FACTORS AFFECTING VALUE ADDITION OF IRISH POTATO AND EFFECTS ON SMALLHOLDER FARMERS' INCOME GENERATION IN BOMET COUNTY, KENYA

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UNIVERSITY OF KABIANGA

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DECLARATION AND RECOMMENDATION

DECLARATION

I declare that this thesis is my original work and has never been submitted in this or any other university for the award of a degree.

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DEDICATION

To my wife Joyce Chepkirui Korir and children (Tonny Kipkemoi, Fransisca Cherono and Deborah Cheptoo). Also to my parents (Dr. David Wilson Kipkorir Koech and late mum Mrs. Fransisca Jebitok Koech) and brothers and sisters (Rose, Denis, Amos and Penina).

ABSTRACT

Agriculture contributes over 25% of Kenya's gross domestic product (GDP), and 65% of export earnings thus making it the backbone of the country's economy. The Irish potato enterprise provides substantial income from sale of potatoes and their value added products that lead to immediate payment. Irish potato is an important food commodity throughout Kenya. However, there is scares information on the factors affecting value addition and their influence on farmers income in Bomet County. The study identified and characterized Irish potato producers in Bomet County, determined factors affecting value addition in potatoes, compared profitability of raw and value-added Irish potato products in County and finally determined the effects of value-addition on farmers' welfare. A structured questionnaire was used to collect cross-sectional data from 200 respondents selected randomly through multistage sampling procedure. To characterize Irish potato producers in Bomet County, descriptive statistics were used while factors affecting value addition of potatoes in Bomet County were analyzed using binary logistic regression model. Gross Margin Analysis (GMA) was used in determining profitability of raw and value added Irish potato products. The Statistical Packages for Social Scientists (SPSS) was used in data analysis and results presented in tables and graphs. From the study, the results show that many of the respondents were farmers standing at 70.5 % while majority of potato farmers were in the age middle age bracket of 36-60 years which stood at 40.5%. Male farmers dominated decision making at 75% and most farmers had potatoes in 0.1 to 3acres at 88.5% indicating that potato is one of the main crops in the area. Furthermore, non-value adders had more land under potatoes than value adders at an average of 0.1 to 3 acres. The most common form of value addition practiced by the farmers was sorting (66.5%) while grading, chipping and frying was practiced by 0.5 % of farmers in each case. Most farmers, who were not employed, carried out value addition at 70.5 % followed by the employed and students, respectively. Majority of the farmers with no education carried out value addition at 67.5% as compared to those who had primary education at 32.5%. Group membership, cost per unit of potatoes and total land size are key variables influencing value addition. Sorting was found to be the most profitable form of value addition. It was also found out that value adders earned more income than non-value adders per unit area. There is need to identify cost cutting technologies for grading, chipping and frying as this forms of value addition are not profitable to the farmers.

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ACRONYMS/ABBREVIATIONS

ADC	Agricultural Development Corporation
ASDSP	Agricultural Sector Development Support Programme
ATC	Agricultural Training Centre
CBO	Community Based Organization
CDP	County Development Profile
CIDP	County Integrated Development Plan
CIG	Common Interest Group
CIP	Centro International De La Papa(International Potato Center)
FAO	Food And Agricultural Organization
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GOK	Government Of Kenya
IFAD	International Fund For Agricultural Development
KALRO	Kenya Agriculture And Livestock Research Organization
KARI	Kenya Agriculture Research Institute
KENAPOFA	Kenya National Potato Farmers Association
KEPHIS	Kenya Plant Health Inspectorate Service
MLND	Maize Lethal Necrosis Disease
MOA	Ministry Of Agriculture
MOALD	Ministry Of Agriculture And Livestock Development
SIP	Strategic Investment Plan

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DEFINITION OF TERMS

Household	A household consists of one or more people who live in the same dwelling and also share meals. It also may consist of a single family or some other grouping of people.
Income	It was measured as the combined incomes of all people sharing a particular household or place of residence. It included every form of income, e.g., salaries and wages, retirement income, near cash government transfers like food stamps, and investment gains
Irish potato	Irish potato is one of the many varieties of potato, a starchy, tuberous crop from the perennial nightshade *solanum tuberosum*.
Profitability	Profitability is the ability of a business to earn a profit. Profit: A profit is the revenue earned after all expenses have been paid.
Smallholder	It refers to their limited resource endowment relative to other farmers in the sector. Smallholder farmers are also defined as those farmers owning small-based plots of land on which they grow subsistence crops and one or two cash crops relying almost exclusively on family labour.
Value addition	Value addition in the agricultural sector has been hailed as a way to improve earnings while diversifying products to consumers.

CHAPTER ONE
INTRODUCTION

1.1 Background of the study

Irish potato, *Solanum tuberosum* L. is the world's fourth largest food crop after wheat, rice and maize. Irish Potato farming is an important component of agriculture, rural employment, human nutrition and economic development (FAO, 2009).World production reached a record 320 million tonnes in 2007 and production in the developing countries has almost doubled since 1991, with a corresponding increase in consumption (Hoffler and Ochieng, 2008). Irish Potatoes are an important source of food, employment and income in developing countries (FAO, 2008). It is high in energy content and ease of production has also made it an important component of urban agriculture which provides jobs and food security to some 800 million people globally (Hoffler and Ochieng, 2008).

Potatoes have been grown in Kenya for over 105 years. Initially the crop was grown primarily by European farmers for their own consumption and for export to Southern Africa and Asia. Over time, potato production has expanded rapidly and now it plays a significant role as a food crop in producer areas and as a consumer good in urban centers (Durr and Lorenzl, 1980). Currently, Irish potato is Kenya's second most important food crop following behind maize, involving more than 790,000 smallholder farmers producing 2.9 million metric tons (MT) annually across 123,000 hectares. The industry generates approximately Kshs 46 billion ($561 million) in sales every year (MoA, 2012). Production of Irish potato in Bomet County stood at 25,517 metric tonnes valued at Kshs 965,918,182 annually (Bomet county integrated development plan, 2013).

Hundreds of millions of people in the third world countries including Kenya are facing food crisis as the cost of their staple foods continues to rise and other obnoxious diseases like maize lethal necrotic disease (MLND), streak and rust diseases continue to affect cereals. Currently, there is a rising demand for quality processed Irish potato products like Chips, Crisps, Chevda etc from the country particularly in Middle East. Potato processing opens a new dimension for development of agro based industries. With the demand for Irish potato value added products rising, the need for farmers to process their Irish potatoes is on the increase (Mrema *et al.*, 2013).

Many of the small scale producers in developing countries, and most undernourished households, value the potato because it produces large quantities of dietary energy and maintains relatively stable yields under conditions in which other crops might fail. Those characteristics make the potato suitable for cultivation in many low-income developing countries, where arable land is limited and

unemployed labour is abundant. Birachi *et al.,* (2012) in their study on markets and value addition in selected agricultural value chains showed that, there is clear advantage for farmers to shift from sale of raw produce to processing into higher value products. The study further found that, the rate of return after value addition increases by more than 90% when compared to prices of the raw produce and that processing helps to prevent postharvest losses that are experienced by farmers in general.There exists very good prospects for value addition in Irish potatoes due to the increasing number of urban consumers willing to diversify their consumption pattern in form of branded and packed fresh Irish potatoes in (super)markets, chips and crisps (Haverkot, A.J., and Struik, P.C., 2015).

In Bomet County, Irish potatoes have a high potential for addressing food insecurity, unemployment and low farm incomes due to its high productivity. Irish potato production is currently practiced and carried out in 5 Sub-Counties of Bomet County. The crop is grown in the upper regions of the county with the main varieties produced being *dutch robjyn, Kenya karibu, shangy* and *desiree* among others (Pers.com, 2015).

Bomet County relies on Irish potato production of the above varieties which have high demand from Irish potato processing firms like Norda potato processing company, Tropical heat potato processing company and local hotel. Despite the existence of opportunities for Irish potato farmers, they face numerous challenges that include lack of organized marketing channels and existence of cartels who manipulate prices by creating a sense of oversupply on producers and the latter buy potatoes in large extended bags which is exploitative to the producers. According to Bomet County Annual Report (2012), low value addition, seasonality in production and lack of on-farm ware potato storage has led to minimal returns to the farmers. Report by ASDSP (2014) indicates that, farmers sell 110 kg bag of potatoes between Kshs 2,500 to 3,000. This translates to Kshs 22.73 to Kshs 27.27 per kilogram. On the other hand, value added Irish potatoes (crisps) sell at Kshs 20 per 50 grams. In 110 kg bag of Irish potatoes, assuming 10 Kg wastage(outer peelings), translates to 2,000 packets of 50gms each when processed. The cost of the 2000 packets translates to Kshs 40,000. This means that, by adding value to Irish potatoes by making chips, crisps and other products, a farmer can make Kshs 400 per kilogram. This implies that a farmer will get a profit increase of over 800% in price per Kilogram of value added Irish potatoes sold.

1.2 Problem statement

Irish potato production is one of the farmers' main agricultural activities in Bomet County. The farmers produce potatoes for household consumption and for income generation. But, despite the existence of high returns from potato value- added products, coupled with increasing demand for the value-added products in both local and urban markets in Kenya, uptake of value addition practices among Irish potato farmers in Bomet County is low. To date, limited information exists on factors that are responsible for the low Irish potato value addition in the County. In addition, there exists scanty information on the effect of value addition practices on profitability among Irish potato farmers in the County.

1.3 Study objectives

1.3.1 Overall objective

The overall objective was to determine the factors affecting value addition of Irish potato, *Solunum tuberosum* and effects on farmers' income generation in Bomet County, Kenya.

1.3.2 Specific objectives

The specific objectives were to:

i. Identify value addition practices on Irish potato by farmers in Bomet County;
ii. Determine the factors affecting value addition of Irish potatoes in the area of study;
iii. Investigate the profitability of value addition in Irish potato by farm households in area of study.

1.4 Research Questions

The research questions on factors affecting value addition of Irish potatoes, *solunum tuberosum* and effects on farmers' income generation in Bomet County are;

i. What are the value addition practices on Irish potatoes by farmers in Bomet County?
ii. What are the factors effecting value addition of Irish potatoes?
iii. What is the profitability of raw and value added Irish potato products to farmer households in Bomet County?.

1.5 Justification of the study

Irish potato is Kenya's second most important food crop next to maize, involving more than 790,000 smallholder farmers producing 2.9 million metric tons (MT) across 123,000 hectares. The industry generates approximately Kshs 46 billion ($561 million) in sales every year. (Ministry of Agriculture, Horticulture Validated Report, 2012).Irish potato production is an important income-generating venture for the people of Bomet County because of characteristics required by the

customers-high level of dry matter for making of crisps and chips. In 2013, Bomet produced 25.517 metric tonnes in 2,899 ha with market value of Kshs.965, 918,182 (Bomet County Development Profile, 2013).

The study was conducted to shed light on factors affecting value addition and its effects on farmer's income. The information generated will contribute to policy making process at County and national level in line with the achievement of County integrated development plan (CIDP), county strategic investment plan (SIP) and vision 2030, which seek to enable the transition of small scale farms into commercially oriented and modern production units. This will facilitate increased market access through value addition.

1.6 Scope and limitation of the study

1.6.1 Scope

This study only focused on selected smallholder Irish potato producers in Bomet County. It also focused on the constraints to Irish potato value addition and effects on farmers' welfare. There were other aspects like extension, marketing, organization and other agricultural services are beyond the scope of this study.

1.6.2 Limitations

The study relied on respondent's memory and therefore data to be collected will be assumed to be valid. The study also used a sample and conclusions made were assumed to represent the true behavior of the whole population.

1.6.3 Assumptions

It was assumed that the respondents cooperated with the interviewer and the information given was valid and correct.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

This section presents a review of literature on Irish potato production, value addition of Irish potato, poverty studies and the role of farm based value addition. Literature on value addition on the Irish potato subsector is also reviewed.

2.2 Irish potato production in Kenya

Irish potatoes are grown under temperate, subtropical and tropical conditions. Optimum yields are obtained where ambient temperatures are in the range of 18^0C to 20^0C. They grow best above 1500m and 3000m above sea level. The potato is a very accommodating and adaptable plant, and will produce well in most conditions. The most important potato growing areas in Kenya are the higher altitude areas (1700m and 3000m above sea level). The major potato producing counties in Kenya include:- Bomet, Bungoma, Elgeiyo-Marakwet, Kiambu, Meru, Nakuru, Narok, Nyandarua, Nyeri, Taita-Taveta, Trans-Nzoia, Uasin Gishu, and West Pokot. Irish potato (*Solanum tuberosum* L.) plays a major role in food security in Kenya and contributes to poverty alleviation through income generation and employment creation. Despite its importance, the potato sector is plagued by numerous problems such as a lack of clean seeds, lack of proper pest and disease management, a disorganized marketing system and a lack of clear policies on packaging (Riungu, 2011).

Potatoes are an important food crop in Kenya, with production volumes only second to maize. They are produced in the cool highlands mostly by small scale farmers under rain-fed conditions. The soils in these areas are generally acidic and of low fertility due to anthropogenic activities. It is grown by approximately 500,000 small scale farmers on 120,000 hectares and with an average yield of 7.7 tonnes per hectare is far below the national potential, largely due to limited use of certified seeds, low application of fertilizers and other organic amendments, and low use of fungicides and other production chemicals (Janssens S.G, Wiersema H.G., Wiersema W., (2013).Marketing problems bedeviling potato industry include lack of organized marketing channels in which farmers have no power. The channels are controlled by cartels, who shield producers from receiving any market information (Kakuongo, W. Gildemacher, P. Demo, P. Wagoire, W. Kinyae, P. Andrade, J.Forbes, G.Fuglie, K. Thiele., 2008). There is a lot of handling and in the process the producer's share in the final price of the commodity is minimal. Transport of potatoes to the market is expensive due to poor road infrastructure in the Irish potato producing areas (Kirumba W, Kinyae

P, Muchara M., 2004). Seasonality in production and lack of on-farm ware potato storage lead to minimal returns to farmers (Muthoni J and Nyamongo D.O., 2009).

The foundation for the post -harvest processing and value addition in the agricultural sector was laid during the post 2nd world war years with the emergence of a dual agricultural sector dominated by large scale European settler farmers and small scale progressive farmers who were producing cash crops for the export market. In Kenya Colony, the African farmers were not allowed to engage in commercial agricultural production and this was confined to European farmers who were growing cash crops such as coffee, tea, pyrethrum, dairy and beef. These European farmers set up institutions to support post-harvest processing; marketing and value addition of their produce in the 1940s and 50s (Durr and Lorenzl, 1980).

Following the Mau Mau War in Kenya from 1948 to 1954, the British Colonial Authorities launched a major agricultural development initiative which laid the foundation of Kenya's post - independence agricultural prosperity. This initiative known as the Swynnerton Plan was implemented between 1954 to1963 and was the largest small holder development programme ever implemented by the Colonial Authorities in Africa. It was anchored on intensification of agricultural production in the Central and Rift Valley Provinces coupled with the establishment of an effective and efficient post-harvest processing and marketing infrastructure (Mrema and Ndikumana, 2013).

2.3 Household Poverty Dynamics

Sessional Paper Number 10 of 2012 on Kenya Vision 2030 is the National Policy Economic Blueprint that entrenches Kenya Vision 2030 as the long term development strategy for Kenya. The Vision aims to transform Kenya into a modern, globally competitive, middle income country providing a high quality of life to all its citizens. The Vision is a product of highly participatory, consultative and inclusive stakeholder's process conducted throughout the country and in all sectors of the economy. The Vision is anchored on three key pillars: economic; social; and political pillars. This study is greatly related to the first two pillars of economic and social pillars.

Poverty still remains a major challenge in the county. Though poverty levels for the county have declined to 46.5 per cent, a lot still needs to be done to create employment opportunities and wealth so as to alleviate poverty. Jayne T. S, Mason N, Myers R, Ferris J, Beaver M, Lenski N., (2010) investigated the factors contributing to household poverty dynamics in Kenya and found that age

and education of the household head, whether someone in the family has a formal job, land ownership, family size, and the distance to a tarmac road were the key factors influencing household asset-poverty levels. Agricultural sector development strategy (ASDS, 2010) cites value chain development as a key to improving linkages amongst the farming community and other actors in the chain and by so doing create wealth and reduce poverty.

2.4 Irish potato value addition globally

According to Boland (2009) value addition is the process of changing or transforming a product from its original state to a more valuable state. Many raw commodities have intrinsic value in their original state. Value-added Irish Potato products are unique**,** less price sensitive and consumer-oriented. Value addition can take place by; form value, location value, time value, ownership/possession value, information value (Stuart and Kynda, 2012). Most value addition studies found in the literature have focused on contributions of value addition on the performance of the different sectors and the effects of value addition on economic welfare indicators such as income, savings, asset ownership and other socioeconomic variables such as education level, age, and household enterprise mix. Value addition has been found to enhance poverty alleviation through its direct and indirect influence on the above mentioned variables (Mrema and Ndikumana, 2013).

Potato is mainly processed into crisps and chips. Other potato processed products include long- life fries, pringles and potato flour (Riungu, 2007). Processing of potato flour, starch, weaning food and wine is yet to be commercially exploited. The main potato processors such as Midlands, Deepa, Norda, and Njoro Canners are operating at 40 percent capacity due to lack of consistent supply of good quality tubers. Inconsistence in supply of raw material is attributed to reliance on rain-fed production system and inadequate storage facilities (Oiko, 2010). *Dutch Robjin* and *Kerr's Pink* are the only two potato varieties suitable for crisp processing available to local processors; while RoslinTana, Dutch Robjin and, and Nyayo are the popular varieties for chip processing (Walingo, M., Kabira J. N., Alexander, C., and Ewell., P.T., 1997). However, most potato processing varieties (Tigoni, Sangi and Desiree) are low yielding and very susceptible to pest and diseases (HCDA Potato Value Chain Report, 2012).

2.5 Irish Potato Value Addition in Kenya

Irish Potatoes are an important crop in Kenya whose volumes comes second after maize. It remains a main stay for most rural farmers in cooler regions where the crop is widely grown. Irish Potatoes are consumed either as boiled, fried, mashed or in stews. Farmers who are able to play with factors

that affect price, that is, demand and supply can be able to fetch good prices at all times for their produce making the production of potatoes a lucrative affair. By embracing value addition, they would reduce post-harvest losses since losses from poor handling and storage are reported to be at 40-50% (Ministry of Agriculture, Annual Report 2013). The bulk of the potato crop is sold as ware potatoes and eaten as a boiled vegetable. The advent of the urban take-way (fast food kiosks) in the early 1990s and the entry of South African fast food companies have increased potato processing into chips (Ferris, R. S. B., Okoboi G., Crissman. C., Ewell, P., and Lemaga, B., 2012).

Urban residents are the country's main consumers and the reason for the soaring demand for ware potatoes and processed products, such as chips and crisps in restaurants and bars (Kirumba *et al*., 2004; Tesfaye, A., Lemaga B., Mwakasendo J.A, Nzohabanayoz Z., Mutware J., Wanda K.Y., Kinyae P.M., Ortiz O., Crissman C. and G.Thiele., 2010). However, whether consumption is increasing due to massive growth of the urban population, or is a reflection of per capita increases, is less clear. Fresh consumption is common in those rural areas where Irish potatoes are grown. Kenya has an expanding food processing industry, driven by its growing urban population, changing population structure, new eating habits and increased tourism. The industry requires potato varieties with better processing qualities (for example, 'Kerr's Pink' and 'Dutch Robjyn' are suitable for crisps, 'RoslinTana' and 'Nyayo' for chips) to replace the old traditional varieties that are not suitable for processing and also susceptible to bacterial and viral diseases (Kakuongo *et al*., 2008). At retail level, Irish potatoes are mainly prepared and consumed as chips in restaurants, bars and takeaway outlets in Kenya's major urban centres (Tesfaye *et al*., 2010).

2.6 Irish Potato Value Addition in Bomet County

There is a growing trade in potatoes to supply the fast growing cities and towns with cheap staple food, and to satisfy the demand of the growing fast industry. 60-65% of the fresh potatoes supplied by urban traders in Kenya are processed in restaurants and street stalls (Kirumba *et al*, 2004).The introduction of potato growing in Bomet County could have been related to the demand by company (Deep Heat-formerly known as Deepa industries) which contracted farmers in this area to plant *Dutch robjin* for processing into chips and French fries. Farmers in Bomet County practice a range of value addition activities which include sorting and grading, storage, transportation and cottage processing and packaging.

Bomet County potatoes have a unique demand for processing into chips. Processing firms like Norda, Deep heat among others prefer Irish potatoes from this county because of the good dry matter content and sugars in the potatoes which are good attributes when processing potatoes (Muthoni *et al.,* 2009). Kaguongo *et al.,* (2008) found that nearly all farmers in Bomet Central and almost all farmers in Longisa divisions grew the red-skinned *Dutch robjin*. Wakahiu, M. W., Gildemacher, P. R., Kinyua, Z. M., Kabira, J. N., Kimenju, A. W., & Mutitu, E. W. (2007) and Kaguongo W.,Nyangweso A., Mutunga J., and Nderitu J., (2013) also found that farmers in these divisions grew Dutch Robjin and postulated this attribute to the specific processing market that farmers in this area supply.

2.7 Role of value addition in improving household income and welfare

Bomet County has two growing seasons namely August –January and March -July season. Agricultural sector development support programme (ASDSP) household baseline survey, 2013 shows that 32% of households grow potatoes in the 1st season and 20% in the 2nd season. The same report shows that farmers added value to their crops with the most widely value added crop being vegetables (valued added by 25% of farmers), trees (15% of farmers), root and tubers (15% of farmers) with most of the value addition carried out in male headed households. The specific crop value addition activities undertaken differed with farmers value adding vegetables by grading or packaging (54%) and by drying (25%); trees had their value increased through making them into firewood (31%), making timber (24%) and making Posts (23%); root and tubers had their value increased through grading and/or packaging (56%), making cake (19%), making chips (12%) and making flour (10%).

Production and value addition in potatoes are essential livelihood strategies for millions of poor smallholder farmers (Devaux A, Ordinola M, Horton D., 2011). A study by Pravakar S, Castellanos IV, Rahut, D. B. (2010) further noted that value addition in agricultural marketing is key in increasing farmers incomes and in poverty reduction. According to Quaye and Kanda (2004), analysis of marketing margin is crucial in identifying the effects of market actors on prices received by consumers and producers of agricultural products. To date, enormous studies have been conducted globally to determine the effects of production and marketing of Irish potatoes on profitability and farmer's income. For instance, Kirumba et al. (2004) in their study noted that production and marketing of Irish potatoes is very challenging to farmers. The study noted that during season of high supply farmers receive low farm-gate and wholesale prices and vice versa

during season of high demand due to seasonality in production coupled by lack of storage facilities. That is, farmers receive farm-gate prices and wholesale prices that range between KES 400-500/Bag and KES 900-1100/Bag respectively. During the season of high demand, the farmer receives farm-gate and wholesale prices that range between KES 1000-2000/Bag and KES 1600-2000/Bag respectively.

Lundy M., Ostertag C.F., and Best R., (2002), postulated that in order to take advantage of value addition potential, the resultant activities must be competitive, sustainable and involve low-income rural populations. The participation of low-income rural populations is critical to achieving poverty reduction. According to Mahendrarajah *et al.,* (2005), farmers should attain income levels similar to the industry workers (and others) They also pointed out that the ability to attain the same income level should be based on the assumption of effective labour use and other factors of production, all of which are possible through farm diversification and value addition. Furthermore, the Northern Ireland Business, (2010) pointed out that by diversifying farms into a rural enterprises, farmers are likely to grasp a range of benefits which they don't often find in a traditional farms. Ramirez (2001) found that value adding activities accounted for a 350 % increase in household incomes and said value adding could prove useful as a poverty reduction tool if it leads to increase in 'on and off' farm rural employment and income. Golleti *et al* (1999) also highlighted the poverty reduction potential of post-harvest and value added activities and emphasized on gains in rural income and employment are complemented by reductions in food prices for urban dwellers and improvements in processing and market chains.

The improvement of processing and market chains reduce traditional food preparation times, thus releasing time for more productive activities. The net result, therefore, may be positive for both the rural and urban poor. Lundy *et al.* (2002) emphasized strengthening of the rural enterprise sector in southern nations as method for achieving both value adding and poverty reduction. Rural household processing enterprises exist in a wide variety of products (and are feasible in a great many more) generating added value and nonfarm employment opportunities for rural populations.

Limited access to profitable markets and production resources by smallholder farmers restricts expansion and investment in technologies that could increase efficiency and add value to primary production but by targeting the collective marketing, value addition and processing of banana and Irish potatoes farmers are able to increase their returns by about 50% compared to the period before interventions. The shelf life of the products also increases drastically. Market efficiency improves

for Irish potatoes by reducing transaction costs and decreasing the market intermediaries who would extract larger margins at the expense of the producers (Birachi *et al.*, 2012).

A study by Sebatta, C., Mugisha, J., Katungi, E., Kasharu, A. K. and Kyomugisha, H. (2015) used break even analysis to determine the effect of potato value addition on farmer's income in Uganda. The study found that farmers who did value addition earned more income than those who did not do value addition. That is, those who did value addition earned income 40% above amount earned by non-value adders. The study further established that prices of value added seed potatoes were 30% more than the prices on non-value added potatoes. On the other hand value added ware potato had the highest maximum price at UGX.1,200 per kilogram while non-valued added potato products had the lowest price of UGX.150.00. The study concluded that value addition in potato farming is a profitable venture that is able to increase farmer's incomes.

Omari, M. Z. (2015) used descriptive statistics and Multiple Linear Regression model to analyze production and marketing of Irish potatoes in Tanzania. The study found that farmers and food sellers made the highest marketing margin of 63%. A study by Maganga et al. (2012) found that irish potato farmers get low farm incomes due to lack of storage facilities. Muthoni, J.and Nyamongo, D. O. (2009) reviewed the constraints to ware Irish potatoes in Kenya. The study found that lack of on-farm storage facilities (which is a form of value addition) reduced farmer's earnings or income. Kaguongo et al. (2008) also concur that majority of farmers in Kenya do not store Irish potatoes due to lack of storage facilities. Instead they sell directly after harvested and end up receiving low prices and thus incomes.

2.8 Factors affecting value addition

Irish potatoes are an important food crop in Kenya, with production volumes only second to maize. Potatoes are produced in the cool highlands mostly by small scale farmers under rain-fed conditions. The soils in these areas are generally acidic and of low fertility due to anthropogenic activities. The national production is far below the potential, largely due to limited use of certified seeds, low application of fertilizers and other organic amendments, and low use of fungicides and other production chemicals. Marketing problems bedeviling potato industry include lack of organized channels in which farmers have no power. The channel is controlled by cartels, which shield producers from receiving any market information. There is a lot of handling and in the process the producer's share in the final price of the commodity is minimal. Transport of potatoes to the market is expensive due to poor road infrastructure in the producing area. Seasonality in

production and lack of on-farm ware potato storage lead to minimal returns to farmers (Muthoni *et al*., 2009)

The uncertainties regarding land tenure and the inadequate access to land have been a critical challenge to smallholder farming in East Africa. These problems can be examined from different perspectives. The constraints related to the tenure system, such as insecurity of land tenure, unequal access to land, lack of a mechanism to transfer rights and consolidate plots, have resulted in under-developed agriculture, high landlessness, food insecurity, and degraded natural resource. Furthermore, the available land in East Africa is overly subdivided into small and uneconomic units, resulting generally in fragmented production systems and low productivity. In fact, the farm sizes range from as low as about 1ha per household in Ethiopia and 2.0 ha in Tanzania and 2.5ha in Uganda and Kenya (Adeleke S., Abdul B., Zuzana B., 2010).

Historically, much of the effort has been focused on increasing agricultural productivity. However, productivity is looked at in terms of physical output rather than the monetary value. In looking at monetary value, focus will shift from extractive activities to post harvest (marketing) activities like transport, storage, breaking bulk and transformation to consumable products. Due to this shift in focus, agribusiness and value addition have gained more importance as a way of fighting rural poverty. Agribusiness enables rural residents to capture more margins from their farm produce, however, this is only possible if the credit and other constraints are resolved (Stanton 2000). Stanton revealed that 'it is imperative that both the productivity and market difficulties experienced by smallholder agriculture be considered in an overall strategy for increasing rural incomes.

Omitti *et al.* (2007) and Okello *et al*. (2009) have argued that value addition (among other things) in rural agriculture should be enhanced in order to promote market oriented smallholder agriculture in the developing countries. There is need to finance value addition to agricultural output, and agribusiness has been identified as the best avenue to channel credit into agriculture, and hence promote value addition (Stanton, 2000). Several other important factors impact global agri-food industry like growing trade of processed foods, changing consumer needs, rising disposable income, improved diets in many areas, industry consolidation, and increasing food demand in developing countries (Kohl., 2001).

Namwata (2010) noted that the low prices are received by Irish potato farmers in Tanzania due to limited opportunities for access to markets for frozen chips and fresh potatoes. Maganga *et al.*

(2012) found that Irish potatoes are highly perishable and farmers need adequate and good storage facilities to avoid losses. However the farmers lack adequate storage facilities. Studies by Kirumba *et al.* (2004), Kaguongo *et al.* (2008), Muthoni, J.and Nyamongo, D. O. (2009), Maganga *et al.* (2012) and Omari, M. Z. (2015) all concur that majority of Irish potato farmers fail to do value addition through storage due to lack of storage facilities.

A study by Orinda *et al.* (2017) used Heckman Two-Stage Selection model to determine factors affecting sweet potato value addition in Kenya. The study established that access to credit and extension services, distance to the market, marketable surplus, group membership and total quantity produced significantly and positively influenced value addition. The study noted that farmers in groups exchange ideas/information, achieve economies of scale, incur less costs and ensures collective production, marketing and training thus increasing probability of practicing value addition. On the distance, the study noted that farmers who are far away from the market outlets were more likely to add value and vice versa due to the fact that better prices are found in far markets and also the fact that sweet potatoes are bulky and perishable and the only way to reduce transport cost is to process. On the other hand the study found that household size, access to off-farm income and land size negatively influenced adoption of value addition activities. They found that larger households consumes more of what is produced hence less is available for value addition and subsequently for sale. Similar findings are reported in Tura *et al.* (2010).

Rono *et al.* (2006) conducted study in Kenya to determine factors affecting value addition in Sweet Potatoes. The study found that farmers who produced more were more likely to carry out value addition activities and vice versa. Ndegwa *et al.* (2000) found that group members help farmers access to credit facilities that subsequently stimulate value addition activities. Oluoch A. et al (2016) employed multiple-regression model in evaluation of effects of value addition in sweet potatoes on farmer's income in Homabay County, Kenya. The study found that, the more value a farmer added to raw tuber, the better the income obtained from the market. The study also noted that farmer marketing groups had a stronger bargaining power in the market compared to farmers selling individually.

A study by Sebatta, C., Mugisha, J., Katungi, E., Kasharu, A. K. and Kyomugisha, H. (2015) used Bivariate Probit regression model to determine factors affecting value addition among smallholder potato farmers in Uganda. The study found that quantity harvested, distance to the market and access to agricultural extension services significantly and positively influenced value addition

activities. On the other hand the study found significant and negative relationship between value addition decisions and off-farm income. However the study found no relation between value addition activities and the household size, access to contracts and credit facilities.

Jagwe, J.N. (2011) and Jaleta, M. and Gebremedhin, B. (2011) also found that as distance to the market increase, farmer's decisions to value add crop products also increases and vice versa. Studies by Mellor, J. W. (1963) and Bagamba, F. (2007) found a negative relationship between access to credit facilities and contracts and value addition on farm products in developing Countries. The reason is the malfunctioning of credit and contract markets in the rural areas of developing Countries. A study by Allen, J. H. (2006) noted that farmers decisions to engage in value addition activities is influenced by expected higher prices and access to markets.

2.9 Theoretical framework

The general assumption was that a huge potential for Irish potato processing exists and that households who decide to exploit this potential were well-off in terms of welfare. It was also assumed that the decision to engage in value addition is premised on higher expected utility by the producers. An interaction of these two decisions will be reflected on the welfare status subsequently. The decision on whether or not to add value is considered under the general framework of utility or profit maximization (Norris and Batie, 1987;Pryanishnikov and Katarina, 2003). Smallholder Irish potato producers within this framework will decide to add value if the perceived utility or profit maximization from this option is significantly greater than is the case without it. Although utility is not directly observed, the actions of economic agents are observed through the choices they make. Suppose that P_j and P_k represent a household's utility for two choices, which are denoted by Y_j and Y_k respectively. The linear random utility model could then be specified as:

$$P_j = \beta_j X_i + \varepsilon_j \text{ and } P_k = \beta_k X_i + \varepsilon_k \quad (2.1)$$

where P_j and P_k are perceived utilities of value addition and non-value addition choices j and k, respectively, X_i is the vector of explanatory variables that influence the perceived desirability of each choice, β_j and β_k are utility shifters, and ε_j and ε_k are error terms assumed to be independently and identically distributed (Greene, 2000). In the case of Irish potato value addition, if a producer decides to use option j, it follows that the perceived utility or benefit from option j is greater than the utility from other options (say k) depicted as:

$$P_{ij}(\beta_j X i + \varepsilon_i) > P_{ik}(\beta_k X_i + \varepsilon_k), \; K \neq j \quad (2.2)$$

The probability that a household will choose to add value, i.e. choose method *j* instead of *k* could then be defined as:

$$M(Y=1 \mid X) = M(P_{ij} > P_{ik})$$
$$M(\beta'_j X_i + \varepsilon_j - \beta'_k X_i - \varepsilon_k > 0 \mid X)$$
$$M(\beta'_j X_i - \beta'_k + \varepsilon_j - \varepsilon_k > 0 \mid X)$$
$$M(X^* X_i + \varepsilon^* > 0 \mid X = F(\beta^* X_i) \quad (2.3)$$

Where *M* is a probability function, P_{ij}, P_{ik}, and X_i are as defined above, $\varepsilon^* = \varepsilon_j - \varepsilon_k$ is a random disturbance term, $\beta_j = (\beta'_j - \beta'_k)$ is a vector of unknown parameters that can be interpreted as a net influence of the vector of independent variables influencing adaptation, and $F(\beta^* X_i)$ is a cumulative distribution function of ε^* evaluated at $\beta^* X_i$. The exact distribution of *F* depends on the distribution of the random disturbance term, ε^*. Depending on the assumed distribution that the random disturbance term follows, several qualitative choice models can be estimated (Greene, 2000). Any household decision on the alternative choices is underpinned by this theoretical framework, the realization of which can be implemented by a critically thought out conceptual framework.

A farmer group will choose to engage in value addition based on several factors like awareness of the value addition opportunity, production, market for the value added product, training and previous knowledge on value addition. Access to credit, availability of value adding equipment, knowledge on value addition technology, policy arrangements will influence the decision to engage in value addition. Group participation influences the choice and ability to practice value addition as it ensures accessibility to credit, equipment and collective marketing which is more effective than individual marketing thus fosters value addition. Individual farmer and farm characteristics such as age, education level, gender, level of social capital and Irish potato production in a season may influence the decision to carry out value addition positively or negatively depending on the vulnerability context of the farmer pursuing different strategies towards improving household welfare.

Education level, quantity of Irish potatoes harvested may positively influence value addition in terms of training and skills required to grasp new techniques and undertake value addition. The gender of household decision maker may influence the ability of the household to adopt new technologies and the replication of these technologies. Issues of food security, income generation,

assets owned are expected to influence the level of value addition .Value addition of Irish potatoes is expected to increase farm income hence enabling the household to improve household welfare. It is expected therefore, that differences in utility levels with farmers who have chosen to add value will be seen.

2.1 Conceptual framework

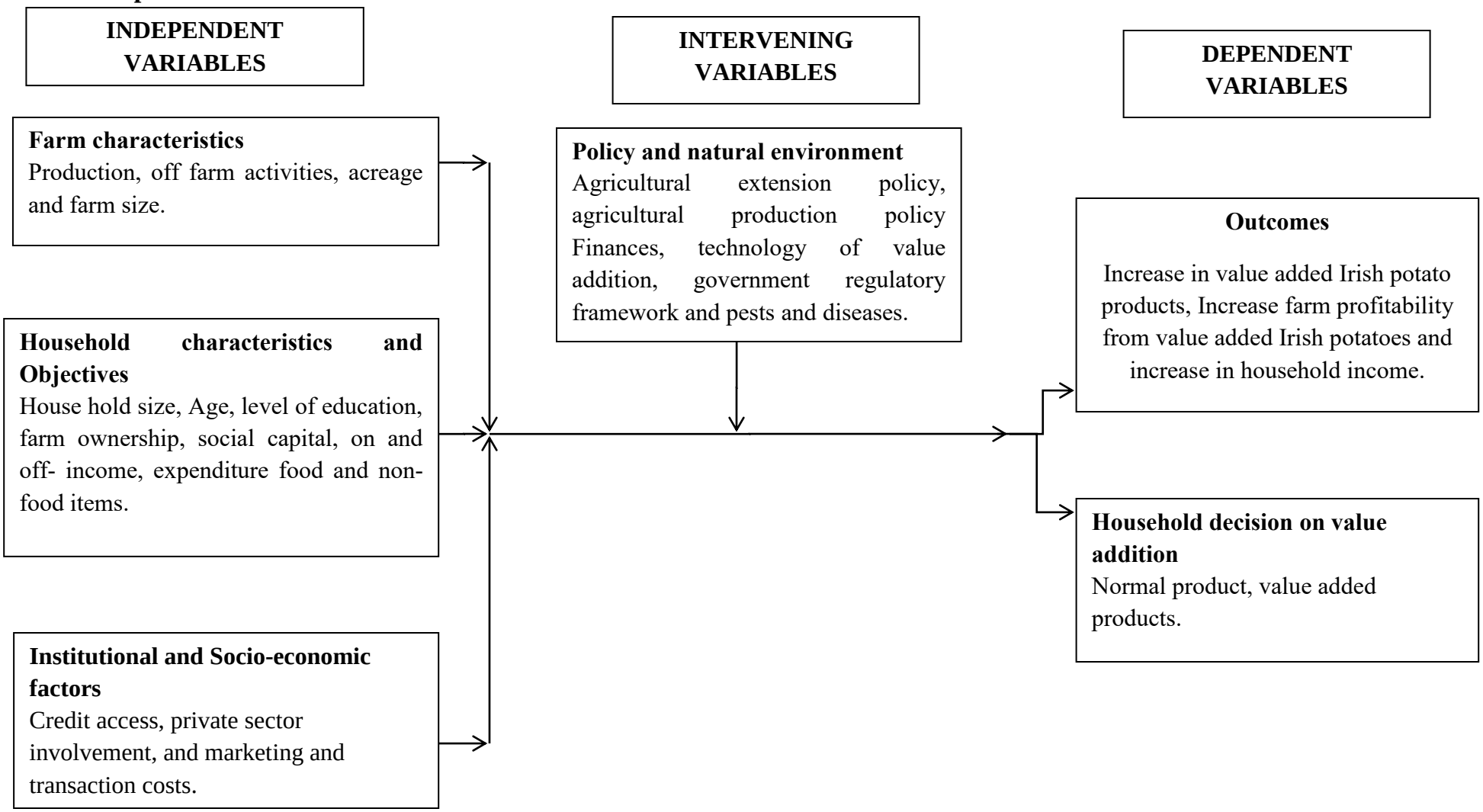

Figure 1: Conceptual framework

Source: Own conceptualization, 2016

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Study area

Bomet County lies between latitudes 0º 29' and 1º 03' south and between longitudes 35º 05' and 35º 35' east. It is bordered by four counties; Nakuru to the east, Kericho to the north-east, Nyamira to the south and Narok to the west. Bomet covers an area of 2037.4 km2. Fig 2 shows a map of Kenya showing the location of Bomet County. A large part of Bomet County is characterized by undulating topography that gives way to flatter terrain in the south. The north eastern part of the county rises eastwards towards the 3,000 m high of Mau Ridge. The land slopes gently from the Kericho plateau to about 1,800 m in the low lying Bomet area where the land is generally flat with a few scattered hills in Chepalungu and Sigor plains. The higher altitudes in the north eastern parts of the county are particularly suitable for tea growing and dairy production.

The middle part of the county which lies between 2,300m above sea level is suitable for tea, Irish potatoes, maize, pyrethrum and a bit of coffee. Dairy/milk production especially in Sotik sub - county is a major economic activity. Areas between 1,800m and 2,300m above sea level are mostly suitable for Irish potatoes, maize, pyrethrum, vegetables and beef production. The population of Bomet County was estimated to be 782,531 in 2012 and was projected to reach 846,012 in 2015. The Irish potato annual production for the year 2013 was 25,517 Tonnes with a value of Kshs 965,918,182 (Bomet County Development Profile, 2013).

3.2 Research design

The study employed cluster sampling procedure to select the respondents. The first stage involved purposive selection of four sub counties in the catchment area (cluster) from the five sub counties (clusters) in the Bomet County. Then second stage employed simple random sampling method to select four wards in each of the five sub counties to come up with 20 wards. In the selected wards, 10 farmers producing Irish potatoes were selected for interview using systematic random sampling procedure and a total sample of 200 farmers were interviewed.

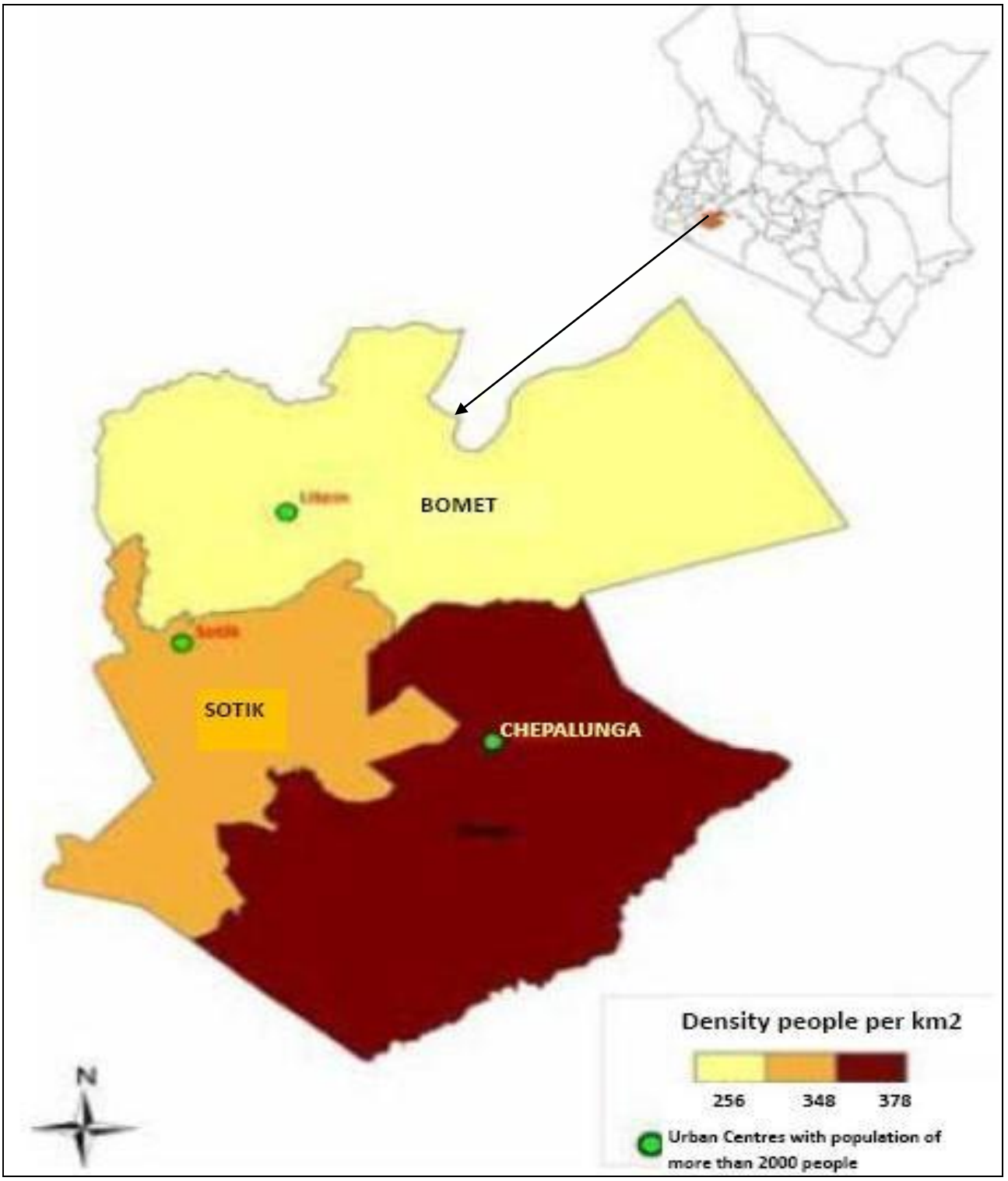

Figure 2: Map of Kenya showing Bomet County, the study area.

Source: Modified map from www.bomet.go.ke

3.3 Target population

The population of Bomet is made up of smallholder Irish potato farmers from Bomet County situated in the south of former Rift valley province in Kenya. In the context of this research, smallholder farmers are those that cultivate potatoes on less than two hectares of land. Smallholder potato farmers who make up the population are spatially distributed across five Sub-Counties namely Bomet Central, Bomet East, Konoin, Sotik and Chepalungu. The populations considered for sampling were from the organized groups producing Irish potatoes in Bomet County. Smallholder farmers considered as part of the sample and eligible for selection, were on the list of smallholder potato producers maintained by County Directorate of Agriculture under the Ministry of Agriculture. Both male and female smallholder farmers within the farmer groups will be considered for selection as part of the representative sample.

3.4 Sample size

The following formula was employed to come up with an appropriate sample for the study as per the determination of the sample size as specified by Anderson et al, (2007). The formula is specified as below:

$$n=\frac{z^2pq}{e^2} \quad (3.1)$$

Where n= sample size, p= proportion of the population doing value addition, q = 1-p, z = the standard variate at a given confidence level (a = 0.05), e= the acceptable error (precision). Using p = 0.6 assuming a conservative sample, z=1.96, q=0.4 and an acceptable error of 6.78% (e). q is the weighting variable and is computed as 1-P. The sample size, computed using the above formula was thus 120 respondents.

The sample was determined as:

$$n=\frac{1.96^2 x 0.6 x 0.4}{0.0678^2}=200 \quad (3.2)$$

3.5 Sampling procedure

This was achieved through multistage selection criteria. First, Bomet County was purposively selected because it is one of the major Irish producing Counties with low value addition. Within the County, five Irish potato producing Sub-Counties was selected using cluster sampling. In each Sub-County, simple random sampling method was used to select 4 wards in each of the 5 Sub-Counties to have a total of 20 wards. In each of the selected wards, farmers producing Irish potato were randomly selected using simple random sampling procedure. A total sample size of 200 smallholder

Irish potato farmers were selected from the list of farmers given by the ministry of agriculture to represent the whole County.

3.6 Data and Data collection

3.6.1 Data

Both primary and secondary data was collected. Data collected included institutional and socio-economic factors; quantity of output, asset ownership, credit access, extension services, private sector involvement, policy environment; land size, finances, land tenure system, methods of value addition, extent of value addition, group membership, source of capital and other sources of income household characteristics and objectives; age, level of education, farm income. Secondary data was collected from sub county agricultural offices, Agricultural Sector Development Support Programme (ASDSP), Kenya National Potato Farmers Association (KENAPOFA), Kenya National Farmers Federation (KENAFF), and other government publications. A structured questionnaire was used to collect cross-sectional data.

3.7 Model specification

3.7.1 Determination of value addition practices on Irish potato by farmers in Bomet County

Descriptive analysis was used to achieve this objective. It entailed cluster analysis to determine value addition practices on Irish potato by farmers in the county. Various Irish potato value addition practices currently employed by farmers were considered. Results are presented in tables, graphs and pie-charts.

3.7.2 Factors affecting value addition of Irish potato in Bomet County.

The decision to add or not to add value among Irish potato farmers in Bomet County was assessed using a binary logit model. The choice of this model was based on the fact that the decision to add value is discreet; it is either one value adds or not. Furthermore, the study assumes a normal distribution and hence the choice of the binary logit model. The reasoning behind the two stage approach is that the decision on the extent of Irish potato value addition (the volume of value added Irish potato) is usually preceded by a decision to engage in the process of value addition. The binary logit model used in the first stage is as specified in Equation 3.1

$$\text{Prob}\,(Y_i=1 \mid X = \int_{-\infty}^{\chi'\beta} \varphi(t)\,\delta t = \varphi(X'\beta) \qquad (3.3)$$

Where Y_i is an indicator variable equal to unity for households that add value, φ (.) is the standard normal distribution function, $\boldsymbol{\beta}$**s** are the parameters to be estimated and *X*s are the determinants of

the choice. When the utility that household ***j*** derives from value addition is greater than 0, Y_i takes a value equal to 1 and 0 otherwise. It follows therefore, that:

$$\mathbf{Y^*}=\boldsymbol{\beta}_i X_i+V_i \quad (3.4)$$

Where $\boldsymbol{Y_I^*}$ **(0, 1)** is the latent level of utility the household gets from value addition**.** Given this assumption, it follows that:

$$Y_i = 1 \text{ if } \boldsymbol{Y_I^*} > 0 \text{ } i \text{ } Y \text{ and } Yi = 0 \text{ if } \boldsymbol{Y^*} \leq 0 \quad (3.5)$$

Empirically, the model can be represented as follows:

$$Y = \boldsymbol{\beta}_j \boldsymbol{X}_i + \boldsymbol{\varepsilon}_i \quad (3.6)$$

Where ***Y***is the probability of a household value adding given farm and household characteristics $\boldsymbol{X_i}$ and $\boldsymbol{\varepsilon_i}$ is the error term. In the second step the Inverse Mills Ratio (IMR) is added as a regressor in the extent of value addition equation to correct potential selection bias. It was expected that the extent of value addition was self-selected in the sense that only some households choose to add value, hence the decision of the extent of value addition is preceded by the decision to add value. Consequently this raised an empirical problem of self-selection. To reconcile this problem, the decision to add value was treated endogenously in the study to control potential sample selection problem. Therefore, first the determinants of the decision to add value were estimated, and then, the mills ratio from the selected equation was used as an independent variable in the target equation, that is used to assess the determinants of the extent of value addition.

$$\boldsymbol{E(Z_i|Y=1)=f(x_i\beta)+\gamma\hat{\lambda}+U_i} \quad (3.7)$$

Where ***E*** is the expectation operator, $\boldsymbol{Z_i}$ is the (continuous) extent of value addition measured by the proportion of value added Irish potato output. ***X*** is a vector of independent variables influencing the extent of value addition, $\boldsymbol{\beta}$ is a vector of the corresponding coefficients to be estimated. $\hat{\lambda}$ is the estimated IMR and ***Ui*** ~ N $(0,\sigma_u)$. $\boldsymbol{Z_i}$ can be expressed as follows:

$$\boldsymbol{Z_i^*=\beta_i X_i+\gamma\hat{\lambda}+u_i} \quad (3.8)$$

i is only observed if the farmer is doing value addition (Y=1), hence $\boldsymbol{Z_i=Z_i^*}$. Empirically, this can be represented as:

$$Z_i^* = \beta_i X_i + \gamma \hat{\lambda} + u_i \quad (3.9)$$

Where Z_i is the extent of value addition given the farm and farmer characteristics, $Xi.$ $\hat{\lambda}$ is the Inverse Mills Ration estimated in step 1 of the Heckman model and $u_i$is the error term. Equation (3.6) and (3.9) will then be jointly estimated using the Heckman two stage procedure in STATA as recommended in Heckman, J.J. (1976). The marginal effects have to be considered in the Probit model since the estimated coefficients in the model cannot be interpreted in the same way as in a linear regression model. To assess the impact of the regressors on the dependent variable, it is necessary to analyze their marginal effects. The following econometric model will be used to analyze the data.

Table 1: Description of variables and the expected signs

Variable	Coding	Units of measurement	Expected effect
Dependent Variables			
Decisions to value add Irish potatoes	1=Adding Value,0= Not adding value	None	None
Independent Variables			
Cost per unit of Irish potatoes produced	Continuous variable	KES	(-)
Price per unit of non-value added Irish potatoes	Continuous variable	KES	(-)
Income from value addition	Continuous variable	KES	(+)
Total quantity harvested	Continuous variable	KGS	(+,-)
Land acreage under Irish potatoes	Continuous variable	Acreage	(+)
If the household decision maker	Dummy (1=yes, 0=No)	None	(+)
Access to agricultural extension services	Dummy (1=yes, 0=No)	None	(+)
Total land size owned	Continuous variable	Acres	(+)
Quantity of Irish potatoes Harvested	Continuous variable	KGS	(+)
Age of decision maker	Continuous variable	Years	(+,-)
Off-farm hours spent daily on off farm activity	Continuous variable	Hours	(-)
Market price of value added Potatoes	Continuous variable	Kenya shillings	(+)
Household decision maker	Dummy (1=Household head, 0=Not household head)	None	(+)
Credit access	Dummy (1=yes, 0=No)	None	(+)
Level of education of the decision maker	Dummy (1=yes, 0=No)	Years	(-)
Total value of the household assets	Continuous variable	Kshs	(-)
Availability of value addition equipment	Dummy (1=yes, 0=No)	None	(+)
Gender of the household decision maker	Dummy(1=Male,0=Female)	None	(+,-)
Distance to the nearest Market	Continuous variable	Kms	(+)
Member to a group	Dummy (1=yes, 0=No)	None	(+)
Value addition practices	Categorical	None	(+,-)
Cost of value addition	Continuous variable	KES	(-)

3.7.3 Profitability evaluation of raw and value added Irish potato products to farmer households in Bomet County

To evaluate profitability, Gross Margin Analysis (GMA) was used. GMA included Total Revenues (TR), Total Variable Costs (TVC) and excluded Total Fixed Costs (TFC). Mathematically, GMA formula is given as:

$$GMA_{ij}=TR_{ij} - TVC_{ij} \quad (3.10)$$

Where GMA_{ij} denotes GMA for raw potato sold (i) and GMA for value added potato products (j). TR_{ij} denotes TR raw potato sold (i) and TR for value added potato products (j) for while TVC_{ij} denotes TVC for raw potato sold (i) and TVC for value added potato products (j).

3.8 Data analysis

SPSS computer program was used in the analysis. Results are presented in tables, bar graphs and pie charts.

3.9 Expected outputs

The results at the end of this study is: a master of science thesis in agricultural economics and resource management, a journal paper on the factors affecting value addition of Irish potato and effects on farmers' income generation in Bomet County - value addition effects on incomes of smallholders, and a policy brief on government interventions to help the farmers in making more efficient value addition choices for stability or increment in their farm income.

CHAPTER FOUR
RESULTS AND DISCUSSIONS

4.1 Overview of the chapter coverage

This chapter presents the findings of the study. The results have been presented starting with general descriptive statistics and according to the number of objectives.

4.2 Descriptive statistics

Table 2a shows that majority respondents' occupation was farming standing at 70.5 %. Majority of potato farmers were in the age middle age bracket of 36-60 years which stands at 40.5%. This shows that majority of the farmers are relatively old. Male farmers dominated decision making at 75% indicating that Irish potato farming is controlled by male gender. Majority of the farmers have primary education of 67% but majority of them did not have secondary education at 78%. This shows that most farmers in the study area only have primary education. Furthermore, majority of the farmers did not have tertiary education at 60% and very few had university education at 5.5 %. This shows that most educated farmers do not engage in potato farming.

Table 2a: Socio-economic characteristics (occupation, Age, Gender and Education level) of both value adders and non-value adders of Irish potatoes in Bomet County

Variable	Frequency	Percent	Valid Percent	Cumulative Percent
Occupation				
Farmer	141	70.5	70.5	70.5
Employed	48	24	24	94.5
Student	11	5.5	5.5	100
Total	200	100	100	
Age				
15-35	70	35	35	35
36-60	81	40.5	40.5	75.5
Over 60	49	24.5	24.5	100
Total	200	100	100	
Gender of the decision maker				
Female	59	29.5	29.5	29.5
Male	141	70.5	70.5	100
Total	200	100	100	
Education primary				
No	135	67.5	67.5	67.5
Yes	65	32.5	32.5	100
Total	200	100	100	
Education secondary				
No	156	78	78	78
Yes	44	22	22	100
Total	200	100	100	
Education tertiary				
No	120	60	60	60
Yes	80	40	40	100
Total	200	100	100	
Education university				
No	189	94.5	94.5	94.5
Yes	11	5.5	5.5	100
Total	200	100	100	

Source: Own computations, 2018

Table 2b indicates that majority of the households had 6-7 members at 17% and 17.5% and majority of the farmers had 0.1 to 3 acres of total land size at 56.5%. Furthermore, majority of the farmers had potatoes in 0.1 to 3acres at 88.5%. A study by Taiy J., Christopher O., Nkurumwa A, Ngetich, K. and Birech R. (2016) on Irish potato value chain analysis found out that 60% of the farmers were small holder farmers owning 2-5 acres of land and majority of them (90%) used 0.1 and 1 acre of their land to grow Irish potatoes which is consistent with the findings of this study. This shows that

potato is one of the main crops in the area amongst the farmers. Majority of the farmers interviewed did not attend training and seminars at 77.5%. Majority of the farmers did not access agricultural extension services representing 79%.Majority of the farmers (79%) did not access credit.

Table 2b: Socio-economic characteristics of both value adders and non-value adders of Irish potato farmers in Bomet County

Variable	Frequency	Percent	Valid Percent	Cumulative Percent
Household size				
1	26	13	13	13
2	14	7	7	20
3	24	12	12	32
4	20	10	10	42
5	21	10.5	10.5	52.5
6	34	17	17	69.5
7	35	17.5	17.5	87
8	16	8	8	95
9	10	5	5	100
Total	200	100	100	
Total land size				
0.1-3	113	56.5	56.5	56.5
3.1-10	73	36.5	36.5	93
Over 10	14	7	7	100
Total	200	100	100	
Land potatoes				
0.1-3	177	88.5	88.5	88.5
3.1-10	19	9.5	9.5	98
Over 10	3	1.5	1.5	99.5
5	1	0.5	0.5	100
Total	200	100	100	
Member attended training seminar on potato value addition				
No	155	77.5	77.5	77.5
Yes	45	22.5	22.5	100
Total	200	100	100	
Agricultural Extension services				
No	158	79	79	79
Yes	42	21	21	100
Total	200	100	100	
Credit access				
No	158	79	79	79
Yes	42	21	21	100
Total	200	100	100	

Source: Own computations, 2018

The comparative analysis between Irish potato value adders and non-value adders based on socio economic characteristics as shown in Table 2c. T-test was carried out to determine whether potato value adders and non-value adders were statistically different based on total income from value

added Irish potatoes, household size, total land size, land under potatoes, Quantity harvested, cost per unit of Irish potato produced, price per unit of Irish potato, expenditure on food, expenditure on non-food, distance to selling point and total household annual income.

The results show that there is significant difference (P=0.05) between the income of value adders and non-value adders with a mean difference of 151,208. This indicates that value adders earned more income than non-value adders per unit area i.e value adders earned 151,208 above what non-value adders earned. There is statistical difference between the household size of value adders and non-value adders (P= 0.034) with a mean difference of 1.1. On average non-value adders had approximately 1 member more than the members of value adders. The table further indicates that there is statistical significance at 1% between the total land size of value adders and non-value adders (P=0.00) i.e majority of non-value adders had more land under potatoes than value adders at an average of 0.1 to 3 acres.

Table 2c: Socio-economic characteristics of the respondents of Irish potato farmers in Bomet County

Variable	Value addition decisions	N	Mean	Std. Deviation	Std. Error mean	Mean difference	P-Value
Annual income	Not value adder	75	218,722.67	161290.89	18624.27	151,208.37**	0.005
	Value adder	125	369,931.04	929147.32	83105.46		
Household size	Not value adder	75	5.59	2.14	0.25	1.11**	0.034
	Value adder	125	4.47	2.43	0.22		
Total land size	Not value adder	75	1.77	0.65	0.07	0.43	0.208
	Value adder	125	1.34	0.56	0.05		
Land under potatoes	Not value adder	75	1.25	0.64	0.07	0.17***	0.000
	Value adder	125	1.08	0.30	0.03		
Quantity produced	Not value adder	75	7.72	31.79	3.67	-63.27**	0.002
	Value adder	125	70.99	211.56	18.92		
Cost per unit of Irish potato	Not value adder	75	12.67	45.09	5.21	-101.05***	0.000
	Value adder	125	113.71	89.48	8.00		
Price per unit of Irish potato	Not value adder	75	487.33	1159.22	133.86	-2321.07	0.279
	Value adder	125	2808.40	1061.13	94.91		
Expenditure on food	Not value adder	75	194830.53	132653.59	15317.52	51,938.26	0.229
	Value adder	125	142892.27	126479.20	11312.64		
Expenditure non-food	Not value adder	75	72406.40	38828.22	4483.50	6,968.28	0.523
	Value adder	125	65438.12	69590.11	6224.33		
Distance to selling point	Not value adder	75	9.32	6.22	.72	1.06*	0.063
	Value adder	125	8.26	36.19	3.24		
Total income from value addition	Not value adder	75	12,118.67	39636.84	4576.87	-50,530.13***	0.001
	Value adder	125	62,648.80	100976.44	9031.61		

Source: Own computations, 2018. T-test was performed to determine if significant difference exists between value adders and non-value adders based on the selected variables. *, **, *** means significant at 10%, 5% and 1% respectively.

4.3 Value addition practices and characterization in Irish potato production in Bomet County

4.3.1 The rate of Irish potato value addition in Bomet County

Majority of the Irish Potato farmers (62.5%) undertook value addition as shown in Table 3 below. The reason is that, the buyers insist on sorted raw Irish potatoes and the processors also require sorted and graded Irish potato according to size and variety and generally the price increases after value addition. The Irish potato farmers also need to sort small potatoes that will subsequently be used as potato seed and the damaged potatoes during harvesting is consumed at the household level.

Table 3: Composition of value addition adopters and non-adopters among Irish potato farmers in Bomet County

Decision to value add	Frequency	Percent	Valid Percent	Cumulative Percent
Not value adder	75	37.5	37.5	37.5
Value adder	125	62.5	62.5	100
Total	200	100	100	

Source: Own computations, 2018.

4.3.2Value addition practices in Irish potato production in Bomet County

Most of the farmers carried out value addition in form of sorting, grading, chipping and frying. However as indicated in Table 4, the most common form of value addition practiced by the farmers is sorting (66.5%) while grading, chipping and frying was practiced by 0.5 % of farmers in each case. The rest of the farmers did not engage in any form of the value addition. The cost of producing potatoes is high and thus constraints profits and so to increase income, farmers opt to do value addition. Chipping and frying is costly and labour intensive and that is why many farmers did not engage in them.

Table 4: Forms of value addition practiced by the Irish potato farmers in Bomet County

Type of value addition	Frequency	Percent	Valid Percent	Cumulative Percent
None	64	32	32	32
Grading	1	0.5	0.5	32.5
Sorting	133	66.5	66.5	99
Chipping	1	0.5	0.5	99.5
Frying	1	0.5	0.5	100
Total	200	100	100	

Source: Own computations, 2018.

4.3.3 Characterization of forms of value addition by socio-economic characteristics category

Table 5 below shows that majority of the farmers who were not employed elsewhere but in their farms carried out value addition at 70.5 % followed by the employed and students respectively. This means that farmers with only farming as their main occupation had more time at their disposal to carry out value addition. Majority of the farmers with no education carried out value addition at 67.5% as compared to those who had primary education at 32.5%. This is because farmers with no education entirely depend on agriculture to take care of their families and thus to increase income, they must add value to the crops they produce.

Farmers with no tertiary education were significantly added value to their potatoes at 60% unlike those with tertiary education. This shows that farmers with tertiary education derive other incomes from other sources and are therefore not motivated enough to value add. It was also noted that majority of the farmers not in groups carried out value addition at 55% as compared to farmers in groups. The reason for this phenomenon is that farmers who produce in groups focus more on production and other group activities like table banking and off farm activities at the expense of value addition whereas individual farmers are motivated to make more income through value addition.

Table 5: Value addition practices by socio-economic characteristics (Age, Occupation, Education level, Group membership and access to training on value addition) of Irish potato farmers in Bomet County

Variable	Indicators	Statistic	Sorting	Grading	Chipping	Frying	Total
Gender of the decision maker	Female	N	46	13	0	0	59
		%	34.60%	20.00%	0.00%	0.00%	29.50%
	Male	N	87	52	1	1	141
		%	65.40%	80.00%	100.00%	100.00%	70.50%
Age	15-35	N	50	20	0	0	70
		%	37.60%	30.80%	0.00%	0.00%	35.00%
	36-60	N	48	31	1	1	81
		%	36.10%	47.70%	100.00%	100.00%	40.50%
	Over 60	N	35	14	0	0	49
		%	26.30%	21.50%	0.00%	0.00%	24.50%
Occupation	Farmer	N	85	54	1	1	141
		%	63.90%**	83.10%**	100.00%**	100.00%**	70.50%**
	Employed	N	44	4	0	0	48
		%	33.10%	6.20%	0.00%	0.00%	24.00%
	Student	N	4	7	0	0	11
		%	3.00%	10.80%	0.00%	0.00%	5.50%
Education primary	No	N	103	31	1	0	135
		%	77.40%***	47.70%***	100.00%***	0.00%***	67.50%***
	Yes	N	30	34	0	1	65
		%	22.60%	52.30%	0.00%	100.00%	32.50%
Education secondary	No	N	105	49	1	1	156
		%	78.90%	75.40%	100.00%	100.00%	78.00%
	Yes	N	28	16	0	0	44
		%	21.10%	24.60%	0.00%	0.00%	22.00%
Education tertiary	No	N	70	49	0	1	120
		%	52.60%**	75.40%**	0.00%**	100.00%**	60.00%**
	Yes	N	63	16	1	0	80
		%	47.40%	24.60%	100.00%	0.00%	40.00%
Education university	No	N	122	65	1	1	189
		%	91.70%	100.00%	100.00%	100.00%	94.50%
	Yes	N	11	0	0	0	11
		%	8.30%	0.00%	0.00%	0.00%	5.50%
Group membership	No	N	82	27	1	1	111
		%	61.70%**	41.50%**	100.00%**	100.00%**	55.50%**
	Yes	N	51	38	0	0	89
		%	38.30%	58.50%	0.00%	0.00%	44.50%
Attended training on value addition	No	N	101	53	1	0	155
		%	75.90%	81.50%	100.00%	0.00%	77.50%
	Yes	N	32	12	0	1	45
		%	24.10%	18.50%	0.00%	100.00%	22.50%

Source: Own computations, 2018. Chi-square test was performed to determine if significant difference exists between value adders and non-value adders based on the selected variables. *, **, *** means significant at 10%, 5% and 1% respectively.

4.4 Determinants of value addition among Irish potato farmers in Bomet County

Determinants of value addition in potatoes were estimated using binary logistic model adopted from the methodology by Nyota (2011). Hosmer and Lemeshow Test is statistically insignificant (p = 0.907) indicating that the model fits the data well as shown in Table 6. Overall prediction success was 92.3 percent. The model is statistically significant indicating that the explanatory variables estimated reliably distinguished between the value adders and non-value adders (p = 0.006). Nagelkerke R-square value is 0.421 indicating that 42.1 percent of the variation observed in value addition among potato farmers was explained by the combined effects of all the independent variables (See Table 6) in the model specified.

Results in Table 6 indicates that group membership (P = 0.013), cost per unit of potatoes (P = 0.041), and total land size (P = 0.058) were key variables that significantly influenced value addition. That is, being a member of a group that deals with Irish potato production decreases the farmer's probability to engage in Irish potatoes value addition by 0.127 times. The reason is that majority of farmer groups in Bomet County deals with only production matters that includes input sourcing but not marketing. The groups are also characterized by lack of funds, corruption and ineffectiveness in service delivery due. Contrary findings are reported in Ndegwa *et al.* (2000) and Orinda *et al.* (2017) who found that group membership positively influence value addition decisions among sweet potato farmers in Kenya. Orinda *et al.* (2017) noted that farmers in groups exchange ideas/information, achieve economies of scale, incur less costs and ensures collective production, marketing and training thus increasing probability of practicing value addition. Similar results are also reported in Oluoch A. et al (2016). The study found that farmer marketing groups had a stronger bargaining power in the market compared to farmers selling individually.

The results further indicate that cost per unit of potatoes produced increases with the level of value addition. That is, if the farmer is willing and able to increase cost of production by 1 unit increase the chances of value adding by 1.012 times. Increased cost of Irish potato production reduces farmers' income and profits. Since increased cost of production reduces profits, farmers are forced to carryout value addition activities in order to access premium prices so as to increase profit levels. A study by Orinda *et al.* (2017) noted that farmers who practice value addition in groups incur less costs and hence ability to increase farm incomes.

That is, increasing land size under of Irish potatoes by 1 acre will increase the chances of value addition in Irish potatoes by 27.362 times. In Kenya, majority farmers own small land sizes of up to

2.5ha (Adeleke S., Abdul B., Zuzana, B., 2010). This means increasing land under Irish potatoes will increase yields which will lower production costs. Increased yields and low production costs will enable farmers have enough money to carry out value addition activates. Results concur with those of Omitti *et al.* (2007) and Okello *et al*. (2009) who found that value addition practices is crucial for small-scale farmers when they want to penetrate market and increase household income. That is, farmers who own small land sizes should engage in value addition activities. Contrary results are however reported in Orinda *et al.* (2017) who found that as land size increases, farmer's probability to adopt value addition activities in sweet potato production decreases and vice versa.

Table 6: Binary logistic regression of the factors affecting value addition among Irish potato farmers in Bomet County

Variables	**B**	**S.E.**	**Wald**	**Df**	**Sig.**	**Exp(B)**
Group membership potato related	-2.061	0.826	6.224	1	0.013	0.127**
Cost per unit of potatoes	0.011	0.006	4.195	1	0.041	1.012**
Price per unit	0.419	0.741	0.320	1	0.572	1.520
Gender of decision maker	-0.147	0.837	0.031	1	0.860	0.863
Total land size			6.211	2	0.045	
Total land size(1)	3.309	1.747	3.589	1	0.058	27.362*
Total land size(2)	1.387	1.709	0.658	1	0.417	4.002
Education secondary	0.531	1.119	0.225	1	0.635	1.701
Education tertiary	0.955	0.867	1.214	1	0.271	2.598
Education university	16.357	8044.054	0.000	1	0.998	127048.870
Quantity harvested	-0.007	0.010	0.523	1	0.470	0.993
Distance to selling point	1.314	0.809	2.640	1	0.104	3.721
Total value addition income	0.636	0.482	1.738	1	0.187	1.888
Constant	-11.872	6.639	3.198	1	0.074	0.000*
Omnibus tests: P<0.05 (0.006)						
Nagelkerke R^2 = 0.421						
Hosmer and Lemeshow: P>0.05 (0.907)						
Correct overall percentage prediction: 92.3						

Source: Own computations, 2018. B is the coefficients of the estimated variables. EXP(B) is the odd ratios of the estimated variables. *, **, *** means significant at 10%, 5% and 1% respectively. S.E – Standard Errors.

4.5 Effects of value addition practices on profitability of Irish potato among farmers in Bomet County

4.5.1 Mean gross margin per acre

Profitability of Irish potato value addition was determined using gross margin analysis and results are presented in Table 7. The gross margin of value added and non-value added potatoes were compared and the results indicates that there is significant difference (P = 0.028) between the gross margin of value adders and non-value adders. Non value adders made losses of around 29,306 per acre as compared to value adders who earned a profit of 16,676 per acre. The findings corroborate with those of Oluoch *et al.* (2016) who found that, the more value a farmer added to raw tuber, the better the income obtained from the market in Homabay County, Kenya.

Table 7: Effects of value addition on profitability among Irish potato farmers in Bomet County

Type of farmer	N	Mean	Standard Deviation	Standard Error Mean	Mean difference	P-values
Not value adder	75	-29,306.67	44,449.70	5132.61	-45,982.83**	0.028
Value adder	125	16,676.16	159,336.80	14251.52		

Source: Own computations, 2018. T- test was performed to determine if significant difference exists between value adders and non-value adders based on the selected variables. *, **, *** means significant at 10%, 5% and 1% respectively. N is the number of observations.

Table 8 below shows that, sorting was found to be very profitable to farmers earning them a profit of Kshs 27,106.92. Frying, grading and chipping led to losses of Kshs 55,900, Kshs 55,889.20 and Kshs 30,000 respectively. This means that, Irish potato farmers should focus more on sorting of Irish potatoes and find new cost effective technologies to carry out grading, chipping and frying of which they are comparatively disadvantaged to carry out profitably. It is also noted that despite value addition being profitable in Irish potatoes in Bomet County, there was no significant effect on household income. The reason could be due to low production levels/subsistence farming which translates to low incomes.

Contrary results are reported in Golleti *et al* (1999), Pravakar S, Castellanos IV, Rahut, D. B. (2010) and Sebatta, C., Mugisha, J., Katungi, E., Kasharu, A. K. and Kyomugisha, H. (2015) who found that value addition in agricultural marketing increases farmer's incomes. Ramirez (2001) also found that value adding activities increases household incomes by 350%. Studies by Kaguongo

et al. (2008), Muthoni, J.and Nyamongo, D. O. (2009), Maganga *et al.* (2012) and Omari, M. Z. (2015) concur that that value addition through access to adequate on-farm storage facilities eventually increases farmer's earnings or income.

4.5.2 Characterization of profitability of potatoes and household income by value addition practices category

Table 8: Profitability of potatoes by value addition practices category

Value addition practice	Statistic	Annual income	Quantity valued added	Cost per unit produced	Price per unit sold of value added product	Total income of value addition	Total cost of production	Gross margin
Grading	Mean	211743.1	3.8462*	3.0769***	38.4615***	0***	55889.2308	-55889.2***
	N	65	65	65	65	65	65	65
	Standard Deviation	127158.6	31.01	24.80695	310.0868	0	103968.4194	103968.4
	Standard Error of Mean	15772.08	3.85	3.07692	38.46154	0	12895.6953	12895.7
Sorting	Mean	362769	67.39*	111.53***	2848.872***	65,714.29***	38607.3684	27106.92***
	N	133	133	133	133	133	133	133
	Standard Deviation	903836.6	205.04	89.95888	1012.937	99539.65	9457+2.91634	134753.8
	Standard Error of Mean	78372.57	17.78	7.80042	87.83274	8631.182	8200.51186	11684.64
Chipping	Mean	14000	35*	50***	2000***	0***	30000	-30000***
	N	1	1	1	1	1	1	1
	Standard Deviation	.	.	.	.	.	.	.
	Standard Error of Mean	.	.	.	.	.	.	.
Frying	Mean	620000	205*	80***	4200***	0***	55900	-55900***
	N	1	1	1	1	1	1	1
	Standard Deviation	.	.	.	.	.	.	.
	Standard Error of Mean	.	.	.	.	.	.	.

Source: Own computations, 2018. T-test was performed to determine if significant difference exists between value adders and non-value adders based on the selected variables. *, **, *** means significant at 10%, 5% and 1% respectively. N is the number of observations.

CHAPTER FIVE
CONCLUSIONS, RECOMMENDATIONS AND SUGGESTIONS FOR FURTHER RESEARCH

5.1 Conclusions

From above results and discussions, it is imperative to note that majority of the farmers are middle aged with primary education. Mean acreage of Irish potato farmers is 0.1 to 3 acres. Majority of the farmers who carry out value addition have no education. The mean household size is 6-7 members with majority of decision makers being of male gender. Group membership, cost per unit of potatoes and total land size are key variables influencing value addition in Bomet county. It is significant to note that; majority of the farmers did not attend training, were not accessing agricultural extension services and did not access credit. It was also found out that value adders earned more income than non-value adders per unit area. Sorting was found out to be most profitable form of value addition to farmers.

5.2 Policy recommendations

Policy makers should focus on middle aged population and especially men as they dominate Irish potato value chain. Trainings contribute immensely to the decision of whether to add value or not and therefore policy makers should consider prioritizing trainings to farmers on modern cost-cutting and efficient technologies on production and processing of Irish Potatoes .There is need to identify cost cutting technologies for grading, chipping and frying as this forms of value addition are not profitable to the farmers.

5.3 Suggestions for further research

The study focused only on factors affecting value addition of Irish potatoes in Bomet County. There is need to study why farmers in groups tend not to carry out value addition as observed in this study.

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APPENDICES

APPENDIX 1: QUESTIONNAIRE

CONSTRAINTS TO IRISH POTATO VALUE ADDITION AND EFFECTS ON FARMERS WELFARE: A CASE OF BOMET COUNTY, KENYA.

School of Agriculture and Biotechnology
[UNIVERSITY OF KABIANGA, P.O.BOX 2030, KERICHO.]

Introduction

Although value addition has been documented to reduce uncertainties by increasing the value of a product, increase the shelf life and improve agricultural incomes, this has not been taken seriously in Bomet County where smallholder farmers have been engaging only in production of Irish potatoes but do little as pertains value adding initiatives and yet they still earn low incomes and are unable to meet most of their household needs, resulting in low living standards. The reasons leading to this scenario have not been understood and this study intends to fill this knowledge gap. The results of this questionnaire will be used for research purposes only. This information will be treated confidentially and the analysis of the data will ensure the anonymity of the individual cases.

Questionnaire No: _____

Name of the enumerator……

Date of interview…….

Type of respondent: Value adder ☐ Not value adder ☐

SECTION A: RESPONDENTS' SOCIO-ECONOMIC CHARACTERISTICS

1. Respondent's name……

2. Respondent's sex (Tick where appropriate)

a). Male ☐ b). Female ☐

3. Respondent's age (years)

a)15-35yrs ☐ b) 35-60yrs ☐ c) 60 yrs. and above ☐

4. Respondent's relation to the household head (tick where appropriate)

a). Head ☐ (b).Spouse ☐ (c).Child ☐ (d).Others. ☐

5. What is the primary occupation of the household decision maker?

a).Farmer ☐ b).Employ☐ c)Student ☐ Others(specify)……

6. Age of the household head (in years)

a).15-35 yrs ☐

b).36-60 yrs. ☐

c).61 yrs. and above ☐

7. Gender of the decision maker (tick where appropriate)

a). Male ☐ b). Female ☐

8. Level of education of the decision maker (years)

a). Primary ☐

b).Secondary ☐

c). Tertiary college ☐

d).University ☐

9. Household characteristics (people living together for the last 12 months)

Code	**Name**	**Gender** **1=Male** **2=Female**	**Marital status** **1=Single** **2=Monogamously married** **3=Polygamously married** **4=Divorced** **5=Widowed** **6=Separated** **7=Other**	**Education level** **1=None** **2=Primary** **3=Secondary** **4=Tertiary**	**Relation to the head** **1=Head** **2=Spouse** **3=Child** **4=Parent** **5=Worker** **6=Other**
1					
2					
3					
4					
5					
6					
7					

10. Please indicate **annual income** from the following **other sources** in the last one year. Income profile (fill in the table below)

Source of income	**Amount in KES annually**
Farm income	
Income from Irish Potato value addition	
Income from land rented out	
Sale of assets	
Remittances	
others	

SECTION B: FARM CHARACTERISTICS

11. What is the size of your landholding (in acres)?

a). 0.1-3 acres ☐ b). 3.1-10 acres ☐ c). 10.1 –above ☐

12. What is the size of your land under Irish Potatoes (in acres)?

a) 0.1 -3 acres ☐ b) 3.1 -10 acres ☐ c) 10.1 and above ☐

13. Irish potato enterprise profile (provide information to fill the table below)

Code	Type of Irish Potato	Portion of the farm under the variety (in acres)
1		
2		
3		
4		

SECTION C: IRISH POTATO MARKETING AND VALUE ADDITION

14 (1) Irish Potatoes marketed

Product type	**Form in which sold**	**Quantity**	**Quantity units**	**Price per unit**	**Buyer type**	**Reason for choosing the buyer**	**Contract with buyer (Yes/No)**	**Distance from the farm to the selling point**

Units: 1=Kg. 2= Debe 3= 110 kg gunny bag 4= 50 Kg gunny bag 4=other (specify) _____

Buyer type: 1=Middle man 2=Supermarket 3= Retailer 4= Individual consumer 5= Farmer cooperatives

6=Retail shops 7=NGOs 8= Private processors 9= Other (specify)_____

Reasons:1=Good price 2= proximity 3= purchases in bulk 4= consistency 5= Have contract with buyer 6= Only buyer in the area 7= other (specify)_____

(2) Value Added Irish Potatoes

Value addition activity done	**Quantity**	**Quantity unit**	**Cost per unit**	**Price per unit**	**Reasons for value addition**			**Proportion of production value added**	**Additional price per unit after value addition**
					Reason 1	**Reason 2**	**Reason 3**		

Value addition activity: 1=Grading 2= Sorting 3=Chipping4= Cooking 5= Frying 6=other (specify) _____

Reasons: 1=get higher prices 2=demand by buyers 3= improve shelf life 4=increase sales

Qty units: 1=Kg. 2= Debe 3=110 kg bag 4= 50kg bag 5= other (specify) _____

If no in Q15 above, please **indicate the reasons**

why……

……

…….

SECTION D: INCOME FROM IRISH POTATO ENTERPRISE (FOR THE PREVIOUS YEARS (2015, 2016 and 2017)

16. Income from the Irish potato

2017

Quantity produced	Quantity sold in raw state	Quantity sold after value addition	Price per unit (KES)	Total (KES)
1st season (Jan-Apr)				
2nd season (May-Aug)				
3rd season (Sep-Dec)				

2016

Quantity produced	Quantity sold in raw state	Quantity sold after value addition	Price per unit (KES)	Total (KES)
1st season (Jan-Apr)				
2nd season (May-Aug)				
3rd season (Sep-Dec)				

2015

Quantity produced	Quantity sold in raw state	Quantity sold after value addition	Price per unit (KES)	Total (KES)
1st season (Jan-Apr)				
2nd season (May-Aug)				
3rd season (Sep-Dec)				

SECTION E: INSTITUTIONAL SUPPORT

17. (a) Did any member of you household receive extension services last year (2017)?

i. Yes ☐ b). No ☐

18 (b). If yes, fill in the table below.

Extension provider (see codes below)	Number of contact times in 2015	Did you pay for the services? 1=YES 0=NO	Cost per each visit

Extension service provider: 1=Government worker 2=Private extension provider 3= NGOs 4=other farmer 5=other (specify)

19. (a)Did any household member attend farmers' training, seminar or exhibition on Irish potato value addition last two years?

i. Yes ☐ ii.) No ☐

19. (b). If yes, how many times during the year?

i. Once ☐ i. Twice ☐ iii. More than three times ☐

19. (c). What was the training about? ---------

1= Irish potato production management 2=Irish Potato harvesting 3= Record keeping 4=Farm management and accounts 5=Marketing of Irish Potato products 6= Chips making 7=Processing of Irish potato products

8=other (Specify)_____

19.(d). How else do you get information on-value addition and market for output?

i. Radio ☐ ii). Newspapers ☐ i).Neighbors) iv) Other(specify)_____ ☐

20. (A) Are you or any member of your household a member of a potato related organized group?

I.)Yes ii). No

(B)If yes how many members of your household are members of such groups?.....

(C) For each member who is in such a group indicate the following details;

Member number	Activities undertaken by the group?	Any position in the group?	Member of another group(other than the Irish producing/processing group) YES/NO

1=collective production 2= collective marketing 3= training 4=group lending 5=collective Purchase of inputs 6=other (specify)_____

(D).Has your Irish potato production benefited in any way from the involvement in the group?

1=yes 2=No

If yes how?

.....

.....

SECTION F: SOURCES OF CAPITAL

21. What are sources of capital used to run value addition?

a) Savings ☐ b) Loans ☐ c) Salary /wages from off farm employme☐

d). Others (specify) ☐

22. (a). Did the household try to access credit (Cash or kind) last year (2017)?

1. Yes ☐ 2. No ☐

22.(b). If yes, fill in the table below

Source of credit	**Granted 1=Yes 0=No**	**Type of Credit 1=Money 2=in kind**	**Amount requested (KES)**	**Purpose**	**Repayment period**	**Interest rate**	**Give reason if not granted**

Source codes: 1= Commercial bank 2=AFC 3=Input store 4= Local money lender 5=other (specify)

Purpose codes: 1=Capital for off farm business 2=Farm inputs (specify) 3=Household consumption 4= Medication 5= other (specify)

Not granted: 1=Lack of security 2=Outstanding loan 3= other (specify)

Repayment periods code:1=Weekly 2=Monthly 3=Quarterly 4=Semiannually 5=Annually 6= other (specify)

23. In your opinion, what do you think should be done to improve Irish potato value addition?

……

……

……..

SECTION G: ASSET OWNERSHIP AND HOUSEHOLD EXPENDITURE

Please tell us about the assets that you own at the moment

No	Item	Current No	Unit value	Total current value
1	Farm house(s)			
2	Farm store(s)			
3	Thatched hut			
4	Panga			
5	Jembe			
6	Bicycle			
7	Radio			
8	Television			
9	Furniture			
10	Mobile phone(s)			
11	Computer			
12	Motorcycle			
13	Vehicle(s)			
14	Other			

G2. Other household expenditures on non-food items in the past one year (2017) in Ksh.

Category	Amount (Kshs)
Expenditure on fertilizer	
Expenditure on seeds	
Expenditure on crop chemicals	
Expenditure on labour	
Expenditure on School fees	
Expenditure on clothing	
Expenditure on rental	
Expenditure on Health	
Expenditure on Transport & fuel	
Expenditure on entertainment	
Expenditure on communication	
Expenditure on gifts, weddings etc	
Other expenditures	

G3. Household expenditures on food items in the past 1 year (2017) in Ksh.

Category	Amount (Kshs)
Expenditure on Maize flour	
Expenditure on baking flour	
Expenditure on tea leaves	
Expenditure on milk	
Expenditure on vegetables	
Expenditure on cooking fat	
Expenditure on sugar	
Expenditure on tubers	
Expenditure on beans	
Expenditure on eggs	
Expenditure on drinking water	
Expenditure on fruits	
Expenditure on salt	
Other expenditures	

G4. Cost of Irish potato value addition

S. No.	Items	Number of units	Amount (Kshs)