSIONS AND POLICY RECOMMENDATIONS

5.1 Summary

There has been a tremendous increase in the demand of AIVs in both formal and informal markets; however, supply has failed to meet growing demand. A larger proportion of the vegetables are sold to informal (traditional markets). However, the reason behind the poor participation of smallholder farmers' in formal (high value) markets has not been assessed. This study aimed at characterizing smallholder farmers as important actors along the AIVs value chain and analyzing factors influencing their participation in high value markets.

Data was collected from a random sample of 150 farmers in three sub-counties of Siaya county; Bondo, Gem and Rarieda. Data analysis was done through the use of descriptive statistics to characterize smallholders and a binary logit model to analyzing factors influencing market participation.

Results show that production of the vegetables is a female dominated activity carried out majorly by the middle aged. Production is carried out using conventional farming methods and inputs. Less than a fifth of the total land size is allocated to AIVs production with a bigger proportion occupied by food crops like maize; this adversely affects output. A majority of the smallholders preferred informal marketing outlets. For instance, the open air market was the most common outlet because of regular and timely payment from buyers. The farm gate was also predominant because it saves time and costs as buyers collect vegetables from the farm. The high value markets had very few participants because of their strict quality requirements, consistency in supply and complex procurement systems. Statistical significant differences were recorded among high value market participants and non-participants in terms of output and price.

The results of the binary logit model show that price, output, income from sales, access to credit and years of formal education had a positive and significant influence on high value market participation. The results indicated that a unit increase in the values of these variables also increased market participation. However, distance had a negative but significant influence on market participation.

5.2 Conclusions and Recommendations

The findings of this study suggest that like in any FFVs market, access to high niche AIVs markets for smallholder farmers is a great challenge. This is attributed to the stringent quality requirements that cannot be met by smallholders. The local county government should collaborate with development partners to identify possibilities for enhancing high value market access. For example, partnership with organizations such as Farm Concern that has helped smallholder farmers of AIVs in Central Kenya to sell their produce in high value markets. Such organizations in partnership with the County government could further enlighten smallholder farmers on the needs of such markets by engaging lead farmers as a reference point.

The findings of this study also suggest that the quantity of output greatly motivates participation in high value markets. Production by the farmers is dependent on conventional farming practices. Research has proven that farmers who apply recommended agronomic practices are more likely to produce a surplus which they can sell; it therefore highly influences the intensity of market participation. This emphasizes the need for external assistance to the farmers. In order to improve the volume and quality of vegetable output, there is need to improve farmers' access to production technologies. Though its impact on market participation is indirect, it is the only way that smallholders can compete and sustain themselves in these high value markets.

Credit was a crucial factor that influenced market participation hence its importance in agricultural marketing. Availability of credit especially during planting could encourage farmers to produce surplus and participate more in high value markets. Access to credit is poor in the region due to existence of few financial institutions with high interest rates. This constraint can be addressed by encouraging farmers to adopt table banking concept, which relies on peer review and group membership. It is far much better than the traditional bank loans system that is dependent on stringent collateral requirements. The findings of the study further suggest that the price of the vegetables is an important factor thus it should not be overlooked. Price regulation by the County government would be the best option though it is technically not feasible as price fluctuates with seasons which are unpredictable. Measures that facilitate farmers to receive timely price information are recommended in order to enable farmers to maximize profits throughout the year.

5.3 Contributions to Knowledge

It has been perceived that smallholder farmers of FFVs do not supply their produce to high value markets because they lack market information. The findings of this study contradict this as it reveals that majority of the farmers are well informed with high value market requirements. It is only that they are not willing to take the risks involved in marketing their produce in these markets. In addition, they have formed a perception that high value markets are for the rich thus have settled on the comfort zone of the farm gate and open air markets and brokers. Even the farmers who are beneficiaries of AIVs projects are not willing to venture out of the traditional system to market their produce. Brokers take advantage of the farmers' unwillingness to venture into high value markets to exploit them.

The assumption that groups helped smallholder farmers' access high value chain markets and also helped diversify their markets is not applicable to all farmer groups. The study reinforces

the importance of strengthening the institutional framework of groups' specifically regarding collective action. Further, it emphasizes the importance of government policies not only in public organizations but in private ones too. This is because problems faced in individual groups have a ripple effect on the society at large.

5.4 Limitations of the Study and Suggestions for Further Research

The study was limited in coming up with policy application since it assessed smallholder participation in any of the given alternative high value markets. More insights would be obtained through further studies that isolate determinants of potential participation in each of the selected emerging high value markets; specifically for hotels, schools and hospitals. The study was also limited in quantifying the output of individual varieties of AIVs sold to various marketing outlets. More comparison on the specific output of all AIVs marketed in Kenya would be obtained. Further, research on the demand and consumers preferences would help in coming up with all-inclusive policy interventions.

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APPENDICES

APPENDIX 1: Survey Questionnaire

AN ASSESSMENT OF SMALLHOLDER FARMERS' PARTICIPATION IN THE DOMESTIC HIGH VALUE MARKETS FOR INDIGENOUS VEGETABLES IN SIAYA COUNTY (APRIL 2015).

IDENTIFICATION

Interviewer's code …… Date of interview …… Sub-County……

Location …… Sub- Location ……. Division ……

Village ……..

A. HOUSEHOLD CHARACTERISTICS (*Tick where appropriate*)

1. Gender of respondent
   (Male =1 Female = 0)
2. Age of respondent …… years
3. Education

Years of schooling	Highest level of education attained
	1= None 2= Primary 3= Secondary 4=Tertiary certificate 5=Diploma 6=Undergraduate degree 7=PhD 8=Other (specify) ……

4. Marital status of respondent
   (1= Single 2 = Married 3 = Divorced 4 = widow/widower 5= separated)
5. Average household size (*total members*) …….
   Is farming your primary activity? (1= Yes 0 = No)
   If No
6. What other activity do you rely on as a source of income?
7. (1 = Salaried employee 2 = Business man/woman 3 = Casual laborer 4 = Boda boda/ motorcycle operator 5 = Fishing 7 = Mining 8= Other (Specify) …….
8. What is the average total monthly income of your household ……...Ksh?

B. PRODUCTION CHARACTERISTICS

1. Estimate your average land size in Ha …….
2. Is your entire farm under indigenous vegetable production?
   (1 = Yes 0 = No)
   If Yes skip to (4), If No
3. What other economic activity is carried out on your farm?

Activity	Area under farm (Ha)
1. Livestock production	
2. Fish farming	
3. Field crops	
4. Rental houses	
5. Other (specify) …….	

4. Which of these indigenous vegetables do you produce in your farm? (*Allowed to tick more than one*)

Vegetable species	Area under production (Ha)	For how long have you been producing?	
		Years	Months
1.Amaranthus (*terere/omboga*)			
2.Nightshade (*managu/osuga*)			
3.Cowpea (*kunde/boo*)			
4.Spiderplant (*sergeti/akeyo*)			
5.Other (specify) ……			

5. Have you gotten assistance from extension officers regarding production practices over the past 12 months? (1 = Yes 0 = No)
   If No skip to (7), If Yes,
6. How frequently do the extension officers visit your farm?
   (1= Daily = 2 = once a week 3 = twice a week 4 = once a month 5= Once a year 6= Once every planting season)
7. Where do you acquire information on production practices?
   (1 = Neighbors 2 = Indigenous (Own) knowledge 3 = Television 4= Radio 5 = Newspapers 6 = Community elders 7= NGO's 8= Government support staff 9 = Other (Specify) ……..)
8. Did you receive any text message in the last 12 months? (1= Yes 0= No)
   If Yes
9. How frequently did you get the message?
   (1=Daily 2= Once a week 3= Twice a week 4= Once a month 5= Other (specify) ……..)
10. What was the source of the text message
    (1=Government agency 2=Extension agent 3=NGO's 4=Vegetable buyers 5=Friends/ relatives 6=Other (Specify)…….)
11. Which of these communication channels do you use to receive texts/messages?
    (1= E-mail 2= Face book 3= Twitter 4= SMS 5= Other (Specify)…….)
12. Which inputs do you use in your production?

Input	Quantity per season	Average cost (Ksh /per season)
Jembes/hoes		
Machinery		
Labor		
Seeds		
Fertilizer		
Pesticides/insecticides		
Other (specify) ……..		

13. Where do you purchase your inputs?
    (1 = Agro-vet store 2 = Local kiosk 3 = Farmer group 4 = Extension officers 5 = Government supply 6 = Other (Specify) …….
14. What kind of labor do you employ in your farm?
    (1= Family labor 2 = Hired labor 3= Both hired and family 4 = Other (Specify) ……)
15. Is rain water your main source of irrigation water? (1=Yes 0=No)

If No, What is your alternative source of water ?

	Water source	Distance in	
		Kilometers	Minutes
1	Lake		
2	River		
3	Borehole		
4	Other (Specify)		

16. How do you get the water into your farm?
(1=Buckets/jerricans 2=Irrigation pumps 3=Other (specify)…….)

17. What is your average harvest per season?

Vegetable species	Output (Kg/ha)
1. Amaranthus (*terere/omboga*)	
2. Nightshade (*managu/osuga*)	
3. Cowpea (*kunde/boo*)	
4. Spiderplant (*sergeti/akeyo*)	
5. Other ……	

18. Is there a reason you prefer producing more of one species over the other?
(1 = Yes 0= No)
If Yes, for which of these reasons?

Vegetable species	Reason you prefer growing it? 1= Seeds are readily available 2= Cheaper to produce 3= Not easily affected by diseases 4= Grow faster 5= Have ready market 6= Fetch higher prices 7= Do not easily get spoilt 8= Other (Specify)……
Amaranthus(*terere/omboga*)	
Nightshade (*managu/osuga*)	
Cowpea (*kunde/boo*)	
Spiderplant (*sergeti/akeyo*)	
Other …….	

19. Do you get any financial support for your production?
(1= Yes 0 = No)
If Yes what is your source?
(1 = Government grants 2 = Bank 3 = Cooperative society 4 = Own savings 5 = Handouts from neighbors/relatives/friends 6 = NGO'S 7 = Other (Specify) ……)

20. What challenges do you face in the production of indigenous vegetables……
(1= Irrigation water 2= Seeds 3= Fertilizer 4= Access to credit 5= Pesticides/insecticides 6= Mechanization (tractor) 7 = Extension support 8= Information on farming practices 9= other (specify) ……. …)

C. MARKETING CHARACTERISTICS

21. Do you normally sell your vegetables to the following outlets? (*Complete the table*)

Outlet (1=Yes 0=No)	Main vegetables sold 1= Terere/Ombogo 2=Managu/Osuga 3=Kunde/Boo 4=Sergeti/Akeyo 5=Other …….	How frequently do you sell to the outlet in a season? 1= Daily 2=Once a week 3= Twice a week 4=Monthly	For how long have you been selling to the outlet?	Quantity sold kg/bag?	Price per kg/bag?	Distance to outlet Km/Min?
Farm-gate						
Broker						
Open air market						
Roadside retailer/Kiosk						
Farmer group						
Wholesaler						
Supermarket						
Hotel						
Hospital						
School						
Other (Specify)						

22. Is there a reason you prefer selling to the outlet in 1 above?

Outlet	Reason you prefer? 1=Offer higher prices 2= Regular buyer/Familiarity/trust 3= Outlet is nearest 4=Time saving 5= Not keen on quality 6=Timely/regular payment 7=Collects from farm 8= Offers technical support 9. Other ……..
1. Farm-gate	
2. Broker	
3. Open air market	
4. Roadside retailer/kiosk	
5. Farmer group	
6. Wholesaler	
7. Supermarket	
8. Hotel	
9. Hospital	
10. School	
11.Other …….	

23. Is there a reason you do not supply your vegetables to the outlet in 1 above?

Outlet	Reason you do not supply? 1=Strict on quality of vegetables 2= Require variety of produce 3= Long distance 4= Require consistent supply 5= Require large quantities 6=Delay in payment 7= Require contractual agreement 8= Other ……..
1. Farm-gate	
2. Broker	
3. Open air market	
4. Roadside retailer/kiosk	
5. Farmer group	
6. Wholesaler	
7. Supermarket	
8. Hotel	
9. Hospital	
10. School	
11. Other …….	

24. Do you normally have prior information on possible markets and prices before selling your vegetables? (1= Yes 0 = No)

If Yes

Where do you get information on possible markets and prices for your produce?

(1= Neighbor 2 = Television 3=Radio 4 = Internet 5 = Newspapers/magazines 6= Buyers 7 = NGO'S 8=Extension officers 9 = Other (Specify) ……..

25. Who sets the prices of the vegetables?

(1= Buyers 2 = Farmer group 3 = Farmer negotiates 4= Government standard price 5 = Other ……)

26. Do you experience spoilage of your vegetables before it gets to your buyer?

(1 = Yes 0 = No)

If Yes what is the estimate of loss incurred in Kg….Bags …….?

27. Do you own a storage facility for your vegetables?

(1 = Yes 0 = No)

If Yes what storage facility do you own?

(1= Cold storage 2 = Boxes 3= Crates 4 = Basket 5 = Basins 6= Other (Specify) …….

28. Do you carry out any value addition/preservation procedures on your vegetables before selling? (1= Yes 0 = No=)

If Yes which of these?

Value addition/Preservation	Cost (Ksh/bag)
1.Sun drying	
2.Fermenting	
3.Sprinkling water	
4.Packaging	
5. Cool air drying	
6. Blunching	
7.Other (Specify) ……	

29. What is the major cost you incur when selling your vegetables?

Activity	Cost per season (Ksh)
1. Storage	
2. Transport	
3. Packaging	
4. Cleaning	
5. Other (specify)	

30. On average, how much income do you make from sales of your produce in a season ……. Ksh?
31. How far is your farm to the nearest tarmac road …… km ……min?
32. What is the condition of the tarmac road?
    (1 = Poor 2 = Very poor 3 = Good 4 = Very good)
33. What challenges do you face in marketing your produce?
    (1= Market information 2= High transportation costs 3= Competition from large/medium scale producers 4= Price exploitation 5=Poor infrastructure (roads) 6 =Perish ability due to poor storage 7=Other (specify)…….)

D. GROUP MEMBERSHIP

34. Do you belong to any group? (1 = Yes 0 = No)
    If No what is your reason?
    (1= There are no groups 2 = I don't have time for groups 3 = I am not aware of any group 4 = Groups are costly 5 = Groups are not beneficial 6 = Others (Specify) …….)
35. What kind of group is it?
    (1= Agricultural 2 = Community 3 = Religious 4 = Savings and credit 5 = Other (Specify) ……)
36. For how long have you been in the group …… months ……. Years?
37. Does your group help you sell your vegetables? (1 = Yes 0 = No)
    If Yes, to which of these markets do they take your vegetables?
    (1= Supermarkets 2 = Hospitals 3 = Hotels 4= Schools 5= Open air markets 6= Wholesalers 7= Retailers 8= Brokers 9= Other (specify) ……)
38. What other benefits do you get from being a member of the group? (*Can tick more than one*)
    (1 = Credit/loan 2 = Input purchases 3 = Joint extension services 4 = Market/ price information 5 = Training 6 = Ready marketing of produce 7 = Higher prices for produce 8 = Other (Specify) ……..

Thank you for your time
Your participation in this study is greatly appreciated
******THE END******

APPENDIX 2: Checklist for Focused group discussion

ASSESSMENT OF SMALLHOLDER PARTICIPATION IN THE DOMESTIC HIGH VALUE MARKETS FOR INDIGENOUS VEGETABLES IN SIAYA COUNTY

FOCUS GROUP DISCUSSION QUESTIONNAIRE

The purpose of this focus group discussion was to obtain preliminary insights from various actors along the indigenous vegetable value chain on the production and marketing/trading, quality issues and the constraints/challenges and opportunities.

Checklist for discussion

1. What kind of indigenous vegetables are commonly grown and traded in this area and by whom? Why indigenous vegetables?
2. Do you buy, sell or produce the vegetables? Are there any value addition procedures you carry out on the vegetables and how effective/important have they been?
3. Are there requirements (qualities or standards) you look for in the indigenous vegetables?
4. Are you keen on traceability aspects like type of water used, fertilizer, chemicals and type of seeds and why?
5. Where do smallholders sell their vegetables in this area and what prices are offered at different outlets?
6. Who can you point out as competitors to smallholders in high value markets? For what reasons are they preferred over smallholders?
7. What priority issues do you think smallholders should do to enable them access more markets and improve on profitability from their farming?
8. Generally, is the supply predictable? What can you say about the availability of the vegetables compared to some years back and what measures do you take during seasons of abundance and scarcity?
9. Can you link fluctuation in supply to aspects of climate change like rainfall? What have been the effects of these aspects on production and marketing and what interventions do you think are necessary?

APPENDIX 3: Results of Variance Inflation Factor (VIF)

Variable	VIF	1/VIF
HH_INCME	2.39	0.418669
OUTPUT	2.35	0.424749
YEARSCHL	1.50	0.666248
FARMSIZ	1.27	0.785852
MRKTINFO	1.27	0.785901
AGE	1.20	0.835563
EXTSERVCE	1.17	0.852411
GEND	1.16	0.863408
CRDTACCESS	1.15	0.871561
MRKTDIST	1.05	0.950406
Mean VIF	1.45	

* VIF value greater than 5 indicates presence of multicollinearity in a data set

APPENDIX 4: Results for Goodness of Fit

Logit model	OLS
No of observations 150	No of observations 150
LR Chi square 105.79	Prob>F 0.000
Pro>Chi square 0.000	Adjusted R2 0.56
Pseudo R^2 0. 6527	
Log likelihood -31.93	

* Pro>Chi square = 0.000 shows joint significance of variables in the model

APPENDIX 5: Results for Heteroskedasticity Test

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Ho: Constant variance

Variables: fitted values of high value market participation

Chi square = 38.89

Prob > Chi square = 0.19

* An insignificant Pro>Chi square shows presence of homoskedacticity