EVALUATION OF EFFECTS OF VALUE ADDITION IN SWEET POTATOES ON FARM INCOME AND PROFIT MARGINS IN HOMA BAY COUNTY, KENYA.

OLUOCH ALICE ACHIENG.

A Thesis Submitted to the Graduate School in Partial Fulfillment for the Requirements of Master of Science Degree in Agricultural and Applied Economics of Egerton University.

EGERTON UNIVERSITY

NOVEMBER, 2016.

DECLARATION AND APPROVAL

Declaration

I declare that this thesis is fully my original work and to the best of my knowledge has not been presented for the award of any degree in this or any other university.

Signature: ------------------------ Date------------------------

Oluoch Alice Achieng

KM17/3712/13

Approval

This thesis has been submitted to the graduate School of Egerton University with our approval as University Supervisors.

Signature: ------------------------- Date: -------------------------

Prof. Job Lagat, (PhD)

Department of Agricultural Economics and Agribusiness Management, Egerton University, Njoro (Kenya)

Signature: ------------------------- Date: -------------------------

Dr. Jackson K Langat, (PhD)

Department of Agricultural Economics and Agribusiness Management, Egerton University, Njoro (Kenya)

COPYRIGHT

© 2016 Oluoch Alice Achieng.

DEDICATION

I dedicate this work to my late grandparents, my family, relatives and friends for their continued support throughout my studies.

ACKNOWLEDGEMENTS

ABSTRACT

Homa Bay County has great potential in terms of the existing arable land, availability of water, human resources base, technological options as well as market growth opportunities. A majority of household engage in fishing and agriculture as a source of livelihood with previous studies indicating that an estimate of 60% engage in sweet potato production. Kasipul, Kabondo Kasipul and Ndhiwa sub-counties have a high potential for sweet potato production. However the abundant production has not translated much into better living conditions by improving incomes as the poverty level in the county still exceeds 50%. Sweet potato value addition has the capability of fetching higher prices from the market. This study therefore established the activities of value addition being practiced in the three sub- counties, the prices of end-products, the marginal effects that value addition had on net income from sweet potatoes and the profit margins along the sweet potato value chain. Multi Stage sampling procedure was used to select 200 respondents. Interview schedules and observation method were used in the collection of data. Data was analyzed using STATA and SPSS computer programs. Descriptive statistics, chi-square test of independence, F-test, multiple regression model and profit margin analysis were used in analyzing the objectives. Results showed that majority of the farmers were involved in cleaning, sorting, grading and packing raw tubers as a form of sweet potato value addition. The prices of end-products of value addition were increasing with the level of value addition. The findings also revealed that the acreage under production, levels of value addition, access to training and transportation costs significantly influenced farm income from sweet potatoes. The profit margins were found to be higher for shorter distribution channels along the value chain. From these findings, the policy makers should encourage farmer group formation to enhance training on value addition, prices and market opportunities. In addition, the study recommends formation of more SACCOs through which farmers can acquire better vines for higher levels of value addition at subsidized prices and ready market for their produce.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS AND ABBREVIATIONS

USAID-KHCP	United States Agency for International Development- Kenya Horticulture Competitiveness Project partnership
ADS- Nyanza	Anglican Development Services- Nyanza
FAOSTAT	Food and Agriculture Organization Statistics
NRCRI	National Root Crops Research Institute
HCDA	Horticulture Crop Development Authority
NGO	Non- Governmental Organization
GDP	Gross Domestic Product
KMS	Kilometers
KES	Kenya Shillings
OLS	Ordinary Least Squares
SPSS	Statistical Package for Social Science
KIRDI	Kenya Industrial Research and Development Institute

CHAPTER ONE

INTRODUCTION

1.1 Background Information

Sweet potato is among the world's most important, versatile, and underexploited food crops. It currently ranks as the world's sixth most important food crop on a fresh weight basis. More than 105 million metric tons are produced globally each year; 95 % of which is grown in developing countries (FAOSTAT 2009). In these developing countries it ranks as the fifth most important food crop after rice, wheat, maize and cassava (*ibid*). Globally it is cultivated mostly in Asia Pacific countries such as China, Papua New Guinea, and Vietnam among other areas. In Africa it is produced in countries such as Angola, Madagascar, Malawi, Mozambique, Nigeria, Zambia, Uganda and Kenya. Sweet potato is one of the most widely grown root crops in Sub Saharan Africa covering around 2.9 million hectares with an estimated production of 12.6 million tons of roots in 2007 (FAOSTAT, 2008). It is predominantly grown in small plots by poorer farmers' hence it is known as the 'poor man's food' (Woolfe, 1992). Yields of sweet potato per unit of land vary widely, from over twenty-five tons per hectare in high-input agricultural systems to below three tons per hectare where sweet potato is grown as a subsistence crop with minimal use of fertilizers or other inputs, mostly in Africa.

In Kenya sweet potato is mostly grown in Kakamega, Bungoma, Busia, Homa Bay and Kisii counties. It is also grown to a small extent at the coast and in central regions. The potential of sweet potato contribution to food security, increased incomes and reduction of nutritional deficit is considerable and is yet to be fully exploited in developing countries (Woolfe, 1992). Nyanza region is among the highest sweet potato growing areas in Kenya with Homa Bay County being the principal source. Additionally, sweet potato is an important traditional crop that is grown customarily by small scale farmers both for domestic and commercial purposes. The crop has a relatively high yield potential that may be realized within a short growing season of between three to five months. It is a drought tolerant crop and has a wide ecological adaptation.

Most sweet potato varieties require low or non-use of external inputs. Moreover, the ability of the crop to establish ground cover fast enables suppression of weeds, control of soil erosion and maintenance of soil fertility. As such, it is an attractive crop for Kenya's farming systems.

The production of sweet potatoes in Homa Bay County is greatly enhanced by conducive conditions including sandy loam soil, and an abundant almost continuous rainfall pattern. Farmers are therefore able to realize two to three crops per year. The crop is either planted as pure stand or relay cropped with maize. The most important variety grown is *Enaironi*. This white skinned variety has desirable characteristics to both farmers and consumers. These include short maturity period (3 to 4 months), high yields, moderate stability after harvesting (up to 7 days) and an attractive yellow flesh. In some cases this variety receives higher prices than other varieties in the market. *Kanchwere* is the second most important variety grown. The tuber has a red skin and yellow flesh and matures within 6 to 7 months after planting. After maturity the tubers can retain their quality for a further 3 to 6 months when left unharvested. This variety is therefore suitable for cultivation for home consumption where sequential or piece meal harvesting is desirable, in order to extend the supply of fresh potatoes. The variety is also suitable for marketing as it can store relatively well (up to 2 weeks) after harvesting.

Many raw commodities have intrinsic value in their original state. Value addition is the process of changing or transforming a commodity from its original state to a more valuable product. For sweet potatoes, value addition may take various forms. It can be boiled, roasted, fried, creamed or baked in their skins (Tewe *et al*., 2003). They are combined with both sweet and savory dishes. In addition other products such as sweet potato vine can be a valuable source of green fodder and lasts throughout the off-season. The tubers as well form an industrial raw material for the production of starch, alcohol, and pectin. On-farm processing of sweet potato in Homa Bay has picked up with a majority of the processors being members of women groups. These groups have been trained on the processing technologies by specialist in home economics. Examples include the Kinda Women Group with a processing site in Rangwe and the Allendu Women group, (Owuor, 1996). ADS-Nyanza is a faith- based organization working in six counties in Nyanza region to implement a sweet potato value chain upgrading project. The aim is to increase farmers' income levels from sweet potatoes by improving production and marketing of the product in Kabondo area of Homa Bay County,(ADS-Nyanza, 2002). The kind of value addition activities include grinding sweet potatoes into flour which can be mixed with sorghum to make porridge. Mild alcoholic beverages can be made from peeled, chopped, pounded and fermented sweet potato. Such processing is only done when there is a surplus.

In many areas of the county, sweet potato flour is used in making *chapatti, mandazi*, crisps and in making any type of baked food such as breads, cookies and muffins or can be fried to obtain potato chips. However, sweet potato value addition can be done in three levels:

Level 1 - Post-harvest level/primary processing: this involves proper cleaning with water, sorting according to size and extent of damage, grading and packing sweet potato raw tubers for sale. This group of activities does not require training to be performed and hence most households easily carry them out.

Level 2 – Secondary/ basic processing: this includes steaming, boiling or roasting the raw tubers. In addition it includes slicing, chipping, drying and grinding sweet potatoes to get flour. All these processes may be followed by packing.

Level 3 - High end processing: involves activities such as frying sliced root tubers to obtain potato chips, noodles, candy, desserts. In addition it involves baking bread, buns, doughnuts and cakes using sweet potato flour, preparing *mandazi* and *chapatti* using the same ground flour or blending the boiled tubers to make sweet potato juice. This level also involves the actual packaging of processed sweet potato products, branding, and marketing.

Initially, the utilization of sweet potato in the County was to consume by either chewing raw or boiling the tubers to act as breakfast meal. However with the vibrant introduction of low cost value addition techniques by Non- governmental organizations, farmers have gradually incorporated other activities of value addition. Value addition trainings have played a major role in educating farmers on the nutritional benefits, food security and improvement in income resulting from adding value to the raw tubers.

1.2 Statement of the problem

Over the years, previous studies have advocated on the benefits of adding value to primary agricultural products with a forecast that this may intensify production and lead to higher incomes to farmers. To achieve this, County government through the strategic Plan (Homa Bay County 2013-2023) has resolved to use the value chain approach to identify possible interventions through a participatory and iterative process to encourage value addition techniques as a way of enhancing rural incomes. While a majority of farmer groups have been trained on low-cost value addition technology, it is generally assumed that they produce the three levels of value addition end-products and fully engage in the market. However, it has not been empirically established to what extent the farmers' are actually involved in value

addition activities and the effects these activities have on net prices and consequently farm income. This study aimed at filling this knowledge gap.

1.3 Objectives of the study

The general objective was to contribute to the existing body of knowledge on the effect of sweet potato value addition on farm income in Homa Bay County.

1.3.1 Specific objectives

1) To establish the actual levels of value addition activities in sweet potatoes practiced.

2) To determine the net prices of products generated from sweet potatoes' value addition activities

3) To determine the effect of different levels of value addition activities on net sweet potato income of farmers.

4) To analyze the profit margins at different levels in the sweet potato value chain.

1.4 Research Questions

1) What are the different levels of value addition activities in sweet potatoes practiced?

2) What are the net prices of sweet potato value added products?

3) Do different value addition activities influence net income margins from sweet potatoes for farmers?

4) What is the profit spread of margins among actors along the sweet potato value chain?

1.5 Justification of the Study

Uncertainty in weather patterns and the existing market potentials has led most farmers in Homa Bay County to diversify their production from maize and beans to other industrial crops such as sweet potatoes. Due to its benefits especially on its potential to improve farmer incomes, a study of this nature is imperative. It brings to the fore the needed information that will enable farmers to make rational decisions with respect to production and value addition. Consequently, an improvement in the level of farmers' income will impact positively by reducing the poverty level which stands at above 50% as per the statistics in the county's strategic plan 2013-2023.

1.6 Scope and Limitation

The study was confined to Homa Bay County and specifically to small scale sweet potato producers. Therefore the interpretation of the results may not to be used as a reflection of the impact in other regions where sweet potatoes are produced. In addition, the study focused on analyzing the differences in income due to different value addition activities in sweet potatoes. Lack of proper record keeping by some small scale farmers due to illiteracy was a hindrance to acquisition of perfectly accurate data.

1.7 Definition of Terms

Smallholder farmers- Refers to farmers with land holdings of less than five acres.

Value Addition techniques- Value addition is the process of changing or transforming a product from its original state to a more valuable state .Value added refers to the additional value created at a particular stage of production or through image and marketing. Value added agriculture is a process of increasing the economic value and consumer appeal of an agricultural commodity. It is an alternative production and marketing strategy.

Sweet Potato Value Chain- Refers to the full range of activities which are carried out from conception, through the different phases of production, transformation, and delivery to final consumers. It is also defined as a "set of interventions by chain actors (producers, buyers, processors) and/or service providers to generate higher value added and create win-win relationships among several chain actors".

Profit margin – It refers to one of the profitability ratios calculated as net income divided by revenue. Net income or net profit is determined by subtracting all expenses from total revenue. Profit margins are expressed as a percentage.

CHAPTER TWO

LITERATURE REVIEW

This chapter reviews previous studies that have been done on sweet potato value addition. It reviews the key findings of different researchers on types of sweet potato value addition, the value added products and their effect on nutrition, food security and income. The chapter will also highlight the knowledge gap in these past studies.

2.1 Sweet potato production in Kenya

Worldwide, sweet potato is the sixth most important food crop after rice, wheat, maize, potato and cassava while in the developing nations sweet potato is the fifth most important food crop (International Potato Center, 2013).In Kenya, sweet potato ranks as the third most important crop after maize and Irish Potato. The area under production grew from 20,181 hectares yielding 227,470 tons (valued at Kes 3 billion) in 2009 to 22,989 hectares in 2011 yielding 300,267 tons valued at Kes 3.6 billion (HCDA, 2012). With this rating and increase in production more intensification by farmers into value addition will probably translate to increased or wide range of processed products which will help capture the unexploited market. Kenya's potential to produce sweet potato both for the local market within the country and for the export market is high due to favorable soil and vine quality plus water availability in production areas. The soil types and texture, (sandy at the Coast to silt with a lot of organic matter in the Nyanza region) with a pH range of 6-7, are suitable for sweet potato production. (USAID- KHCP, 2014).In addition efforts towards farmer awareness on clean vine multiplication coupled with the need for good storage have been well adapted. There have been releases of new varieties with diverse characteristics for virus tolerance. Almost 75 percent of the total sweet potato production is concentrated in the densely populated Lake Victoria Basin in the West. This region is mostly humid or semi humid (Rees *et al.,* 1997).

The sweet potato tuber production plays a three prolong role of nutrition, income and food security at household level. USAID-KHCP is currently working with over 30,000 farmers in the sweet potato value chain in 13 counties (USAID-KHCP, 2014). Although sweet potato was once traditionally viewed as a low value crop, clean planting material has catalyzed improved yields and farm incomes for smallholders, particularly in the major sweet potato

growing areas of Homa Bay, Migori, Bungoma, and Busia counties. A study on livelihood diversification strategies among small holder farmers in the southern Nyanza region of Kenya revealed that sweet potato is among the most important crops that help in food security in the area.

2.2 Impact of value addition on agricultural products

According to World Bank Report (2012), In the East African region, Kenya has the highest agricultural value added standing at $8.3 billion rounded figure in 2011, followed by Tanzania which stood at $5.8 billion and Uganda standing at $3.87 billion. Various literatures has shown that sweet potato can be an excellent vehicle for creating value added, income generating opportunities in rural villages and towns in Sub-Saharan Africa (Best *et al*., 2006; Wheatley *et al*., 1995; Kapinga *et al*., 2000; Westby *et al*., 2004).Agro processing has a tremendous potential for increasing income through value addition achieved through processing of sweet potatoes into flour and other products, increasing their market range. Agro processing enterprises/ units and rural based industries if efficiently run will become responsive to the ever-changing market demands implying improvement in market efficiency which is a precursor for overall economic growth of the country (Mbeine, 2014). However this study did not measure to what extent sweet potato value addition could impact on income. The results only indicated that there were unexploited opportunities in improving income through value addition.

Sweet potato can be processed from its raw form and utilized in different ways. It can be boiled, roasted, steamed and consumed at home as accompaniment for breakfast or taken as an actual meal, the vines can be used as livestock feed, and in addition it can be used in industrial processes to make mild alcohol beverages. The orange-flesh varieties are good sources of vitamin A and C. (Yanggen and Nagujia, 2005). Processing of sweet potato into value added products helps increase the shelf life of these products, increases the range of products available for consumers and ensures food availability in time of scarcity (Westby *et al.,* 2003). This study illuminates on some of the benefits of adding value to raw tubers such as improving on their shelf life and availing range of products for consumers to choose from. It focuses on the benefit to consumers and leaves the gap of knowing how farmers would benefit in terms of income from adding value.

Abubakar *et al.* (2010) revealed the value of sweet potato leaf as containing protein and crude fiber which are important for addressing deficiency diseases and colon diseases. A closer

analysis also shows that a number of products can be obtained from processing low priced sweet potato and this processing has proved to be cost effective hence giving these products a competitive edge thus benefiting farmers through creating better markets and participating in integrated production-processing marketing to add value to their produce (Fawzia *et al*., 2000). Ray and Tomlins, (2010) demonstrated that sweet potatoes can be made into liquid and semi-solid food products such as beverages, soups, baby foods, ice cream, baked products, restructured fries, breakfast cereals, and various snack and dessert items. Sweet potato can also be used instead of tomato in preparation of ketchup. These findings looks at the range of value added products resulting from sweet potato value addition. However, there still exists a gap on the values attached to these products and the difference in prices of the resulting end-products.

Research on the development and promotion of sweet potato products in western Kenya revealed that sweet potato utilization has for a long time been limited to boiling, roasting and chewing raw. However, diversified sweet potato utilization had an indication for improving food security and local household incomes of the region. A study conducted by Owuor (1996) observed that besides boiling or selling sweet potato as raw food, Kenya's sweet potato could be processed and used to make *chapati*, *mandazi*, chips and cakes. Consumers preferred sweet potato products to pure wheat flour products and depended on seasons as observed by 82.4% and 78% of the consumers respectively (Owuor, 1996). Past trends showed that unit prices of sweet potatoes in Kenya have been increasing since the year 2003, a likely indication of rising demand for the product. The study findings revealed that there were more ways of adding value to sweet potato other than boiling, roasting and chewing raw. These activities fall under level two value addition. The study also concluded that diversification in utilization indicated possibility of improving food security. This still leaves a gap on knowing the actual effect that other activities in level one and three value addition has on farmers' income.

 Westby *et al.* (2003) discovered that sweet potato juice offers good return on investment though currently the juice market is only local and small while the market size for sweet potato chips and animal feed is estimated to be about 100 metric tons per month in Uganda. Sweet potato juices being produced are of different types, notably 100% sweet potato; mixture of sweet potato with oranges, passion and pineapples. The finding of the study looked at only blending the tubers into juice. This is level three value addition. There however still exists knowledge gap on knowing the other activities of value addition at this

level such as baking and preparing *chapatti* and *mandazi* and how these would impact on farmers' income.

Other findings have shown that value addition technology has had great impact on community livelihoods in those areas where farmers have assimilated the practice. These impacts are such as there has been wide acceptance of value added sweet potato products in the local market areas; increased production has greatly contributed to food security in the area and increased incomes from sale of surplus potato. Commercialization of vine production and processed or developed sweet potato products has helped parents or guardians sustain education of children and orphans. The technology has also contributed towards economic empowerment of women, who are the majority of the farmers (Hagenimana and Owori, 1997).The study analyzed the overall impact that value addition had on the livelihood of the community members. However, despite having an overall positive effect, it would be more appropriate to evaluate the effect of each level of value addition separately on income.

On the feasibility, acceptability and production costs of sweet potato-based products, using comparative gross margins for sweet potato and wheat products in Ndhiwa and Rongo in South Nyanza, Hagenimana and Owori, (1997), results showed that the net revenue per unit was higher for the sweet potato products than for wheat products. This was principally due to the low cost of sweet potato flour relative to wheat. Since *Mandazi, chapatti* and buns are popular snack foods with ready market in urban and rural settings throughout Kenya and Uganda, their relatively low cost makes them affordable and attractive to many consumers. Interestingly, *Mandazi* and *chapatti* made from sweet potato were selling at a price double those made out of wheat flour. This indicates the possibility of value addition in significantly improving incomes. This study empirically measured the impact that end-products at level three value addition had on farmers' income. However, there is still a knowledge gap as the products under study were only two, *chapatti* and *mandazi*. This level of value addition has other end-products such as baked and puree products which implies that the overall impact on net revenue should consider all the available end- products sold at this level.

In Tanzania, sweet potato products and fresh sweet potato as products had end markets all over Tanzania and around Eastern and Southern Africa (Kenya, Uganda and Burundi).The market trends for processed sweet potato products in Tanzania was not fully utilized and local production met the demand partially. However in Shinyanga and Mwanza many end consumers preferred processed products. In Nigeria two primarily products were generated

locally called *inginyo* and *amukeke*; it was from further processing that these two secondary products (*amukeke* flour and *inginyo* flour) were derived (Engoru *et al.*, 2005).The study focused on marketing of sweet potato raw tubers and the value added products. This still left a gap on the benefits of value addition from the production view.

The Impact of adoption of value added products (Cassava, Cocoyam and Sweet potato processed products) in IMO State Nigeria revealed that only 22% earned income from value-added products. Surprisingly 35% used theirs to feed families and in receiving visitors (Aniedu, 2012). Indeed Young (1994) revealed that women's priority in adoption of innovation in Nigeria was most importantly for subsistence with market and income generation being secondary. However, the adoption of the value-added products had made appreciable tangible impact on the livelihood of the households in that they were able to cater for school fees and buy/hire more farmland and paid medical bills. The research findings revealed that individuals added values for different reasons mostly subsistence compared to other reasons such as improving on incomes from the market. Obtaining the percentages of farmers adding values for different reasons, however fails to address the knowledge gap of what impact does value addition have on incomes of those who add value with the sole reason of improving their incomes.

Lemaga (2005) posited that the introduction of sweet potato based enterprises to poor and marginalized smallholder farmers increased their income through potato products sales and knowledge on post-harvest technologies. There was improved food security and some households were able to cater for household basic needs like medical expenses, and paying school fees. This research generalized on the benefits of adding value and leaves out the importance of segmenting differently the impact that each level of value addition is having on incomes in order for farmers to make rational decisions with regard to adding value.

A recent study, (USAID-KHCP partnership (2012), established that value addition had a positive impact on groups' and SACCOs incomes and savings. It established that cost effective training during value addition practices had enabled most farmer groups in the area to make OFSP and butternut products for sale in the local markets, with the group selling the value added products worth approximately Kes 8,000 in less than a week in 2013, putting this revenue in a savings scheme. This research findings focuses on the impact value addition is having on farmer groups as a whole. It leaves out the impact it would have on individual farmers cultivating sweet potatoes and not engaged in group farming.

2.3 Marketing of agricultural commodities.

Anyaegbunam and Nto, (2011) found out that sweet potato marketing system in south eastern Nigeria was not efficient but lucrative and that lack of infrastructural facilities was the main problem mitigating against efficient marketing system . The findings recommended that infrastructural facilities be provided for the marketers to reduce spoilage and distressed sales.

Kenya has various sweet potato marketing systems that are mostly dominated by women. Often, they run parallel, some with forward linkages from the villages, others with market wholesalers having backward linkages into the villages. These marketing systems display a channel embracing village level retail markets which sell small quantities in heaps usually supplied from small surpluses of farmers. The local town markets are supplied by farmers-traders who collect small supplies from farms. From local markets products are, transshipped to big urban markets countrywide. (Odondo *et al*., 2013). However, Olwande *et al*. (2013) revealed that in Kabondo, producers have a range of channels through which they sell sweet potatoes. Marketing of the produce by the producers, however, is largely unorganized. Much of the sales occur at farm gate, although there are instances where the producers sell at the local market.

2.4 Theoretical Framework

Value Chain Analysis (VCA)

The Value Chain Analysis concept was introduced by Porter (1985) suggesting that activities within an organization add value to the service and products that the organization produces. Porter suggested that these value addition activities should be run at optimum level if the organization is to gain any real competitive advantage. If they are run efficiently the value obtained should exceed the costs of running them. Value Chain Analysis is a useful tool that helps identify the ways in which value is created for customers, and helps to think through how the value can be maximized: whether through superb products, great services, or jobs well done. Value chain analysis is a process that requires four interconnected steps: data collection and research, value chain mapping, analysis of opportunities and constraints, and vetting of findings with stakeholders and recommendations for future actions. These four steps are not necessarily sequential and can be carried out simultaneously. Taking a value chain approach necessitates understanding a market system in its totality: the firms that operate within an industry from input suppliers to end market buyers; the support markets

that provide technical, business and financial services to the industry; and the business environment in which the industry operates. Such a broad scope for industry analysis is needed because the principal constraints to competitiveness can lie within any part of this market system or the environment in which it operates. While it may be beyond the capacity or mandate of a donor or implementing agency to address certain constraints, the failure to recognize and incorporate the implications of the full range of constraints will generally lead to limited, short-term impact or even counter-productive results.

The decision of where to intervene in a value chain should be primarily driven by the end goal of sustainable economic growth by raising levels of farm incomes. Interventions that target a particular part of a value chain such as processing or group of beneficiaries such as small-scale producers must therefore be designed and implemented within the context, and with an understanding, of the value chain as a whole; and with an explicit focus on benefits to Medium and Small size enterprises and the poor. Value Chain Approach looks at the economic opportunities that are profoundly influenced by the dynamic systems in which they participate. By influencing how those systems perform, the research aims at improving opportunities and outcomes for the poor (*ibid*).

The end markets into which a product or service is sold whether local, regional or international provide the opportunities and set the parameters for economic growth. Generally there are multiple actual and potential end markets, each with different demand characteristics and returns. It is therefore important to segment the market: outline each of the potential end markets, what is required to compete in them, and what benefits and risks can be expected by selling into them. Since end markets are dynamic, the identification of trends should complement information about the current situation.

Understanding the role of value chain governance is fundamental to the value chain approach. Governance describes which firms within a value chain set and enforce the parameters under which others in the chain operate. Embedded in governance are inter-firm relationships, power dynamics both symmetrical and asymmetrical and the distribution of benefits. While the form of value chain governance is influenced by the characteristics of the product and the degree of specification in the end market, governance patterns evolve over time with changes in markets, products and inter-firm relationships. The quality of relationships between different stakeholders is a key factor affecting the functioning of a value chain. Strong, mutually beneficial relationships between firms facilitate the transfer of information, skills

and services all of which are essential to upgrading. Value chain opportunities and constraints generally require a coordinated response by multiple firms in the chain which necessitates trust and a willingness to collaborate.

The value chain approach therefore emphasizes a dynamic that has long been recognized: Social capital that is networks of individual relationships and social institutions are critical to business and competitiveness. In contrast to much enterprise development work in the past, the value chain approach seeks to do more than solve specific identified production and marketing problems. Directly solving problems may create some initial momentum, but building internal capacity to address value chain constraints will empower stakeholders, reduce dependency and ensure sustainability of investment impacts. The focus of the value chain approach is therefore on transforming relationships particularly between firms linked vertically in the value chain to: facilitate upgrading to become more competitive, and adapt to changes in end markets, in the enabling environment or within the chain to remain competitive. Value chain actors make upgrading decisions based on a variety of financial and non-financial incentives. In order to be able to influence the uptake of new market behaviors, the value chain approach seeks to understand the business and cultural norms, risk tolerance levels, environmental factors and other such non-financial determinants *(ibid)*.

The study therefore in summary seeks to establish the opportunities along the sweet potato value chain that may improve on net revenues and the point along the chain where the value addition will maximize utility.

2.5 Conceptual Framework

The framework (Fig 1) shows that there are a number of factors that influence the choice of the level of value addition small scale farmers settle on. These include socio- economic factors such as gender, education level, number of schooling years, farm size, and household size. An individual with more schooling years or higher education level most likely has a stable white collar job and therefore may not choose to add value as a means of improving income since they already have stable employments that they rely on for survival. Most farm activities such as planting, weeding, harvesting and kitchen related tasks are mostly performed by women in the rural areas. Therefore with regard to gender, most women compared to men tend to make value addition decisions. These include level two activities such as boiling, steaming or roasting the raw tubers for home consumption or for commercial purposes to earn income. Acreage of land under cultivation has influence on value addition

decisions. Farmers with larger acres generally are assumed to get higher outputs. These could be used for home consumption while part of the surplus could be sold as raw tubers after being assembled, cleaned, sorted and packed while some could be sun dried, sliced and chipped and later grinded into flour for baking.

The institutional factors that influence the level of value addition include whether a farmer belongs to a group most especially a marketing group, if they are able to access credit and extension services. These combined factors influence the choice of level of value addition a farmer settles on. An individual belonging to a marketing group has the advantage of stronger bargaining power for better prices for the produce, also known as collective action. Therefore such farmers would opt to add value to the raw tubers to fetch better incomes from the market. A farmer who has attended frequent trainings on better vine qualities, value addition and better farming is most likely to understand intensive profitable ways to maximize their production and consequently their profits.

When considering value addition, the framework looks at the three levels of value addition that adopters practice. A sweet potato farmer may be involved in only level one value addition which includes assembling, cleaning, sorting and grading before selling the raw tubers directly to local market. Different end-products of value addition are sold in different market outlets at different prices. This in turn results to different levels of profit margins which in turn determine the farm income that farmers get from sweet potatoes.

With regard to market outlet, different end-products appeal to different end users found in different markets. For instance raw tubers can be sold to brokers, retailers or wholesalers. The three buyers would offer different prices depending on the quantity of sacks being transacted.

Grinded raw tubers have different market outlets which include bakers, retail and wholesale shops who purchase the flour packed in different sizes. This product has a different profit margin compared to raw tubers. The margins in turn determine the total farm income a farmer gets from through the value chain.
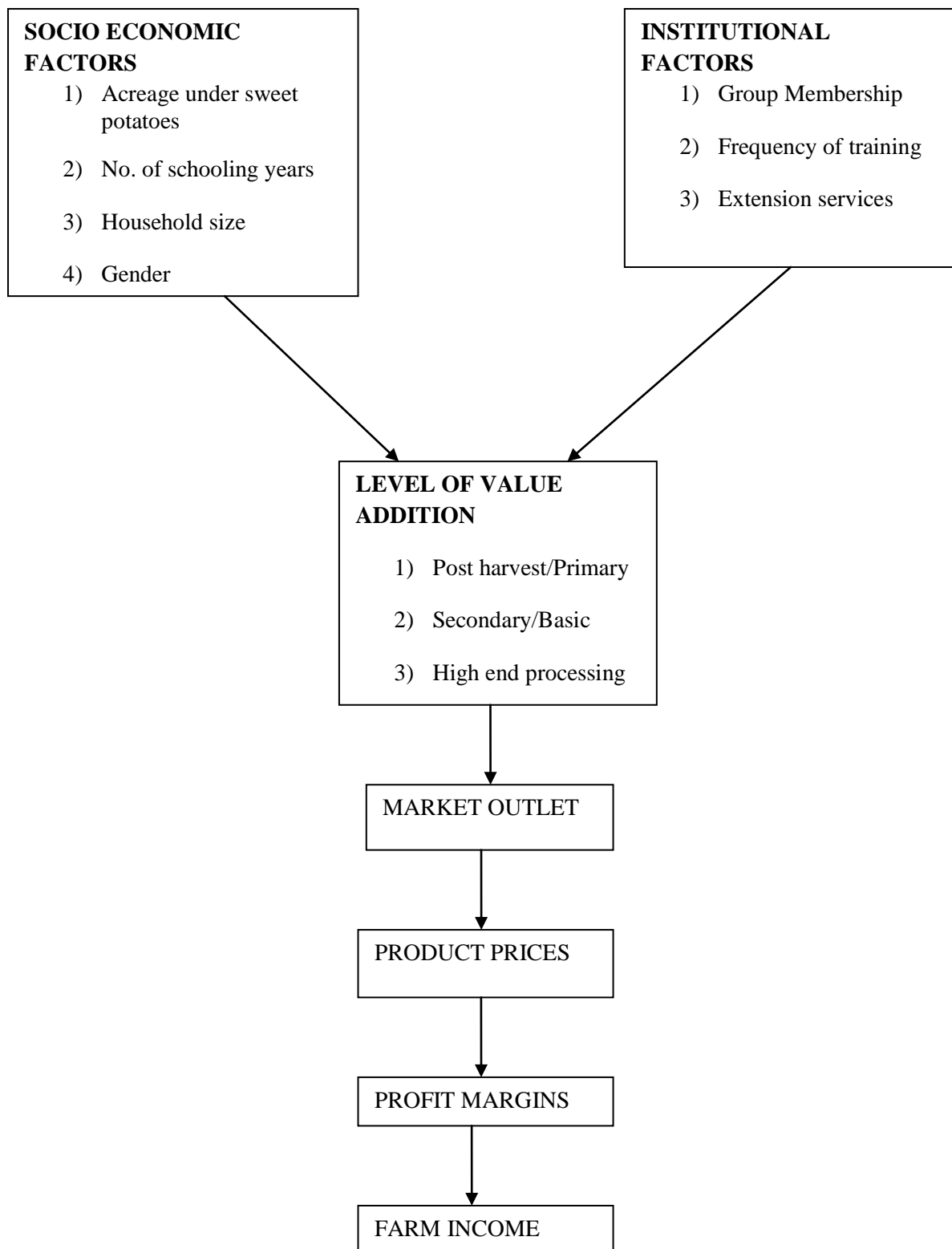
Figure 1: Conceptual Framework

Source: Own Conceptualization.

2.6 Summary of Literature Review.

Previous studies have addressed the role of value addition from various angles. The authors have researched on the prolonged roles that sweet potato plays at household level, the forms of value addition of sweet potatoes, the utilization of both end-products and by-products of sweet potatoes as well as the impact of value addition adoption on community livelihoods. Other researchers have addressed marketing challenge by looking into the availability of markets for value added products and the feasibility, acceptability and production costs of the raw tubers. These findings have added knowledge on the general impact of value addition for sweet potato and other traditional crops. However, there exists a knowledge gap in the literature on the separation of levels of value addition and their individual impact of farmers' income. It is therefore necessary to address value addition from this angle, and to establish the value attached to these products for farmers and other stakeholders to make informed decisions.

CHAPTER THREE

METHODOLOGY

This chapter highlights the key relevant features of the study area. These include the climatic conditions, population statistics, key enterprises and economic activities practiced in the county as well as the average landholdings of farmers. This chapter also describes the sampling design and procedure used in the study.

3.1 The study area

Homa Bay County was chosen as the study area since it is leading in the production of sweet potatoes in Kenya. The County is located in the Nyanza region, along the south shore of Lake Victoria's Winam Gulf lying at latitude of 0.6833° S and longitude of 34.4500° E. The county covers an area of 3,183.3 sq km with a population of about 963,794 (male - 48% and female - 52%), according to the 2009 National Census. It is located about 420km from Nairobi. The County borders Migori to the south, Kisii and Nyamira to the east and Kericho and Kisumu to the north east. The county also borders Lake Victoria to the north and west. The county comprises eight sub-counties: Karachuonyo, Rangwe, Suba, Mbita, Kasipul, Kabondo, Ndhiwa and Homa Bay Town.

The County has an inland equatorial climate which is however modified by the effect of altitude and proximity to the Lake Victoria which makes the temperatures range from 17° to 25° centigrade. It is divided into two main relief regions namely; the lakeshore lowlands and the upland plateau which starts at 1,220 metres above the sea level. It has two rainy seasons with long rains starting from late March to June and range from 800mm-1800m. The short rains start in August to December ranging from 250mm-700mm. Kasipul and Kabondo Kasipul sub-counties receive reliable rainfall. The County has 452 acres of arable land of which 95% are small scale holdings and is characterized by a variety of soils; the dominant of which are alluvial, loamy and sandy soils. It has 44660 small farm holdings, between 1.2 to 3.0 acres on which food crops such as sweet potato, maize, cassava, and sorghum are grown. Fishing and agriculture are the main economic activities in the county.
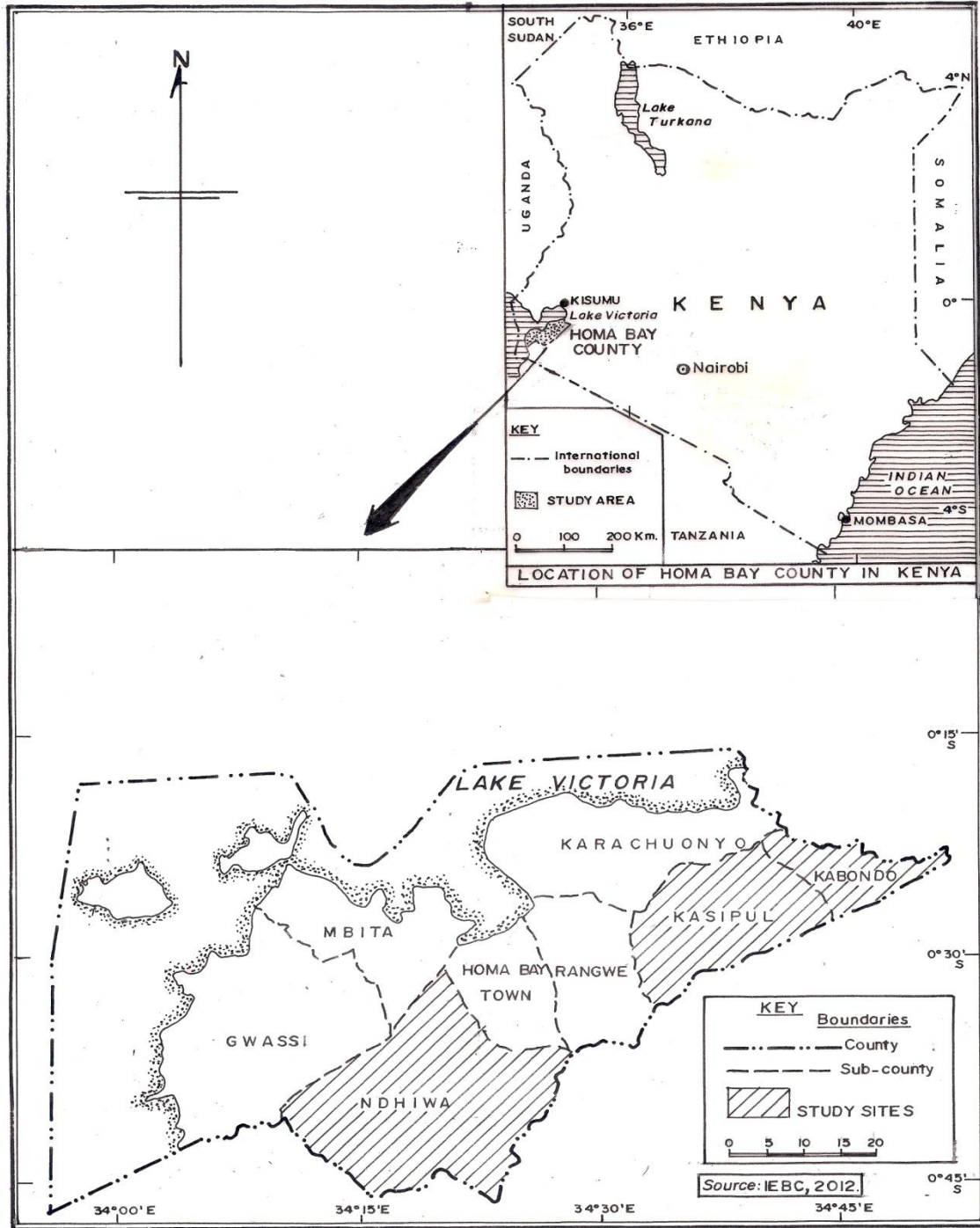
Figure 2: Map of study area.

Source: Independent Electoral and Boundaries Commission, 2012

3.2 Sampling design and sampling procedure

The sampling frame included sweet potato farmers, processors and traders. The sampling procedure for the study was done as follows: Multi stage sampling procedure was used. The three sub- counties under study (Kasipul, Kabondo Kasipul and Ndhiwa) were purposively selected as they comprise the major areas of sweet potato production. Then the respondents were administratively stratified into farmers, traders and processors. With the help of a list from the NGOs working in the county towards upgrading value addition, systematic sampling method was used whereby the names of farmers were serially numbered and then selected at an interval of five numbers to get an appropriate sample size of 174. The same sampling method was used with focus group of traders. They were individually assigned serial numbers and selected at an interval of three to arrive at 20. All processors in the three sub-counties were selected using a census approach and all the six processors were involved.

3.3 Sampling method

Determination of the sample size followed a proportionate to size sampling methodology (Anderson *et al*., 2007).

$$n = \frac{p\,q\,Z^2}{E^2}$$ .... (2)

Where n = sample size, p = proportion of the population containing the major attribute of interest, q = 1-p, z= confidence level (α = 0.05), which is 1.96 and E = acceptable error. Using P= 0.6 given that the previous studies indicated that approximately 60% of the households are sweet potato farmers in the area (IDCCS, 2009), Z = 1.96, q = 0.4 and e is an acceptable error, the sample was determined as;

$$n = \frac{1.96^2 \times 0.5 \times 0.5}{0.0678^2} = 200$$

3.4 Data types, data sources and data collection methods

Cross sectional data was used. This was collected from a sample of small-scale sweet potato farmers, traders and processors. The methods for data collection used included observation and the use of interviews schedule Data types collected included levels of value addition practiced, net prices for various value-added products and profit margins along the value chain.

3.5 Methods of data analysis

3.5.1 Objective 1: Determining the levels of value addition activities practiced.

This objective was analyzed using descriptive statistics by use of percentages, graphs and tables. The different levels were characterized and described. Chi-Square test of association was also computed for relevant variables relating to level of value addition to check the correlation between variables. One Way Analysis of Variance and Tukey post-hoc tests were used to compare means across the sub-counties.

3.5.2 Objective 2: Determining the net prices of products generated from value addition activities.

This objective was analyzed using descriptive statistics as well. This included using tables. One-way ANOVA and Tukey post hoc tests were used to compare if there were significant differences in the mean prices of end products across the levels of value addition and sub-counties.

3.5.3 Objective 3: Determining the effect of different levels of value addition activities on net income for farmers

Multiple regression models were used to determine the effect of activities at different levels of value addition on net income from sweet potatoes. The study analyzed the significance of key socio economic and institutional factors expected to have effect on the income received from value added sweet potatoes. Marginal effects were also calculated.

The model was specified as:

$Y = \beta_o + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \dots\dots\dots\dots\dots + \beta_n X_n + v$ $\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots$ *(1)*

$Y = \beta_o + \beta_1 Acrgswtpot + \beta_2 schlnyrs + \beta_3 lvl1valueaddtn + \beta_4 lvl2valueaddtn + \beta_5 lvl3valueaddtn + \beta_6 hhsize + \beta_7 transportncosts + \beta_8 extnacc + \beta_9 attendtraing + \varepsilon$... *(2)*

Table 1: Description of variables to be used in the regression model

Variable code	Variable	Measurement of the variable	Expected Sign
Net Incm (Y)	Net income	Net income from sweet potatoes solely	+
Acrgswtpot	Acreage under sweet potatoes	Total Acreage(continuous)	+
Nschlnyrs	Schooling years	Number of schooling years(continuous)	+
Lvl1valuaddtn	Level One value addition	Level One(Yes=1, No=0)	+
Lvl2valuaddtn	Level Two value addition	Level Two(Yes=1, No=0)	+
Lvl3valuaddtn	Level Three value addition	Level Three(Yes=1, No=0)	+
Hhsize	Household size	Total number of household members(continuous)	+
Transportncosts	Total transportation costs	Total transport costs incurred to the market(continuous)	+
Extnaccs	Access to extension services	Access to extension(Yes=1,No=0)	+
Attendtraing	Attend training	Attend trainings(Yes=1,No=0)	+

3.5.4 Objective 4: Determining the profit margins at different levels in the sweet potato value chain

The profit margin on any product sold refers to the difference between revenue obtained by an individual selling the product to the next person along the chain or the end user and costs incurred in between before transfer of ownership. Objective four was analyzed by calculating the value added along the chain indicated by the profit margin. Profit margin percentages were obtained for farmers along the value chain and actors along the distribution chain.

Mathematically, Margin (%) $= \dfrac{\mathrm{Re}\,venue - \cos ts}{\mathrm{Re}\,venue} \times 100$

For this objective, the study further used one-way ANOVA and Tukey post hoc tests to determine whether the profit means at different points along the value chain were statistically significant from each other.

CHAPTER FOUR

RESULTS AND DISCUSSION

This chapter presents the analysis of the primary data collected. It outlines the findings and interpretation of the results. Further it offers discussion with respect to the objectives of the study. The specific objectives were: To establish the actual levels of value addition activities of sweet potatoes practiced, to determine the net prices of products generated from sweet potatoes' value addition activities, to determine the effect of different levels of value addition activities on net income from sweet potato and lastly to analyze the profit margins at different levels in the sweet potato value chain.

4.1 Levels of value addition activities practiced in Homa Bay County

4.1.1: Levels practiced by farmers.

The results presented in Table 2 indicate that 34.7% of households practicing level one value addition were from Kasipul while 33.3% and 31.9% came from Kabondo Kasipul and Ndhiwa sub-counties respectively. However, within the respective sub-counties, 65.7% of farmers carrying out activities in level one value addition were from Ndhiwa sub-county while Kasipul and Kabondo Kasipul had 55.6% and 25.5% respectively. These findings suggest that many households are more inclined to performing basic activities such as cleaning, grading and packaging before releasing the products to the market.

It was established, that for level two value addition, 33.3% of households were from Kasipul, 38.1% (Kabondo Kasipul) and 28.6% (Ndhiwa) sub-counties. In the analysis within sub-counties, 17.1% of farmers carrying out value addition at this level were from Ndhiwa sub-county while 15.6% from Kasipul and 8.5% from Kabondo Kasipul. Only a small percentage (12.07%) were practicing level two value addition for commercial purposes. It emerged that 87.93% of the farmers engaging in activities at level two were doing so solely for home consumption. Other than boiling and steaming the raw tubers for breakfast and other meals, some households were drying, grinding and milling the raw tubers from the nearby *posho* mills. The flour could then be used for making porridge for the family but mostly for children.

In addition, the households that were practicing level three value addition were Kasipul (42.9%), Kabondo Kasipul (33.3%) and Ndhiwa (23.8%) sub-counties. The majority of the farmers carrying out the highest level of value addition tended to be concentrated in Kasipul and Kabondo Kasipul sub-counties. This could be because most of the organizations supporting value addition and processing sites were based in these two sub counties and hence proximity of households to trainings and facilities. At this level of value addition, farmers were using a combination of sweet potato flour and wheat flour, mixed in specific ratios for preparing baked products (*chapatti* and *mandazi)* which were then sold in the local market. With regard to the sub-counties, the findings showed that 20% of farmers in Kasipul, 14.3% in Ndhiwa and 7.4% in Kabondo Kasipul were carrying out activities in level three value addition.

Table 2: Level of value addition practiced by farmers in different sub- counties.

			Level of Value Addition practiced by farmer				
			no value addition	level 1	level 2	level 3	N
Sub County	'Kasipul'	% within Sub County	8.9	55.6	15.6	20.0	45
		% within Level of Value Addition practiced by farmer	6.7	34.7	33.3	42.9	
	'Kabondo Kasipul'	% within Sub County	58.5	25.5	8.5	7.4	94
		% within Level of Value Addition practiced by farmer	91.7	33.3	38.1	33.3	
	'Ndhiwa'	% within Sub County	2.9	65.7	17.1	14.3	35
		% within Level of Value Addition practiced by farmer	1.7	31.9	28.6	23.8	
N			60	72	21	21	174

Legend

Level 1: Assembling, cleaning, sorting, grading and packing.

Level 2: Boiling, steaming, roasting, grinding into flour for baking and other uses.

Level 3: Baking, preparing *chapatti* and *mandazi*, making puree products.

Results of the Chi-square test of association (Table 3) revealed that there was a statistically significant relationship between the sub-counties and the level of value addition. This is noted in the p-value of 0.000.

Table 3: Correlation test between level of value addition and sub-counties.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	53.676[a]	6	.000
Likelihood Ratio	61.359	6	.000
Linear-by-Linear Association	.448	1	.503
N of Valid Cases	174		

To establish whether the mean proportions were statistically different from each other, one way ANOVA and Tukey post-hoc tests were used to compare the proportions across and within sub-counties. The one-way ANOVA results (Table 4) indicated that there was an observable difference in proportion/percentages of farmers at each level of value addition. The p-value for the calculated F-ratio (0.000) was statistically significant at 1%.

Table 4: Variation in the mean proportions of farmers in different levels of value addition vs. sub-counties.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	27.762	2	13.881	17.302	.000
Within Groups	137.186	171	.802		
Total	164.948	173			

The Tukey post-hoc tests (Table 5) further showed that in specific the proportions are significantly different (0.000) across Kasipul compared to Kabondo Kasipul as well as across Kabondo Kasipul compared to Ndhiwa. In addition, the tests showed that the proportion of farmers were not significantly different (0.981) between Kasipul and Ndhiwa sub-counties.

26

Table 5: Comparison of mean proportion of farmers in different sub-counties.

	(I) Sub County	(J) Sub County	Mean Difference (I-J)	Std. Error	Sig.
Tukey HSD	'Kasipul'	'Kabondo Kasipul'	.818	.162	.000
		'Ndhiwa'	.038	.202	.981
	'Kabondo Kasipul'	'Ndhiwa'	-.780	.177	.000

4.1.2: Levels practiced by traders.

From a focused group discussion, it was revealed that retailers and wholesalers were involved in selling the raw tubers from farmers to fellow retailers, wholesalers, or consumers. In addition, both were carrying out activities in level one value addition. There were pre-arranged contracts between farmers and traders. Out of the total household in the study, 45.4% of farmers were engaging in these contracts. This implied farmers would enter into an agreement with traders during the planting season such that as soon as the crop would mature, traders would come, pay for labor to harvest the raw tubers, sort into small and large sizes, grade, clean them, and then pack into bags. The traders would then pay the farmer accordingly.

Table 6: Percentage of farmers and traders involved in post-harvest sale contracts.

	Percent
Farmers in trade contract	45.4
Farmers selling without contract but ready market	54.6
N	174

4.1.3: Levels practiced by organizations

Table 7 shows the organizations and the key roles they played in adding value to the raw tubers before selling the end-product to the next player along the chain. Kabondo Sweet Potato Processing SACCO was dealing with three varieties. They were purchasing red skin yellow fleshed and red skin white fleshed varieties from farmers, and then they cleaned the tubers, sorted and graded them and obtained fresh market for farmers. In addition, they were purchasing red skinned orange fleshed variety at KES 14/= per kilogram from farmers, then

they would clean the tubers, sort, grade, weigh, chip, dry the chips. They would then store these dried chips in sacks and mill when an order arose.

RICAM bakery was dealing with a single variety, which is red skinned orange fleshed. They would purchase the flour milled from this variety from Kabondo Sweet Potato Processing SACCO then use the flour together with other ingredients for baking bread, buns, cakes and scones.

Delight Food Processors was involved in baking and would buy red skinned orange fleshed flour from the SACCO as well and use it in baking breads, queen cakes, buns and scones. They would then sell these end-products to retailers as well as institutions around the area.

Kinda bakery, based in Kendu Bay, was also purchasing the red skinned orange fleshed flour from the Kabondo Sweet Potato Processing SACCO, and using it together with other ingredients for baking breads, buns, scones and cakes.

HOMA SG, a processing firm carrying out value addition at level three was involved in making unique end-products known as puree products. This firm dealt only with red skinned orange fleshed variety. They purchased the tubers from farmers, cleaned and peeled them, then boiled and crushed them to make the mashed end-product known as puree.

Lastly, Kenya Institute Research and Development Institution (KIRDI) carried out value addition at level one and two. This research institution obtained the red skinned orange fleshed variety either from farmers, HOMA SG or from Kabondo Sweet potato processing SACCO. They were involved in weighing, sorting, washing, peeling, slicing, drying and milling. They could then sell the flour under the brand 'Tamasha foods'. The flour could be used for baking purposes, either as composite flour for porridge and for baby food.

Table 7: Value addition carried out at the Organizational level.

ORGANIZATION	SWEET POTATO VARIETY/PRODCT USED	ACTIVITIES CARRIED OUT	LEVEL OF VALUE ADDITION	END PRODUCT
Kabondo Sweet Potato Processing SACCO	Red Skinned Orange Fleshed	Wash,sort,grade,weigh ,chipping, drying and milling when an order arises	Level 1 & 2	Sweet Potato Flour
Kabondo Sweet Potato Processing SACCO	Red skinned yellow fleshed and Red skinned white fleshed	Grade,wash,packaging into sacks	Level 1	Raw tubers
RICAM Bakery	Red skinned Orange fleshed flour	Baking breads, buns, scones	Level 3	Breads, buns, cakes, scones
Delight Food Processors	Red skinned Orange fleshed flour	Baking bread, buns, queen cakes	Level 3	Breads, buns, cakes
Kinda Bakery	Orange fleshed flour	Baking breads,scones,cakes, doughnuts	Level 3	Breads,scones, cakes, doughnuts
HOMA SG	Red skinned Orange fleshed variety	Wash,peeling,boiling, crushing,weighing,pac king,cooling	Level 1 & 2 & 3	Puree products
KIRDI-Kisii Branch	Red skin orange fleshed	Weighing,sorting,was hing,peeling,slicing, drying, milling	Level 1 &2	Sweet potato flour

4.1.4: Level of value addition by vine type

Apart from the analysis of level of value addition by sub-counties, comparison of the levels to other variables such as vine type was explored. The results are presented in Table 8.

Table 8: Level of value addition by vine type.

	Level of Value Addition Practiced by Farmer				
	0	1	2	3	
Vine Type	Percent	Percent	Percent	Percent	Total
Red Skinned Orange Fleshed	0	45.45	0	54.55	100
Red Skinned Yellow Fleshed	51.13	34.09	13.64	1.14	100
Red Skinned White Fleshed	25	41.67	33.33	0	100
Brown Skinned White Fleshed	12.5	75	12.5	0	100

The results showed interesting patterns. Farmers who planted red skinned orange fleshed (RSOF) variety carried out level one (45.45%) and level three value additions (54.55%). The possible explanation is that the farmers cultivating this variety reported that it was not palatable in its raw form and hence had to be processed before consumption..

Farmers cultivating red skinned yellow fleshed (RSYF) variety mostly sold the raw tubers without adding any form of value (51.13%) while 34.09% carried out the basic activities of level one value addition before sales. Only 13.64% of farmers cultivating this variety boiled the raw tubers (level two value addition) for commercial purposes. Only 1.14% used this local variety for level three value addition respectively. This is because this variety was preferably consumed as boiled and not used for processing in form of sweet potato flour.

In addition, the findings revealed that a majority of farmers cultivating red skinned white fleshed, RSWF (41.67%) were carrying out activities in level one value addition before selling the raw tubers. Out of the total farmers cultivating this variety, 33.33% were adding value at level two for commercial purposes while none was using this local variety for baking purposes at level three value addition. This is because this variety was considered to be a local variety mostly palatable as boiled and not used for processing in level three due to its lack of vitamin A.

Notably, a majority of farmers cultivating brown skinned white fleshed variety, BSWF (75%) were also selling the tubers only after carrying out the basic activities at level one value addition. Only a small percentage of farmers growing this variety (12.5%) were practicing

level two value addition before sales while none of the farmers was carrying out level three value addition.

Red skinned yellow fleshed, red skinned white fleshed and brown skinned white fleshed are all local varieties which had an almost similar pattern with regard to value addition. Farmers cultivating these three varieties mostly sold the raw tubers having added no value at all or engaging in only basic activities at level one before sales. Most farmers practicing level two value addition for these varieties were doing so for home consumption and thus a smaller percentage compared to level one are seen to be engaging at this level two for commercial purposes as seen in Table 8. Most local varieties of sweet potatoes are consumed as boiled or steamed and not used for processing as sweet potato flour. Only 1.14% of the farmers growing the local varieties were processing the tubers before sales.

Table 9: Chi-square test of association between level of value addition and vine type.

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	76.058[a]	15	.000
Likelihood Ratio	76.903	15	.000
N of Valid Cases	174		

The resulting probability value of chi-square (0.000) also indicated that there was a significant association between vine type and the levels of value addition.

4.1.5: Value addition by gender

The findings (Table 10) showed that females were the ones mainly involved in value addition with 56.14% of the total value adders being female while 43.86% representing their male counterparts. This could be attributed to the fact that women were the ones mainly associated with farm work, and culturally responsible for handling food items. They pursued and exploited this responsibility to their advantage so as to generate extra income.

Table 10: Value addition by gender.

	Non value adders	Value Adders
Gender	Percent	Percent
Female	58.33	56.14
Male	41.67	43.86
N	60	114

In addition, the chi-square test of association results (Table 11) revealed that there was a statistically significant relationship between gender and the level of value addition.

Table 11: Correlation test between level of value addition and gender.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	7.022[a]	3	.071
Likelihood Ratio	7.501	3	.058
N of Valid Cases	174		

4.1.6: Level of value addition by education level attained.

Majority of farmers (62.28%) who engaged in value addition (Figure 3) had attained primary level of education, while 26.32%, 1.75%, 5.26% had attained secondary, college and university education respectively. Most of those who had attained primary education had no white collar stable jobs hence relied on farming and value addition fully to generate income for household needs.

A minority (4.39%) of value adders had never attended school. In addition, those who had studied up to college and university were not at all involved in higher levels of value addition such as level two and three. This could be justified since these farmers had other mainstream sources of income. They had formal employment with secure jobs and guaranteed income and hence were doing farming mostly for food security. These results are presented in Figure 3.
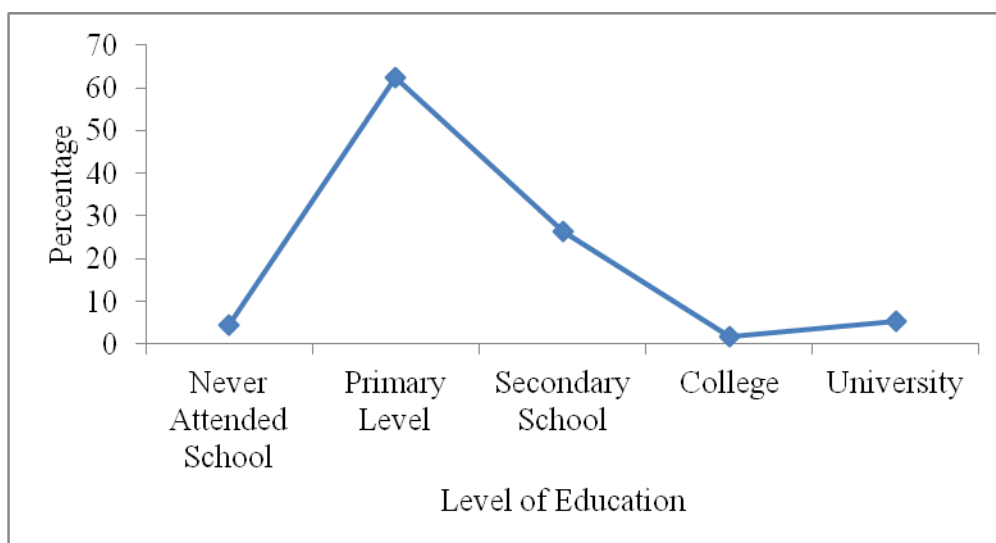
Figure 3: Level of value addition by education level attained.

However, the resulting probability value of chi-square, Table 12 (0.274) showed that the education level and the level of value addition were independent of each other.

Table 12: Chi-square test of association between levels of value addition and education.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	14.435[a]	12	.274
Likelihood Ratio	15.338	12	.223
N of Valid Cases	174		

4.1.7: Impact of training on level of value addition

With regard to training, results in Table 13 show that those who had attended training were involved more in value addition (57.02%) compared to those who had not attended value addition training (42.98%).

Table 13: Value addition influenced by training.

	Non value adders	Value Adders
Attended value addition training/Not	Percent	Percent
No	56.67	42.98
Yes	43.33	57.02
N	60	114

While further conducting the chi-square test of independence, (Table 14) the resulting probability value (0.000) showed that there exists a statistically significant relationship between access to training and the decision to add value or not.

Table 14: Chi-square test of association between level of value addition and training.

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	22.294[a]	3	.000
Likelihood Ratio	30.362	3	.000
N of Valid Cases	174		

4.1.8: Value addition as influenced by access to co-operative group marketing

The type of marketing outlet influenced value addition. Findings in Table 15 show that farmers who were in farming and marketing groups were more involved in value addition

(73.68%) since they could benefit from collective marketing due to a stronger bargaining power compared to those who did not belong to any marketing group (26.32%). The ready markets were a motivation for most of them to be involved in value addition at all levels.

Table 15: Value addition influenced by marketing group membership.

If farmer belongs to Marketing Group/Not	Non Value adders Percent	Value adders Percent
No	65	26.32
Yes	35	73.68
N	60	114

In addition, the probability value of the chi-square test of independence, Table 16 (0.000) showed that there exists a statistically significant relationship between access to group marketing and the decision to add value. This implied that if a farmer was a member of a marketing group, they would be involved in value addition since they would have better bargaining power during sales.

Table 16: Chi-square test of association between levels of value addition and group marketing.

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	33.855[a]	3	.000
Likelihood Ratio	41.417	3	.000
N of Valid Cases	174		

4.2 The net prices of products generated from value addition activities.

Traditionally Kenyan farmers' obsession with certain crops has worked against them as evidenced in market oversupply. Farmers would produce the same crop at the same time, which would be harvested at the same time and taken to the same market, yielding low prices. From the findings, it was observed that with sweet potatoes, the more value a player along the chain added, the better the prices it fetched. Results of the Tukey post hoc test in Table 17 revealed that the mean prices per kilogram on average of all sweet potato products varied significantly at 1% across the levels of value addition. Results showed that the mean prices of tubers not added any value at all compared to the end products at level two and level three value addition differed significantly (0.000) at

34

1%. In addition the mean prices of raw tubers at level one value addition compared to the mean prices of end products at level two and three value addition differed from each other significantly (0.000) at 1%. The mean prices of end products at level two equally differed significantly compared to mean prices of end products in level three value addition (0.000).

Table 17: Comparison of mean prices of products across levels of value addition.

	(I) Level of Value Addition practiced by farmer	(J) Level of Value Addition practiced by farmer	Mean Difference (I-J)	Std. Error	Sig.
Tukey HSD	no value addition	level 1	-4.385	2.273	.220
		level 2	-19.706	3.297	.000
		level 3	-298.277	3.297	.000
	level 1	level 2	-15.321	3.225	.000
		level 3	-293.892	3.225	.000
	level 2	level 3	-278.571	4.013	.000

4.2.1: Level one end-product.

The main activity at level one was cleaning, sorting, and grading. Tubers were sorted and graded into different sizes and packed. The categories of packaging were 50, 90, 135 and 165 kilogram bags. One-way ANOVA results as shown in Table 18 indicate that the mean prices of the raw tubers per kilogram were statistically significant at 1% across the sub-counties.

Table 18: Variation in the mean prices across sub-counties.

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	28.944	2	14.472	11.246	.000
Within Groups	88.792	69	1.287		
Total	117.736	71			

In addition, the Tukey post hoc test results (Table 19) showed that the mean prices of the raw tubers per kilogram were statistically different at 1% while comparing Kasipul and Ndhiwa and equally significant at 1% while comparing Kabondo Kasipul and Ndhiwa.

Table 19: Variation in the mean prices across sub-counties.

	(I) level one value addition by sub county	(J) level one value addition by sub county	Mean Difference (I-J)	Std. Error	Sig.
Tukey HSD	Kasipul	Kabondo Kasipul	.206	.324	.802
		Ndhiwa	1.448	.328	.000
	Kabondo Kasipul	Ndhiwa	1.243	.331	.001

4.2.2: Level two end-products

In the second level of value addition, results in Table 20 show that boiled sweet potato on average yielded revenue of Kes.46 per kilogram. In addition, farmers who sold the boiled sweet potato did so in piecemeal and would ferry the same to the market using 20kg bucket on the respective market days. The second activity was milling. This activity was carried out at the organization level and yielded revenue of KES.110 per kilogram. Further post hoc tests revealed in Table 21 that the mean differences of prices of end products in level two across sub-counties were not statistically different from each other.

Table 20: Value added end-products at level two value addition.

	Mean prices per kilogram(in KES)
Boiled tubers	46
Milled Flour	110

Table 21: Comparison of mean prices of end-product at level two per kilogram.

	(I) Level two value addition by sub county	(J) Level two value addition by sub county	Mean Difference (I-J)	Std. Error	Sig.
Tukey HSD	Kasipul	Kabondo Kasipul	-1.964	3.092	.803
		Ndhiwa	-4.048	3.323	.458
	Kabondo Kasipul	Ndhiwa	-2.083	3.226	.797

4.2.3: Level three end-products

Level three value additions had three main end-products (Table 22). These include puree products, baked products and cooked snacks. Puree products are a result of various activities

including cleaning the raw tubers, peeling, boiling using a boiler, then crushing the tubers using Puree crushing machine. The end product is mashed sweet potato which is then weighed, packed and chilled in freezers. Puree fetched KES. 61/= a kilogram. Baked products included buns, queen cakes, and doughnuts that were sold at an average price of KES.150/= per kilogram and bread fetching a price of KES.240/= per kilogram. Farmers who had attended value addition training were venturing into cooking *chapati* and *mandazi* from orange fleshed sweet potato flour. The prices varied from KES. 300-340/= per kilogram.

Table 22: Value added end-products at level three value addition.

	Price per kilogram (KES)
Puree products	61
Baked products	
Scones/buns/Doughnuts	150
Bread	240
Cooked Foodstuff	
Chapatti	340
Mandazi	300

The Tukey post hoc test results (Table 23) showed that the mean price differences of end products at this level of value addition were not statistically different across the three sub-counties.

Table 23: Comparison of mean prices of end-products at level three per kilogram.

	(I) level three value addition by sub county	(J) level three value addition by sub county	Mean Difference (I-J)	Std. Error	Sig.
Tukey HSD	Kasipul	Kabondo Kasipul	5.873	18.231	.945
		Ndhiwa	-30.556	20.179	.308
	Kabondo Kasipul	Ndhiwa	-36.429	21.183	.225

4.3 Marginal effects regression results of factors that influence farmers' income

The econometric results of factors that influence the level of income that farmers obtained from the sale of raw and value added sweet potatoes are presented in Table 24. Of all the factors that were considered in the multiple-regression model, 6 were found to have a significant effect on the farmers' level of income derived from the sale of sweet potatoes.

Table 24: Marginal effects results of factors affecting farmers' income.

Variable	dy/dx	Std. Err.	z	P>z
Household size	0.014	0.019	0.740	0.461
Schooling years	-0.007	0.024	-0.280	0.782
Acreage under sweet potatoes	0.161**	0.064	2.520	0.012
Extension access	0.041	0.192	0.220	0.829
Level 1 value addition	0.610*	0.316	1.930	0.054
Level 2 value addition	1.317***	0.345	3.810	0.000
Level 3 value addition	1.893***	0.349	5.430	0.000
Attend Training	0.257*	0.150	1.720	0.086
Transportation costs	0.346***	0.054	6.460	0.000

(*significant at 10%, **significant at 5%, ***significant at 1%)

The adjusted R^2 signifies the percentage of variation in the dependent variable explained by the independent variables. The Adjusted R-square in the regression was 58% which implied fifty eight percent of the variation in household revenue from sweet potatoes is explained by the independent variables.

Marginal effects indicate the effects of one unit change in an independent variable on household revenue. From the estimated marginal effects results, six variables were found to be significant at different confidence levels.

The acreage under which sweet potato is cultivated is statistically significant at 5% implying a unit change in the acreage cultivated leads to an increase in income (Table 24). The corresponding marginal effect show that one unit increase in the acreage under sweet potato cultivation would lead to the household income increasing by 16.1%. A greater acreage under sweet potato could translate to a greater output. Large scale production enables farmers to channel resources towards adding value at different levels while comparing prices in the market across the value addition levels. This result is consistent with that of Akteruzzaman and Parvin, (2012) who used multiple regressions to analyze factors affecting farm and non-farm income of Haor Inhabitants of Bangladesh and found out that farm size had a significant effect on farm income.

Level one value addition is statistically significant at 10%. This implies an extra effort of activity under this level would increase the household income by 60% compared to farmers who were not doing any value addition at all. The difference in prices among these two groups could be attributed to the actual activities of sorting, grading, cleaning and packing done by farmers carrying out level one value addition.

Level two value addition was statistically significant at 1%. This form of value addition had a positive effect on income. The more value a farmer added, the better the income. This implies farmers who were adding value at level two improved their incomes by 132%. The diversified range of products due to value addition reaches a larger market segment. This result was consistent with that of Umeh, (2013) which found that cassava value addition had a positive influence on the income generated and specifically raised income level of cassava flour by 80%.

Farmers carrying out activities in the highest level of value addition recorded highest improvement in their income. Level three value addition was statistically significant at 1%. This implies the more the value added to the raw tubers at this level, the higher the household income by almost thrice the current income. Hagenimana, *et al.* (1999 revealed that substituting sweet potato flour for wheat flour in *mandazis* made the product more profitable for market vendors.

Transportation costs were found to be statistically significant at 1%. Costs are known to have a negative impact on income. These results however, were contradicting this fact. The higher the transport costs incurred by a farmer, the higher the household income from sweet potato. The explanation for this is that the transportation cost was being charged per sack hence the more the output the more the sacks and consequently the higher the transportation cost. More output when sold was translating to higher income. These results contradicted that of World Bank (2004) which revealed that high transaction costs increased the poverty level in the rural areas as a result of reduced farmer incomes.

Impact of attending training seemed to determine the extent of involvement of value addition activities. From table 24, the results show that training is statistically significant at 10%. Farmers who had attended some form of training improved their incomes by up to 26% compared to those who had no training at all.

Table 25: Correlation Analysis

		Level 1 value addition	Level 2 value addition	Level 3 value addition
Level 1 value addition	Pearson Correlation	1		
	Sig. (2-tailed)			
	N	174		
Level 2 value addition	Pearson Correlation	-.311[**]	1	
	Sig. (2-tailed)	.000		
	N	174	174	
Level 3 value addition	Pearson Correlation	-.311[**]	-.137	1
	Sig. (2-tailed)	.000	.071	
	N	174	174	174

** Correlation is significant at the 0.01 level (2-tailed)

The study performed a correlation analysis using the bivariate correction matrix. Results in Table 25 showed that there was a moderate negative correction between level one and level two value addition R= -0.311 which was further significant at p= $0.00<\alpha(0.05)$. In addition, level three value addition had a moderate negative correlation with level one value addition R=-0.311 significant at p=$0.00<\alpha$ (0.05) and level two value addition R=-0.137 not significant at p=$0.071>\alpha$ (0.05) respectively. In summary, a moderate negative correlation implies there was no correlation at all between the three levels of value addition hence the three variables could be used in one model: multiple regressions.

4.4 Determining the profit margins at different levels in the sweet potato value chain.

The study identified the different actors along the value chain including brokers, retailers and wholesalers and used the profit margin percentage to calculate the margins made at each level along the value chain. In addition to profit margin analysis, the study used an F- test to verify whether the differences in profit margins were statistically significant along the different points on the value chain.

In obtaining the profit margin percentage, the mean values of quantities, prices, total revenue, costs and profit level of farmers along the value chain were analyzed and presented in Table 26.

Table 26: Summary of profit margin for farmers along the value chain

Level of Value Addition	Mean Quantity (Kilograms)	Mean price/kilogram (Kes)	total revenue	total cost	profit level	profit margin percentage
no value addition	760.77	26.48	20145.08	15972.25	4172.83	24.16
level 1	918.33	30.87	28348.72	19677.68	8671.04	38.52
level 2	579.31	46.19	26758.33	11806.19	14952.14	68.36
level 3	72.5	324.76	23546.9	2829.05	20717.86	92.1

The results showed that the higher the level of value addition along the value chain, the higher the profit margin percentage. This asserts the assumption that as the farmer adds more value along the chain, they are likely to make higher profit margin. Farmers carrying out activities in level three were getting a profit margin of 92.10%, a relatively higher percentage compared to farmers in level two, (68.36%). The trend is similar as farmers in level two were getting higher margins compared to farmers in level one who were getting a profit margin of 38.52%.

Table 27: Summary of profit margins for traders along the value chain:

Role along the value chain	Mean Quantity (90Kg bags)	Mean Price(Kes)	total revenue	total cost	Profit level	Profit margin percentage
Broker	7.9	2596.52	20512.5	14356.3	6156.25	33.52
Retailer	6.39	2500	15975	12520.8	3454.17	29.85
Wholesaler	25	3550	88750	46931	41819	51.44

Results in Table 27 showed an interesting pattern since brokers were making a relatively higher profit margin of 33.52% compared to retailers (29.85%). This could be because brokers were a direct linkage between farmers and retailers and therefore at times could exploit both sides in terms of prices to get higher revenues. However wholesalers were making the highest profit margin (51.44%) compared to both retailers and brokers. This could be attributed to trading in large scale. Hence the fixed costs are evenly spread while the revenues remain positive.

Further analysis of variance as revealed in table 28 showed that the profit margin mean differences of farmers at different points of value addition were statistically significant from each other.

Table 28: Variation in the profit means of farmers across the levels of value addition

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	8.641	3	2.880	43.320	.000
Within Groups	11.236	169	.066		
Total	19.877	172			

The Tukey post-hoc test (table 29) further revealed that the mean profit margin varied significantly at 5% (0.010) between farmers not carrying out any value addition and those carrying out level one value addition. The mean profit margin of farmers at level one value addition compared to those at level two and three was statistically significant at 1% (0.000) whereas the mean profit margin for farmers carrying out level two value addition compared to those in level three was statistically significant at 5%.

Table 29: Comparison of mean profit margin of farmers across the value chain

	(I) Level of Value Addition practiced by farmer	(J) Level of Value Addition practiced by farmer	Mean Difference (I-J)	Std. Error	Sig.
Tukey HSD	no value addition	level 1	-.14358	0.045	0.010
		level 2	-.44197	0.066	0.000
		level 3	-.67933	0.066	0.000
	level 1	level 2	-.29839	0.064	0.000
		level 3	-.53575	0.064	0.000
	level 2	level 3	-.23735	0.080	0.017

In the analysis of traders, Table 30 showed that the mean profit margins were significantly different for the players along the value chain. The mean profit margins were found to be statistically significant at 1%. (0.000).

Table 30: Variation in the profit means of traders along the value chainable 30:

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	6.968E9	2	3.484E9	12.423	.000
Within Groups	4.768E9	17	2.804E8		
Total	1.174E10	19			

The results in table 31 showed that the mean profit margin of brokers compared to wholesalers was statistically significant at 1% whereas there was no significant mean difference on the profit margin of brokers compared to retailers. The mean profit margin of retailers compared to wholesalers was also found to be significant at 1%.

Table 31: Comparison of mean profit margin among traders in the value chain

	(I) Role along the value chain	(J) Role along the value chain	Mean Difference (I-J)	Std. Error	Sig.
Tukey HSD	Broker	Retailer	2702.08	10809.8	0.966
		Wholesaler	-35663	9907.38	0.006
	Retailer	Wholesaler	-38365	8647.87	0.001

4.5 Summary of Findings

The findings revealed that vine type determined the level of value addition carried out. Most local vine varieties were being sold as raw tubers with no value added or farmers having carried out activities only at level one value addition. The improved orange fleshed variety was mostly being used for level three value addition that is baking using sweet potato flour. Farmers who had attended training and were members of marketing groups were carrying out value addition at higher levels; level two and three respectively and were getting higher profits compared to those who had no training at all. Prices of end-products at different levels of value addition were increasing with the level of value addition. These prices were statistically significantly different from each other at different points along the value addition levels.

Key factors that influenced farm income from sweet potatoes were the actual levels of value addition, the acreage under which the sweet potato was being cultivated, access to training and the transportation costs. Lastly the profit margins along the value chain of farmers were found to be increasing across the value addition points. While considering traders, the profit margin was higher for brokers who were obtaining raw tubers directly from farmers. This implied the shorter the distribution chain the better the profit margins. Wholesalers were making better profit margins which could be attributed to operating under large economies of scale.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusions

The findings revealed that:

- ➢ Farmers in the three sub-counties mostly practiced activities in level one value addition. These included assembling, cleaning , sorting, grading and packing the raw tubers for sale. Only 12% of households practiced activities in level two which included boiling raw tubers and selling for commercial purposes while 12% practiced activities in level three which was baking and using sweet potato flour to prepare *mandazi* and *chapati*. Traders practiced value addition activities at level one whereas processing organizations carried out activities across all levels of value addition.
- ➢ Prices of end-products at different levels of value addition were increasing as the level of value addition went higher. These prices were statistically significantly different from each other at different points along the value addition levels.
- ➢ Key factors that influenced farm income from sweet potatoes were the actual levels of value addition, the acreage under which sweet potato was being cultivated, access to training and transportation costs.
- ➢ The profit margins along the value chain of farmers were found to be increasing along the value addition points. For traders, the profit margin was higher for brokers' who were obtaining raw tubers directly from farmers compared to that of retailers. This implied the shorter the distribution chain the better margins. In addition, wholesalers were making better profit margins which could be due to operating under large economies of scale.

5.2 Recommendations

➢ Enhanced training to sweet potato farmers through seminars and workshops. It is through training that farmers can be able to acquire better knowledge on adding value at higher levels of value addition to maximize income, learn about prevailing prices at different market outlets, new vine varieties and existing opportunities.

➢ Farmers should be encouraged to form and join more farmer groups. Farmer groups and especially marketing groups raise bargaining power for individuals. This could assist in improving incomes and reducing the losses incurred by farmers selling individually at the prevailing market prices due to excessive supply.

➢ The study recommends formation of more SACCO groups: Most Non-governmental organizations' in the area promoting value addition work closely with the existing Kabondo Sweet Potato SACCO. These Non-governmental organizations' supports the SACCO through purchase of equipments such as chippers, electric driers, milling machines, as well as putting up solar driers. If more SACCOs are established especially in the other two sub-counties, it would act as a motivation for farmers to add value since the SACCO will provide ready market opportunity for the raw tubers. Moreso SACCO buys from farmers the raw tubers in kilograms. This measure yields better income compared to brokers, retailers and wholesalers who negotiates the price per sack not in kilograms.

➢ Organize enhanced trainings on cost cutting and marketing strategies for traders through focus groups to educate them on how to reduce and monitor their costs while increasing their incomes. This will enable them make rational marketing decisions to improve the profit margins along the value chain.

REFERENCES

Abubakar, H. N., Olayiwola, I. O., Sanni, S. A., and Idowu, M. A. (2010). Chemical composition of sweet potato (*Ipomea batatas Lam*) dishes as consumed in Kwara state, Nigeria. *International Food Research Journal 17*: 411-416.

Amamgbo, L. F., Akinpelu, A. O., and Ekumankama, O. O. (2010). Utilization of sweetpotato based confection technology : A panacea to food crisis among women farmers in Imo state. *Journal of Agriculture and Social Research, JASR: 1-6*

Aniedu, C., Aniedu, O. C., and Nwakor, N. (2012). Impact and Adoption of Value Added Innovations in Root and Tuber Crops among Farmers in Imo State, Nigeria. *Global Journal of Science Frontier Research Agriculture and Veterinary Sciences, 12: 1-7*

Anyaegbunam, H.N., and Nto, P.O., (2011). Assessment of the Performance of Sweet Potato Marketing System in South East Agro Ecological Zone, Nigeria.*American Journal of Experimental Agriculture, 4:* 1-9

Carey, E. E., Gichuki, S. T., Ndolo, P. J., Turyamureeba, G., Kapinga, R., Lutaladio, N. B., (1995-1996). *Collaborative Sweet potato breeding in eastern, central and Southern Africa.* Lima, Peru: International Potato Centre.

Ememwa, L., Nungo, R. A., Obiero, H. M., and Ndolo, P. J. (2008). Challenges and Experiences in Transfer of post harvest Technologies to Farming Communities in western Kenya: A case of cassava and sweet potato processing. *Biennial scientific conference and 3rd agricultural forum, 10th- 13th November.*

Ewell, P. T. (2002). *Sweet potato production in Sub-Saharan Africa: Patterns and key issues.* Nairobi, Kenya: CIP.

Fawzia, A., Karuri, E. G., and Hagenimana, V. (2000). Sweet Potato Ketchup: Feasibility, Acceptability and Production costs in Kenya. *Journal of Food technology in Africa. 5:* 14-18.

Fonseca, C., Zuger, R., Walker, T., and Molina, J. (2003). Impact study of the adoption of new varieties of sweet potatoes released by INIA in Peru*: Case of the Canete valley.* Lima, Peru: CIP.

Gichuki, S. T., Hagenimana, V., Low, J., Oyunga, M. A., Carey, E. E., and Kabira, J. N. (1997). Evaluation of Orange-fleshed sweet potato varieties by women's groups to improve vitamin A nutrition in Western Kenya :*4th Triennial Congress of the African Potato Association.* Pretoria, South Africa

Government of Kenya. (2009). *Population and Housing Census.* Kenya National Bureau of Statistics.

Hagenimana, V., and Owori, C. (1997) Feasibility, acceptability, and production costs of sweet potato-based products in Uganda: *The International Potato Center (CIP) Program Report 1995-1996*. Lima, Peru. Ppgs: 276-281

Hagenimana, V., Carey, E., Oyunga, M., and Gichuki, T. (1999). 'Caretonoid contents in fresh, dried and processed sweet potato products. *Journal of Ecology of food and Nutrition , 37:* 455 – 473.

Hagenimana, V., Karuri, E. G., and Oyunga, M. A. (1998a). Oil content in fried processed sweet potato products. *Journal of Food Processing and Preservation 22:* 123-137.

Hall, A. J. (1998). Sweet Potato post harvest systems in Uganda: Strategies, constraints and potentials*(International Potato Centre Social Science Department working paper series 6:, pages 81.* Lima, Peru: CIP.

Kaguongo, W., Ortmann, G. F., Wale, E., Darroch, M. G., and Lowi, J. (2010). Factors influencing adoption and intensity of adoption of orange fleshed sweet potato varieties: evidence from an extension intervention in Nyanza and Western province, Kenya. *Paper presented at the joint 3rd African Association of Agricultural Economists (AAAE) and 48th Agricultural Economists Association of South Africa (AEASA)*. Cape Town, South Africa.

Lemaga, B. (2005). Improving the Livelihoods of small-scale sweet potato farmers in central Uganda through a crop post harvest-based innovation system. Crop post Harvest Programme. *Monitoring and Evaluation report* ; *Project R8273*. PRAPACE, Kampala, Uganda.

Masumba, E. A. (2004). Participatory evaluation of improved sweet potato varieties in Tanzania. *African Crop Science Journal 3*: 259-266.

Mazuze, F. M. (2005). *Analysis of adoption and production of Orange Fleshed Sweet potatoes: the case study of Gaza province in Mozambique.* Msc. Thesis submitted to Michigan State University, Department of Agricultural Economics.

Moyo, C. (2004). Cassava and sweet potato yield assessment in Malawi. *African Crop Science Journal 3:* 295-303.

Nungo, R. A., Ndolo, P. J., Kapinga, R., and Agili, S. (2007). Development and promotion of sweet potato products in Western Kenya. *Proceedings of the 13TH ISTRC symposium*,UK.

Odondo, A., Mukras, M. S., and Momanyi, G. (2013). Determinants of Demand for Sweet Potatoes at the Farm, Retail and Wholesale Markets in Kenya. *Horizon Research Publishing.Kisumu,Kenya*

Olwande, J., Kirimi, L., Mathenge, M., Oduol, J., Mithofer, D., and Place, F. (2013). Improving Participation in Agricultural Commodity Markets for Smallholder Sweet Potato Farmers in Kenya: Assessing Growth Opportunities for Women in 'Rachuonyo' District. *Tegemeo Institute, Nairobi,Kenya.*

Omosa, M. (1997). Current and Potential Demand for Fresh and Processed sweet potato products in Nairobi and Kisumu, Kenya. *International Potato Centre (CIP) 88p. Working Paper (CIP). No 1997-1.*

Porter, Michael E. (1985). "Competitive Advantage": Value Chain Analysis. The Free Press. New York.

Scott, G. J. (2005). Sweet potatoes as animal feed in developing countries: *Present patterns and future prospects.* Lima, Peru: CIP.

Singh, S., Riar, C. S., and Saxena, D. C. (2008). Effect of incorporating sweetpotato flour to wheat flour on the quality characteristics of cookies. *African Journal of Food Science 2* : 065-072.

Smith, N. E., Ocitti, P., and Obawoya, C. N. (1994). Piece meal Harvesting of Sweet potato. Its effect on Yield loss due to Sweet potato Weevils. *3rd Conference.African Potato Association Sousse.* Tunisia.

Tomlins, K., Ndunguru, G., Kimenya, F., Ngendello, T., Rwiza, E., Amour, R. (2008). On-farm evaluation of methods for storing fresh sweet potato roots in East Africa. *Tropical Science Journal 47* : 197-210.

United States Agency for International Development, (USAID and KHCDA Project,. (2012). *Issue No. 24* .

Westby, A., Tomlins, K., Ndunguru, G., Burnett, D., Ngendello, T., Rwiza, E. (2003). Maximizing incomes from sweet potato production as a contribution to rural livelihoods: *Project report: (1999-2003), Tanzania.*

Yanggen, D., & Nagujia, S. (2005). The use of Orange- fleshed sweet potato to combat vitamin A deficiency in Uganda: Astudy of varietal preferences, extension strategies and post- harvest utiization. Uganda. *International Potato Center (CIP)*, Lima, Peru.

Interview Schedule: Farmers.

Code: _____

The intention of this study is purely academic and in particular to generate information on the impact of value addition of sweet potatoes on net prices amongst smallholder farmers in three Sub- Counties. Your response will assist in gearing towards formulation of policies in support of enhanced value addition techniques in the County aimed at improving the welfare position of all stakeholders. Any information shared will be kept **CONFIDENTIAL** and will be used only for the purpose of this study. Kindly state your consent to provide information for this purpose.

Yes ☐

No ☐

Section A: General Information

1. Date of interview _____

2. Name of Enumerator _____

Section B. Socio- Economic Characteristics of the Respondent

1. How old are you? _____

2. Gender: Male ☐

        Female ☐

3. Sub- County: Kasipul ☐

          Kabondo ☐

          Ndhiwa ☐

4. Household size (*number of people living and eating together*) _____

5. Number of children attending school? _____

6. What is your educational level or professional qualification?

1. University ☐
2. College/Tertiary ☐
3. Secondary school ☐
4. Primary school ☐
5. None ☐

7. What is your number of Schooling years? _____

8. How many members of household are employed? _____

9. What are your sources of income?

1. Employment Income ☐
2. Farming Income ☐
3. Value Addition Income ☐
4. Remittances from family members from city/abroad ☐
5. Others.(State) _____

Section C: Production Characteristics of Households

1. What is the size of your household farm land? _____

2. What is the acreage under sweet potato production? _____

3. Which inputs do you use in sweet potato production? Kindly state and give the unit costs under which you obtain them in the table below.

Inputs	Unit cost (KES)

4. What is the Average cost of inputs used per production season?

Activity	Cost(KES)
Ploughing	
Planting	
Weeding	
Harvesting	
Others	

5. What is the average yield per acre?(bags/kgs) _____

6. What is the quantity used for home consumption? (Bags) _____

7. What is the quantity of raw tubers sold? (Bags) _____

8. What is your output price/bag of marketed surplus? _____

Section D: Value addition activities, Net prices of value added products and the effects of different value addition activities on net price.

1. Do you practice any form of value addition?

    1. Yes ☐

    2. No ☐

2. If No, skip to question 6

3. If yes in (1) above, what activities do you carry out? *tick as appropriate*

    1. Cleaning ☐

    2. Sorting ☐

    3. Grading ☐

    4. Packing into bags ☐

    5. Roasting ☐

    6. Boiling ☐

    7. Grinding into flour ☐

    8. Steaming ☐

    9. Baking into breads/cakes/buns ☐

    10. Frying into potato chips ☐

    11. Blending into potato juice ☐

    12. Cooking *Mandazi/Chapatti* ☐

13. Others. (Specify)

_____

4.   What are the costs you incur for doing these activities?

Assembling, cleaning, sorting, grading	
Packaging Materials	
Peeling raw tubers	
Roasting/Steaming/Boiling	
Grinding Costs	
Baking Materials	
Oil for frying	
Others/Specify	

5. How much do you sell a kg of products after value addition?

FINAL PRODUCT	KES

6. Have you attended any training?

      1. Yes   ☐

      2. No   ☐

7. If No in question 6 above, skip to section E.

8. If Yes in question 6 above, what kind of training did you attend?

      1. Agricultural Training   ☐

      2. Training on Value Addition   ☐

      3. Seminar/training on how to access credit   ☐

      4. Others(Specify) _____

9. Who offers the training?

      1. County Government   ☐

2. NGO.(Specify) _____

10. How often do you attend the training above? _____

Section E: Determining Price Margins in the sweet potato value chain

1. What is your average costs including transportation costs incurred to get the goods to the next actor in the value chain or end user?

ACTIVITY	COST (KES)
Assembling, sorting, grading	
Packing including cost of bags	
Loading into means of transport	
Offloading	
Marketing costs such as market search	
Grinding/ processing into flour	
Others	

2.　　What is the distance to the local or main market where you sell your output?(kms) _____

3.　　What is the nature of the road to the market _____

4.　　What is your mode of transport to the market? _____

5.　　What is the total transportation cost you incur to deliver output to the market?(Kes)

6. Indicate your market outlet.

    1. Consumers ☐

    2. Processing Units ☐

    3. Traders(retailer/wholesaler) ☐

    4. Collection centre ☐

7. In regard to (6) above what price do you obtain from the channel you sell?(KES/bag)

    1. Consumers ☐

    2. Processing Units ☐

    3. Traders(retailer/wholesaler) ☐

4. Collection centers' □

5. Others (specify) _____

Section F: Institutional Factors

1. Do you belong to any farmer group, Cooperatives, Associations or Processing Units?

    1. Yes □

    2. No □

2. If no, skip to question 6

3. If yes in (1) above, what type of group is it?

    1. Marketing Association/group □

    2. Self help group □

    3. Women Group □

    4. Community Based Organization □

    5. Co operative □

    6. SACCO □

    7. Processing Unit □

    8. Merry Go Round group □

    9. Others(Specify) _____

4. How long have you been a member in the group? _____

5. What benefits do you get from the group

    1. Collective farming and marketing

    2. Access to Credit □

    3. Access to Information □

    4. Access to extension services □

    5. Trainings including aspects of better value addition □

    6. Others.(Specify) _____

6. Are you able to access credit as an individual farmer?

    1. Yes □

    2. No □

7.   If yes in question (6) above, from where do you access the credit?

    1. Microfinance Institution   ☐

    2. Government parastatal/Organization   ☐

    3. NGO (Name) _____

8. Are you able to access to extension services as an individual farmer?

    1. Yes   ☐

    2. No   ☐

9. If yes in question (8) above, how often do the extension officers visit?   _____

10. What are your sources of information regarding value addition aspects, prices and market outlets?

    1. Fellow farmers/Neighbors'   ☐

    2. Radio   ☐

    3. Television   ☐

    4. Extension worker   ☐

    5. NGO organizations   ☐

    6. Others (Specify) _____

10. What are the challenges you are facing?

_____

_____

_____

11. What are the Recommendations you would suggest to help improve sweet potato production and value addition enhancement in the area?

_____

_____

_____

INTERVIEWEE CONTACT:

Thank you for your time.

Information provided will remain ***STRICTLY CONFIDENTIAL.***

Interview Schedule: Traders and Processors.

Code_____

The intention of this study is purely academic and in particular to generate information on the effect of value addition activities of sweet potatoes on Price Margins along the Value Chain. Your response will assist in gearing towards formulation of policies in support of enhanced value addition techniques in the County aimed at improving the welfare position of all stakeholders. Any information shared will be kept **CONFIDENTIAL** and will be used only for the purpose of this study.

Kindly state your consent to provide information for this purpose

Yes ☐

No ☐

Section A: General Information
1. Date of interview _____

2. Name of Enumerator _____

Section B. Socio- Economic Characteristics of the Respondent

1. How old are you? _____

2. Gender: Male ☐

       Female ☐

3. Sub- County: Kasipul ☐

       Kabondo ☐

       Ndhiwa ☐

4. What is your educational level or professional qualification?

   1. University ☐
   2. College/Tertiary ☐
   3. Secondary school ☐
   4. Primary school ☐
   5. None ☐

Section C. Interview Questions to Be Administered

1. Which role do you play along the value chain? _____

2. Where do you obtain sweet potatoes from? _____

3. At what cost do you obtain the sweet potatoes?(KES/bag) _____

4. What are the other costs you incur in the transaction? Kindly list in the below table with the unit costs for each.

ACTIVITY	UNIT COST(KES)
Assembling, sorting, grading ,Cleaning	
Packing including cost of bags	
Loading into means of transport	
Offloading	
Other Marketing costs such as market search	
Others (Specify)	

5. What is the distance to the market?(Kms) _____

6. What is the nature of the road to the market? _____

7. What is your mode of transport to the market? _____

8. What is the total transportation cost you incur to get your output to market?

    _____

9. What are the further activities of value addition you practice if any before sales to the next actor?

    _____

10. What are the other costs involved related with value addition activities

Activity	Unit Cost
Peeling	
Roasting	
Boiling/Steaming	
Drying	
Chipping	
Grinding into flour	
Oil for frying	
Baking materials and baking related costs	
Blender and blending costs involved	

Cost of firewood/fuel used	
Others(Specify)	

11. Through what distribution channel do you sell your final product?

1. Another trader/Wholesaler ☐
2. Processor ☐
3. Retailer ☐
4. Consumer ☐
5. Others(Specify) _____

12.What is the price at which you sell your value added product?(Kes/kg)

OUTPUT	PRICE(KES)

13.(For traders), have you attended or received any form of training to better your activities?

1. Yes ☐
2. No ☐

14.If No in question (13) above, skip to question 19.

15. If Yes in question (13) above, kindly specify the training. _____

16.For processing units, have you arranged any form of training for members/employees?

1. Yes ☐
2. No ☐

17.If No in question (16) above, skip to question 19.

18. If yes in question (16) above, kindly specify the form of training organized

1. Agricultural training ☐
2. Training on value addition ☐
3. Others(Specify) _____

19.What are the challenges you are facing?

_____

_____

_____

20.What are the Recommendations you would suggest to help improve the smooth flow of activities along the Value chain?

_____

_____

_____

INTERVIEWEE CONTACTS:

TRADER

ORGANIZATION/PROCESSING GROUP (Name) _____

Contact _____

Thank you for your time.

Information provided will remain ***STRICTLY CONFIDENTIAL.***