INFLUENCE OF SELECTED SOCIO-ECONOMIC AND INSTITUTIONAL FACTORS ON ADOPTION OF IMPROVED CASSAVA PROCESSING TECHNOLOGIES AMONG SMALL SCALE FARMERS IN MIGORI COUNTY, KENYA

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DECLARATION AND RECOMMENDATION

Declaration

This thesis is my original work and to the best of my knowledge has not been presented for the award of a degree, in this or any other institution.

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Recommendation

This research thesis has been submitted for examination with our approval as the university supervisors.

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DEDICATION

I dedicate this thesis to my dear mum Margaret Mugure and my late dad Nderitu Kinyua for being the best parents and for believing in me. Also, my siblings, nieces and nephews for being my constant motivation to work harder.

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ABSTRACT

Cassava is an important food crop, an economical raw material for animal feed and has various industrial uses but still remains underutilized. The underutilization arises from its limitations such as; short life upon harvesting if not processed, bulkiness which makes transportation difficult and also has high cyanide concentration .Cassava processing has the potential to increase its utilization. In Kenya, improved cassava processing technologies have been developed but their adoption continues to be low, especially among small scale farmers and this could be attributed to several factors including socio-economic and institutional factors. This study was carried out to establish the influence of selected socio-economic and institutional factors on adoption of improved cassava processing technologies. The study employed a cross-sectional survey design with a purposive sampling procedure; Migori County was purposively selected on the basis of high cassava production. Data was collected using a semi-structured questionnaire. A coefficient Cronbach's alpha was used to test reliability and the results gave a coefficient of 0.79. Simple random sampling was used to select a sample of 120 small scale cassava farmers to be interviewed. Statistical Package for Social Science (SPSS) version 20 was used to analyse data. Descriptive statistics was used to present the findings while logistic binary regression model was used to test the hypotheses at the set level of significance, $p \leq 0.05$. The results indicate that the socio-economic and institutional factors have a statistically significant (P=.000) influence on adoption of improved cassava technologies. Limited access to government extension services, credit facilities and education have contributed to low adoption of technologies. The recommendation is to strengthen by employing more extension providers at the Ward level in the devolved system, increase farmer awareness of the existence of improved cassava technologies through trainings in value addition of cassava and advocate for farmer aggregation so as to access credit.

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LIST OF ACRONYMS AND ABBREVIATIONS

ASALS	Arid and Semi- Arid Lands.
CDBK	Cassava Development Board of Kenya
DOI	Diffusion of Innovations
FAO	Food and Agricultural Organization
GAP	Global Agricultural Productivity
HQCF	High Quality Cassava Flour
ICPTs	Improved Cassava Processing Technologies
IFPRI	International Food Policy Research Institute
KNBS	Kenya National Bureau of Statistics
MoALF&I	Ministry of Agriculture, Livestock, Fisheries and Irrigation
NACOSTI	National Commission for Science, Technology and Innovation
NAL	National Agricultural Library
SPSS	Statistical Package for Social Science

CHAPTER ONE
INTRODUCTION

1.1 Background to the Study

Cassava (*Manihot Esculenta Crantz*), is a starchy tropical root crop that develops underground and is originally from Latin America. It is an important food security crop due to its tolerance to low quality soils, resistance to drought, pests and diseases. Cassava also has a flexible harvest cycle as it can remain underground for up to 18 months or more after maturity without getting spoilt (Allem, 2002; Olsen & Schaal, 2001). The classification of cassava is either sweet or bitter. The bitter varieties are those that contain high amounts of cyanide compounds up to 400 mg/kg of fresh root and thus must be processed before consumption to avoid intoxication. The sweet varieties contain less than 50 mg/kg of cyanide compounds and can be consumed fresh (Apea-Bah *et al*., 2011). The composition varies depending on; the variety, age and processing. The roots are primarily rich in carbohydrates 38grams/100 grams, has low fat content (0.3 g/100 grams), protein content between 1-3 % on dry matter. The leaves have a high content of proteins, calcium, vitamin A and K (Montagnac, *et al.*, 2009).

Globally, cassava provides food to an estimated 800 million people and is mostly grown by small scale farmers (Food and Agricultural Organisation (FAO), 2013). It is a staple food for many people in the world and is also used as a raw material for various industries including food, animal feed and starch (Balagopalan, 2002). It is one of the few food crops that can be produced efficiently without need of mechanization and in areas with unpredictable weather patterns. The world's annual cassava production has been increasing yearly due to high demand especially in Asia, Africa, Latin America and Caribbean (Reinhardt , 2017). According to FAO (2012), about 51% of cassava in the world is produced in Africa, 35% in Asia, and 14% in Latin America and the Caribbean.

In Africa, there is an expanding market for cassava food products and there is great potential for increased production to reach the optimal 80 tonnes per hectare as compared to the current world average yield of just 12.8 tonnes (FAO,2013). Cassava grows well in tropical and sub-tropical regions especially in Sub-Saharan Africa.

Cassava production in Kenya remains low compared to some other African countries who not only produce as a staple food but also for commercialization (FAO, 2013). Kenya produces 1,112, 000 tons from an area of 90,394 hectares (FAO, 2017). It is one of the most important root crops in Western, Coastal and Eastern Kenya where it accounts for 63%, 30% and 7% respectively. Counties that produce cassava include: Migori, Busia, Homa Bay, Kisumu, Kilifi and Machakos (Ministry of Agriculture, livestock, Fisheries and Irrigation (MoALF&I), 2007). In Kenya, it is mainly grown for home consumption and the surplus sold in the local market as whole fresh roots, boiled or roasted and dried and milled for porridge or *ugali*. . Being drought tolerant and with low input requirement, it can do well in Arid and Semi-Arid Lands (ASALs) of Kenya where other crops like maize and beans fail and therefore it is an alternative food security crop (Achieng *et al.*, 2017).

The Kenyan National Policy on Cassava Industry that was established in 2007 indicates that cassava processing is being promoted through installation of modern processing plants in order to embrace new cassava processing technologies. By doing this, the government aims at fuelling local production of cassava and improving cassava value addition (MoALF&I, 2007). The Cassava Development Board of Kenya (CDBK) was established in 2007 as a sub-coordinating mechanism for the cassava sub-sector with the aim of moving Kenya towards self-sufficiency in cassava production and utilization. Promotion of cassava processing technologies has also been done through trainings in order to increase utilization of cassava by diversifying the cassava based products (Achieng *et al.*, 2017).

Cassava processing increases the shelf life, reduces bulkiness and reduces cyanide concentration (FAO, 2013). Processing also improves nutritional content through fortification with other foods. It also reduces food losses and stabilizes recurrent fluctuations in the supply of the crop, hence food security. There are various cassava processing technologies used to make different products depending on availability of the resources, customs and preferences (Ehinmowo, 2016). The traditional processing methods utilized in Kenya include pounding, grinding, boiling, brewing, fermentation and open sun drying (Karuri *et al.*, 2001). Boiling, fermentation and sun drying help to reduce the toxin concentration but is only recommended for the sweet varieties. Sun drying and pounding are the most common technologies in Africa (Westby, 2002). The process involves peeling, grating and spreading the roots in an open space for sun-drying which is then grinded to make flour. Fermentation is also an important processing technology that improves cassava palatability, texture and also upgrades the nutritional value and food safety. Fermentation reduces cyanide level from 10-49 mg HCN/kg raw cassava to 5.4-29mg HCN/kg in fermented products and also extends the shelf-life to between 3 to 30 days as compared to fresh roots that takes 2-3 days (Nhassico *et al.*, 2008).

Improved cassava technologies include use of up-to-date equipment that enhance acceptability, reduce on labour and diversify of cassava products. This equipment includes; flour mill, grinder, grater, dryer, fryer, sifter, oven and peeler (Dada, 2012). In the food industry; they are used to make products such as *ugali, chapati*, pastries, biscuits, alcoholic beverage, baby foods, binding and thickening soups as well as stew. In the non-food industry; cassava starch is preferred because of its qualities of being smooth, clear and stickier and also provides glue with neutral pH. It is also used in the pharmaceutical industry to manufacture drugs (Nuwamanya *et al.*, 2010).

The availability, access and adoption of these technologies that are utilised across the value chain from production, harvesting, processing and packaging are critical in any food value chain. If the adoption rate of these technologies is slow due to some diverse factors, then it leads to low food productivity. The current situation indicates that despite the government efforts to support improved technology adoption by cassava farmers, the adoption rates are still low (Mamudu *et al*., 2012). There are several factors that may influence adoption of technologies by farmers. These factors include; the socio-economic, biological, technological, institutional, socio-psychological, cultural, among others. Of these, the most important among the small scale farmers according to Beshir (2014), are the socio-economic and institutional factors.

Socio-economic factors are the features that define an individual, household or a population in terms of characteristics. These features are directly associated with improvement of welfare through enhancement of production, investment and management. These include; age, gender, household size, education, farmers' experience, income level and land size (Tenge *et al.*, 2004). The institutional factors are all characteristics involving organizations and interactions that regulate access to and use of resources and services by farmers and they include access to extension services, access to credit facilities and membership in farmer organizations (Rousan, 2007).

This study focused on the influence of institutional and socio-economic factors on the adoption of improved cassava technologies to enhance productivity of cassava value chain. The study was undertaken in Migori County being among those counties with high cassava production in Kenya. The study examined the socio-economic and institutional factors influencing adoption of improved cassava processing technologies among small scale farmers in Migori County.

1.2 Statement of the Problem

Cassava is utilized as food and as an economical raw material for industries and animal feed. However, its utilization is limited by its short shelf life, bulkiness as well as the high cyanide content. Processing cassava has the potential to increase its utilization. In Kenya, improved cassava processing technologies have been developed but their adoption continues to be low especially among small scale farmers, hence affecting the returns on productivity by lowering the value of cassava products. Migori County is one of those counties producing high quantities of cassava but value addition is lacking despite the existence of improved cassava processing technologies. This study examined the socio-economic and institutional factors influencing adoption of improved cassava processing technologies among small scale farmers in Migori County.

1.3 Purpose of the Study

The purpose of this study was to establish the influence of selected socio-economic and institutional factors on adoption of improved cassava processing technologies. This will facilitate formulation of effective strategies that can be employed to address the constraints hindering adoption of these technologies among small scale farmers in Migori County, Kenya.

1.4 Specific Objectives

The study was set to achieve the following specific objectives:

i) To describe the types of improved cassava processing technologies that small scale farmers utilize in Migori County.

ii) To determine the influence of selected socio-economic factors on adoption of improved cassava processing technologies among small scale farmers in Migori County

iii) To determine the influence of selected institutional factors on adoption of improved cassava processing technologies among small scale farmers in Migori County

1.5 Research Questions and Hypotheses of the Study

The following are the research question and hypotheses of the study;

1.6 Research Question of the Study

Which types of improved cassava processing technologies are the small scale farmers in Migori County aware of?

1.7 Hypotheses of the Study

The study was guided by the following research hypotheses:

Ho_1. The selected socio-economic factors [age, household size, gender, education level, farmer experience in cassava production and land size] have no statistically significant influence on the adoption of cassava processing technologies by small scale farmers of Migori County.

Ho_2. The selected institutional factors [access to extension services, access to credit facilities and membership in farmer organizations] have no statistically significant influence on the adoption of cassava processing technologies by small scale farmers of Migori County

1.8 Significance of the Study

This study provides information on cassava processing technologies available and accessible in Migori County, as well the socio-economic and institutional factors that influence the small scale farmers in adoption of technologies. The findings of this study also form a basis for interventions that can be put in place to support farmers adopt improved cassava technologies. The findings can also guide the government, academic institutions, policy makers, farmers and other stakeholders in formulating effective policies and strategies that will help address challenges faced by small scale farmers in the process of adopting cassava processing technologies. Finally, it also adds to the existing body of knowledge on adoption of technologies.

1.9 Scope of the Study

This study investigated cassava small scale farmers of Migori County, being a major cassava producing area in Kenya. The cassava processing technologies for this study were those applicable to small scale farmers which include the use of machines like flour mill, grinder, grater, dryer, fryer, oven, sifter and peeler. Whereas there may be many factors influencing adoption of cassava processing technologies, the study limited itself to the socio-economic [age, gender, household-size, education, farmers' experience, income and land size] and institutional factors [access to extension services, access to credit facilities and membership in farmer organizations]. These are the most important factors on small scale farmers.

1.10 Assumptions of the Study

The study was guided by the following assumptions:

(i) The respondents would be truthful and honest in providing the information required of them.

(ii) There would be no social or economic commitments that will make the potential respondents unavailable for data collection exercise.

1.11 Limitations of the Study

The main limitation of the study was language barrier, the researcher is more conversant with English and Swahili languages yet some farmers only spoke Kuria and Luo languages. A translator was required to translate the questions into local languages for respondents to understand and minimize misunderstanding of the items.

1.10 Definition of Terms

Adoption: It is the continued use of innovation after individuals of a social system have been introduced to it as part of course action for addressing a particular need (Suleman, 2012). This study applied the term as the acceptance and frequent utilization of cassava processing technologies by small scale farmers

Cassava processing: Performing a series of mechanical or chemical operations on cassava tuber or leaves in order to change its form or preserve it (Quaye *et al.,* 2009). In this study, it applies to use of one or different improved technologies by small scale farmers' in order to increase its shelf-life and increase the profit margins.

Climate change: It refers to any change in climatic patterns over time, whether due to natural variability or as a result of human activity, in particular a change apparent from the mid to late 20th century onwards and attributed largely to the increased levels of atmospheric carbon dioxide produced by the use of fossil fuels (United Nations, 2011). In this study it applies to how the change in climate patterns has affected food security in the world.

Extension services: refers to an educational process directed towards the rural population that offers advice and information to help solve problems, create awareness, increase the efficiency of the family farm, increase production and generally increase the standard of living of the farm family (FAO, 2012). In this study it is used to mean a system that assists farmers through educational procedures, in improving farming methods and techniques through adoption of agricultural technologies.

Hydrogen cyanide: a highly poisonous gas or volatile liquid with an odour of bitter almonds, made by the action of acids on cyanides (National Research Policy, 2002). In the context of this study it is refers to the cassava toxic characteristics that can cause death of people and animals due to severe intoxication on consumption.

Improved technologies: According to Rogers (2003), there are innovations resulting from advances in technical processes that increases the productivity of machines and eliminates manual operations done by older machines. In this context it refers to machinery and equipment developed from the application of scientific knowledge in order to make cassava processing more efficient.

Influence: The ability to have an effect on the character, development or behaviour of someone or something, or the effect itself (Dimitra *et al.,* 2016). In the context of this study, influence referred to the strength and relationship between the independent and dependent variables

Institutional factors: They relate to the structures in society which include rules, norms, and routines that guide behaviour. These processes can exist within an organization or the structure may be part of the culture in a particular area (D'souza *et al.,*1993). This study focuses on access to extension services, access to credit facilities and membership in farmer organizations.

Small scale farmers: Producers of crops on relatively small and without use of advanced and expensive technologies (FAO, 2012). In this study it refers to cassava farmers who farm on an area on land of 2.5 acres or less.

Socio-economic factors: Variables which are directly associated with improvement of welfare of the people through enhancement of production, investment, management and marketing capacity of people and their organizations (Tey, 2013). This study focuses on the aspects of market, land, farmers' income, farm inputs, labour, farming experience & education, age and household size.

Traditional technologies: These are techniques that utilize indigenous methods that are often cultural in origin (Quaye *et al.,* 2009). In this study it refers to the local techniques used to process cassava such as pounding, open sun-drying, boiling, brewing traditional beer, among others.

CHAPTER TW0
LITERATURE REVIEW

2.1 Introduction

This chapter discusses existing information relating to the objectives and the hypotheses of the study. Principally, it gives detailed information about the importance of cassava as a food crop, the cassava processing technologies and the factors that influence adoption of technologies among small scale farmers. This section also highlights the current status of adoption of cassava processing technologies and discusses the socio-economic and institutional factors that influence adoption of the technologies among farmers. This section also provides the theories that inform the study. In addition, it provides a conceptual framework of relationships among variables pertinent to the study.

2.2 Status of Food Security in the World

Recent evidence shows that world's food and nutrition insecurity has increased over the past few years showing a reverse of trends after a prolonged decrease. In 2017, the number of undernourished people is estimated to be 821 million people around the world that translates to one out of every nine people. Malnutrition and food insecurity seem to be increasing in almost all regions of Africa, as well as in South America, whereas it is stable in most regions of Asia. The situation is more pressing in the region of sub-Saharan Africa where an estimation of 23.2 % of the population (about one out of five people) may have suffered from chronic food deprivation (FAO, 2018).

In Kenya, agriculture drives the economic growth, and is an important income source for the majority of the citizens. About 75% of the population derive part or all of their livelihoods from the agricultural sector and this explain 18% of the gross domestic product (GDP). In Kenya, only 20% of the land is arable with no maximum yields in these areas. This leaves a significant potential for productivity increase. Majority of farmers do not have access to modern technologies, inputs, extension services as well as adequate financial services (Kenya Agricultural & Livestock Research Organisation [KALRO], 2012).

2.3 Contribution of Agricultural Technologies to Food Security

Agricultural technologies refer to equipment developed in order to make agricultural activities more efficient. Technologies can be traditional or improved ones. Traditional technologies are the techniques that utilize indigenous, out-dated methods that are often of ethnic or cultural origin. Examples of traditional technologies in agriculture include use of ploughing animals, hoes, machetes, pounding and grinding of grains among others (Quaye, 2009). Improved technologies are the innovations resulting from advances in technical processes that increase the productivity of machines and eliminates manual operations. Examples include use of motorized equipment like flour millers, modified housing for animals, biotechnology, among others. These technologies utilize less labour and are more efficient (Rogers, 2003).

Use of improved technologies contributes to food security and agricultural economic progress of any country. For example hybrid seeds produce higher yields, are resilient to weather changes and are pests and diseases resistant. In order to provide for the ever growing population especially in developing countries, continuous research on the appropriate technologies and the understanding of factors that influence adoption of technologies by farmers is of importance (Odebode, 2008). In developed countries, there is an advanced level of technical know-how and widespread application of technologies contrary to developing countries where technologies are not often available to farmers. Where these technologies are made available, there are few farmers involved and usually there is limited access especially to the women. In Kenya, improved agricultural technologies have contributed significantly to agricultural productivity and there is need to continue disseminating the technologies across the country (MoALF&I, 2007).

2.4 Adoption of Agricultural Technologies

Adoption is the process of receiving information about the existing innovations which guides the intended users in the decision making process and then putting the innovations into practice and then disseminating the same innovations to others. Adoption of technologies is not a single act but a multi-process with many stages (Rodgers, 2003). According to Suleiman (2012), it is the continued use of the recommended technologies by others over a period of time. In this study it is the decision that farmers take to use new technologies within the cassava value chain. The decision whether to adopt technologies or not, always comes after the process of evaluation of the technicality, the economic, social and other factors that come with the same. Some farmers may adopt technologies and then with time decide to continue or discontinue with the same, this depends on whether the technologies are satisfactory or not. Modern technologies are developed from findings from science and other analyses. Most times agricultural related technologies are responsive to the needs of the farmers whereas sometimes they prefer to use their traditional know how (Adofu *et al.*, 2010).

Farmers get technologies through technology transfer; which is the entire process of passing information and skills on technologies from research centres, education institutions and communication channels to the consumers (farmers).The Global Agricultural Productivity report of 2011 informed that some countries like China, Brazil and the United States have really benefited from the spread and taking on of the science-based technologies for example; best science based agricultural management practices like plant breeding through biotechnology among others.

According to Mamudu *et al.,* (2012), the availability and access of the improved agricultural production technologies and actual utilization of these technologies by farmers on their farms or enterprises is very crucial in any agricultural production system. Most technologists and agricultural scientists developing new innovations believe that the new agricultural practices with apparent benefits will obviously be accepted by farmers within a very short time because the benefits of the new ideas will be extensively grasped by the prospective adopters, and that the innovation will therefore spread quickly among all the members of the community (Toborn, 2011). However, according to Rogers (2003), the adoption of most innovations that have been developed and disseminated to farmers has been at a slower rate due to diverse factors and hence leading to low agricultural productivity. Numerous interventions have been enforced by respective governments in many countries including Kenya to promote modern technology uptake by farmers but the rates of adoption are still low despite the efforts (Mamudu *et al.*, 2012).

The observable indicator of new technologies transmission from the agricultural research centres to farmers is the farmers actually adopting and practicing the technologies on their own farms and further diffusing the same to the larger community. In Kenya and other countries in the world there are some good examples of modern agricultural technologies that have been adopted; for instance, tissue culture bananas, artificial insemination, greenhouse farming, hydroponics farming and hybrid seeds (Mwangi, 2013). Few studies have been carried out in Kenya to determine the factors that influence the adoption and diffusion of the available modern agricultural technologies by small scale cassava farmers. There is no much literature on the same studies in Migori County and especially on cassava technologies.

2.5 Cassava as a Potential Food Security Crop

Cassava is an important crop to small scale farmers in marginal areas which are characterized by poor soils and unreliable rainfall. The leaf production reduces during the dry season, lowering the rate of transpiration. The planting materials are also affordable because it is propagated from stem cuttings which are readily available. The crop also has a symbiotic association with soil fungi that helps in absorption of micronutrients and phosphorus. Due to its high content of the toxic hydrogen cyanide, it protects itself from being digested by herbivores. Most cassava varieties can be harvested anytime of the year after maturity therefore making it available for utilization. The ability of cassava to adapt well amidst climate change in the world favours its potential to increased productivity. A recent study shows that cassava is the least sensitive to climate change when compared to other major staple food crops in Africa. These characteristics have made cassava one of the most reliable food security crop in world (FAO, 2013).

Additionally, once harvested, cassava roots are utilized for food by roasting, frying or boiling and can also be dried and milled to make flour (Ragasa *et al.,* 2010). Cassava leaves are also utilized as food, as they contain up to 25% protein. Cooking and sun-drying reduces the hydrogen cyanide to levels that are harmless. In regards to the nutrition content, it has high starch content in the roots making it a high dietary energy source. The yield per hectare of the energy found in cassava is potentially much higher than that of cereals. In most sub-Saharan African countries, cassava is the cheapest source of available calories. Consequently, the cassava roots contain significant amounts of thiamine, riboflavin, niacin6 and vitamin C (Apea-Bah *et al.,* 2011).

Apart from being a major staple food for humans, cassava has also an advantage over other starch crops in that, it can be put into various uses. It is also an excellent potential in industries such as brewing, textile, plywood, paper and pharmaceutical. Cassava leaves are also important in feeding livestock such as cattle, buffaloes, pigs, chickens and silkworms (FAO, 2013).

2.6 Cassava Production in Kenya

Cassava is grown majorly in western, coastal, and eastern of Kenya in that order. Utilization is limited to roasting, boiling of fresh roots, frying and making flour for porridge or ugali which is combined with other cereals like maize and sorghum. The leaves are also utilized as vegetables. Majorly, cassava is for human consumption but the surpluses are also used to make starch for the domestic animals. Market for fresh cassava roots is limited in Kenya; however the crisps and chips are gaining popularity especially in the urban centres (MoALF&I, 2007).

In Kenya the production is 1,112, 000 tonnes from an area of 90,394 hectares (FAO, 2017). Trials have however shown that it has a potential of 50 metric tonnes per hectare of fresh cassava. It is among the top non-cereal crops in Kenya. In the world, cassava is ranked fifth after wheat, rice, maize and potatoes. The potential of cassava surpasses maize and Irish potatoes because of its adaptability to wider ecological zones, high yields, high calories, low labour requirement and its potential in the food and non-food industries (MoALF&I, 2007).

Cassava industry development in Kenya has been focusing on varieties that are high yielding and are resistant to pests and diseases. There is need to put up measures that will help boost commercialisation of cassava and its products in the sub-Saharan Africa. In Kenya there are several institutions that are involved in the cassava industry but they are less linked and coordinated. Linkage of research to the farmers has been inadequate in Kenya therefore dissemination of new technologies has been very low and therefore low adoption. Despite the potential of cassava in the food industry, feed, pharmaceutical and paper industry, production is still low and it is still considered as a marginal crop (Balagopalan, 2002).

In Kenya, malnutrition is still major health problem which is more prevalent among children under 5 years and this call for the need for nutritional surveillance or nutritional intervention programs. The main form of malnutrition that is prevalent in Kenya is protein-energy malnutrition. Since cassava is a good source of energy, many African countries including Kenya have embarked on promoting cassava production and utilization. Its ability to grow in harsh environmental conditions has seen cassava as the best alternative food security crop (GoK, 2015).

The Kenyan cassava policy of 2007 was developed with the aim to improve the cassava production and utilisation. For the longest time Kenya has not had policy that promotes cassava because the colonial policies were aimed at supplying the European markets with raw materials and therefore traditional crops like cassava, millet and cassava were abandoned. Therefore, there was less research in product development of such crops. Even after attainment of independence the agricultural policies were aimed towards self-sufficiency in maize as the staple food. With the liberalization of trade, there has been an increase on imported food and this has affected the cassava industry in that, there has been hesitation to develop food processing industries of traditional crops (MoALF&I, 2007). The quality of cassava in Kenya has to be improved in order to compete with the standards of Common Market for Eastern and Southern Africa (COMESA). The new government policy in Kenya allows substitution of a certain percentage of wheat baking with floor with cassava flour. This will increase production and commercialisation.

In Migori County, farming is the main economic activity in which the communities mainly generate income from. They get income from the sale of crops such as maize, sugarcane, cassava among others. Also livestock keeping is another important income source as well as casual jobs as farm labourers. Cassava is ranked the second most important food crop after maize in the county. This is based on the amount of land resource allocated to different crop enterprises in Migori County (Ouma, 2019). Cassava is mainly grown by small scale farmers in mixed cropping system with many other crops and lately in sole crop stands in Migori. Cassava has a higher farm returns in the County as compared to maize though the average production is still below worlds' average (Ouma, 2019). Commercialization of cassava can increase domestic production and increase the demand. It is important to encourage farmers to grow high yielding varieties and the use of improved agronomic and other post-harvest technologies (Adebayo *et al.*, 2013).

2.7 Importance of Cassava Processing

Cassava has a very short shelf-life once harvested; this restricts the storage potential of the fresh root to a few days. Post-harvest deterioration causes a reduction in the root quality, which ultimately leads to low prices and therefore economic losses. Additionally, cassava contains hydrogen cyanide which is toxic if consumed in high levels. Also, fresh cassava roots are bulky resulting to high transportation cost. Cassava processing resolves these challenges that may hinder utilization of cassava.

Cassava is commonly categorized into two main types depending on the level of hydrogen cyanide, that is bitter and sweet cassava roots. The sweet varieties contain less than 50 mg of hydrogen cyanide per Kilogram of cassava roots on fresh weight basis, whereas that of the bitter variety may contain up to 400 mg per Kilogram (Apea-Bah *et al.*, 2011). The bitter varieties carry potential danger of cyanide poisoning. Upon hydrolysis in the human gut, the cyanogen produces hydrocyanic acid (HCN) which is toxic (Tivana, *et al.,* 2014). This leads to several health complications such as Konzo disease, thyroid goitre and tropical ataxic neuropathy and stunted growth in children (Nhassico *et al.*, 2008). Symptomatic effects of critical poisoning may include nausea, vomiting, stomach-ache, dizziness and headache (Mercola, 2016). Cyanide poisoning is also associated with emotional as well as behavioural abnormalities in children (Kariuki *et al.*, 2017), epilepsy and death (Ngugi *et al.*, 2013). Cyanide poisoning should be treated with emergency for doctors to provide appropriate decontamination. First aid include ingestion of activated charcoal to help absorb the toxin and clear the body for free circulation of oxygen (Centre for Food Safety, 2008).

According to FAO (2013), Sweet cassava roots are generally safe for consumption since they contain low levels of the hydrogen cyanide, they can therefore be consumed through cooking. However, bitter cassava roots require more comprehensive processing. Traditionally, prolonged soaking of the cassava gratings allows leaching and fermentation to take place, and then followed by cooking or boiling to discharge the volatile hydrogen cyanide gas. Effectively processed cassava and cassava based products have very low cyanide contents and are considered safe to use.

2.8 Traditional Cassava Processing Technologies

According to FAO (2013), the most common traditional cassava processing methods used in Africa include peeling, boiling, slicing, grating, soaking, fermenting, pounding, roasting, drying and grinding. These methods are not efficient in that they are time consuming with the final products being of low quality and cannot meet the demand. Knowledge of the traditional processing and utilization methods and of present urban patterns of consumption and changing urban needs will guide future strategies for cassava processing and utilization (Adeoti, 2015).

In Migori County and Kenya in general, cassava is majorly utilised to make porridge and *ugali* (a semi-solid porridge). Fresh cassava roots are first peeled then washed and cut into chips which are then sundried for a period of one to two weeks depending on the intensity of the sun. After the chips are dry, they are then mixed with dried maize, sorghum, or finger millet at a ratio of 2: l and the mixture is either pounded, grinded or milled. The flour is put in boiling water and stirred to make *ugali* which is then served with either fish, meat or vegetables (Githunguri, 1995).

Sun-drying is the simplest form of processing cassava in Migori, more common because it is simple and does not require fuel. The drying period depends on the end products the producer wants to make. Drying is important because it reduces moisture, volume and cyanide content of roots, thereby prolonging product shelf life. Slow sun-drying, produces a great loss of cyanide (Westby, 2002).

Roasting is also another traditional utilisation method utilised in Kenya; it involves the process of peeling, washing and then splitting the cassava into small pieces and place on a burning charcoal where it is left to cook. Once done, burned parts are scrapped off and it’s served with tea. Another common traditional method is boiling, it decreases cyanide concentration by about 10 percent and hence recommended to the sweet cassava varieties (MoALF&I, 2007). Boiling involves peeling, washing and splitting the cassava roots into small pieces (it can also be boiled as a whole). The water should not be excess to prevent the root from absorbing water. It is then placed in water and left to boil for about 30 minutes while covered. After it is well cooked it is left to cool down and is served for breakfast, lunch or dinner with tea, coffee or milk.

Traditional brewing, though not common in Migori County, it involves peeling, washing and slicing the roots. Then they are placed in sacks and stored in a dark tightly closed container for fermentation to occur. Then it's removed from the sack and sundried for about 14 days. The dried cassava is then mixed with maize and dry pre-germinated finger millet. The mixture is milled to flour which is then used to prepare a thick porridge (ugali). The ugali then broken into pieces and sundried for three weeks and then milled to flour. The flour is placed in big containers or pot and water is added, stirred and boiled to produce porridge which is then cooled and is ready consumption as a traditional beer (Hillocks *et al.*, 2001).

2.9 Improved Cassava Processing Technologies

The primary goal of improved cassava processing technologies is to minimize crop losses, improve labour productivity and improve the quality of the product. Better quality of cassava products raises the income and standards of living. For small scale cassava farmers to be competitive and have a chance of increasing their income, they need to trade in processed products that are of high quality and with high shelf life. Due to the challenge of low shelf life and rapid deterioration of the fresh roots; cassava roots must be converted into more stable products within the shortest time possible after harvest. Harvesting the cassava roots on time and having an efficient post-harvest operational system plays an important role in the lives of the farmers. Suitable equipment to perform these operations reduces the waste from the crops and enables a more complete utilization of the food crops that are grown (Ragasa *et al.*, 2010).

Improved processing and utilization of technologies addresses issues related to farmers and consumers' needs as well as the economic factors and nutritional values. Science, technology and innovation capabilities are major determinants of economic growth and sustainable development (Adeoti, 2015). The economic environment is dynamic and in response to this, new technologies have to be developed to make new products. Promotion of use of technologies is essential for any nation aspiring to develop economically. There is need to have trainings, testing and demonstration of the technologies to familiarize the small scale farmers with the technologies being advocated for (Abdulai & Huffman, 2014).

The improved cassava processing technologies applicable to small scale farmers involve use of flour mill, chippers, graters, fryers, oven for bread making and other confectioneries (Dada, 2012). The most commonly adopted improved technologies in Migori County is the flour mill followed by the chipper.

2.10 Factors Influencing Adoption of Food Processing Technologies

There are various factors that influence adoption of food processing technologies by farmers. They include; the socio-economic, agro-ecological, technological, institutional, cultural, among others. Agro-ecological factors encompass all the farm natural resources with their related operational aspects and interactions. They include land resources and their characteristics such as size, slop, weather patterns and fertility of land. For example, farmers with relatively fertile land have a higher likelihood of harvesting more produce and therefore adopting technologies to process their products due to the high labour requirement (Tenge *et al.*, 2004). Cultural factors influence adoption in that; there are cultural aspects that may act as barriers to change adoption of technologies. With time attitudes toward cultural change can shift; new ideas may be welcomed as promising a better life instead of being regarded as a threat to established ways of doing things. Many rural societies look upon new technologies with suspicion. Respect for elders often results in the attitude that the old ways are best. Farmers also fear criticism for doing something different from other farmers (FAO, 2012).

Technological factors refer to the perceived key characteristics or attributes of an innovation which influence acceptance and utilization of a new practice or idea by people. People are more likely to adopt technologies that possess desirable features in terms of their relative advantage, compatibility, complexity and observability as compared with conventional practices. Positive attitudes and perceptions of the farmers towards an innovation yields interest to seek information about it as well as the intention to try out the practice. This, consequently, increases the likelihood of adopting a technology (Rogers, 2003). Due to these factors, the adoption of food processing technologies has been very unsatisfactory in developing countries and is yet to attain the levels of developed countries (Abdulai & Huffman, 2014).Whereas these factors influence adoption of improved cassava processing technologies, studies carried before in other areas indicate that the most important factors that influence adoption of technologies among small scale farmers are socio-economic and institutional factors.

2.10.1 Socio-economic Factors Influencing Adoption of Cassava Technologies

According to Tey (2013), socio-economic factors are the features that define an individual, household or a population in terms of characteristics. These features are directly associated with improvement of welfare through enhancement of production, investment, management and marketing capacity. The most relevant socio-economic factors related to adoption of cassava technologies include Demographic factors (age, household size, gender, level of education), farmer experience in cassava production & land size and farmers' income.

Age influences decisions to adopt cassava technologies since some of older farmers are more resistant to adopt innovations due to their short-term objectives, energy loss and motivation (Murendo *et al.,* 2016). Aged farmers also tend to value their past knowledge of agricultural practices more than they do with modern alternatives. They also believe that adoption of any innovation is less likely or may take long time to bring about substantial benefits. In divergence to the negative correlation of age and adoption, Kassie *et al.,* (2015) argued that age can either positively or negatively correlate with adoption depending on the circumstances. Regardless of the short-term planning and risk divergent behaviour that hinder technology acceptance with increasing age, some older farmers are more likely to have many years of farming experience. More experienced farmers possess information and knowledge that help them make informed evaluations and decisions related to a particular practice or idea. These farmers are more likely to adopt improved cassava technologies which have a significant number of beneficial attributes.

Gender; studies show that most female farmers tend to have limited access to and control over production resources as compared to male farmers. This gender inequality is attributed to socio-culturally constructed roles, privileges and statuses to which individuals are subjected to especially in developing world. As a result, the women are prevented from meaningfully contributing to adoption of technologies (Chisenga, 2015). The differentiated division of labour confines females to reproductive, community and selected productive roles at the expense of their contribution to development. Moreover, limited mobility of female farmers minimizes their opportunities to access extension services and other production resources (Kassie *et al.,* 2015). There have not been deliberate efforts to consider proportionately both male-headed and female-headed farming households in the technology world (Chisenga, 2015).

With regard to education level, farmers with formal education are more likely to comprehend and easily make informed decisions about an innovation due to their capacity in pursuing and assessing appropriate facts about a technology. Therefore they are more likely to embrace improved processing technologies with ease as compared with those with no formal education (Abdulai & Huffman, 2014).

Investment in improved cassava technologies requires land, which can either be family or hired. Land plays an important role because the bigger the size the more labour will be required (Tey, 2013). Since improved cassava technologies are labour-saving and mostly rely on natural processes, farmers with larger pieces of land are more likely to use technologies. Therefore, the size of land is assumed to be positively related to the adoption of improved cassava technologies. In regards to experience, according to Kassie and Manjur (2009), the more experienced the farmers, the more they possess information and knowledge that help them make informed evaluations and decisions related to a particular practice or idea. Therefore, such farmers are more likely to adopt improved cassava technologies when they have a significant experience in the practice. Farmers' income is another factor that influences farmers' decisions to adopt cassava processing technologies. Small scale farmers with more income holdings have a higher likelihood of adopt cassava processing technologies because of their increased flexibility to allocate income for purchase of technological equipment (Murendo *et al*., 2016).

2.10.2 Institutional Factors Influencing Adoption of Cassava Technologies

Institutional factors are all characteristics involving to organizations and interactions that regulate access to and use of resources and services by farmers. They include access to extension services, access to credit facilities and membership in farmer groups (D'souza *et al.*, 1993).

Extension services educate farmers and inform them on upcoming technologies that could help solve their problems in the whole cassava value chain. The extension providers empower farmers to identify and analyse their agriculture-related problems as well as help them utilize available opportunities to maximize their profits. The extension agents play an important role in the adoption process directly being involved in creation of awareness, training on new skills required for the utilization of technologies and assisting in understanding of improved cassava processing technologies and its relevance to farmers (Matata *et al*., 2010). The services assist farmers to access, acquire and use information, knowledge and farm resources. Extension plays an important role in creating awareness about characteristics of particular technologies and enable farmers make informed adoption decisions. Therefore, farmers with a greater contact with extension agents are more likely to adopt technologies (Beshir, 2014). Nevertheless extension is faced with shortage in number and the working facilities. Sometimes they are faced with lack of transport to reach the farmers in the remote areas and therefore they lack motivation to reach them. This causes the farmers not to be informed about new technologies and therefore leading to low adoption (Anderson & Fedder, 2004).

Access to credit facilities: In the processing industry, the main challenge is usually the cost of the machinery and equipment and small scale farmers can hardly afford them. Where credit facilities are available then the adoption could be higher because it increases the affordability. There is limited availability of commercial credit facilities for the agricultural sector. This is influenced by the fact that the rural banking sector is not well established though it is slowly expanding. This leads to less aggressiveness for loan placements. In addition the banks require collateral with high coverage requirements. Most of the small scale farmers in the rural areas do not even have title deeds for their farms and therefore do not qualify for the loans. Also most banks are reluctant to lend agricultural based loans due to the perceived risks that come with it (Quartey, 2015).

Membership to farmer groups: When farmers come together, they often take collective decisions for the benefit the members. Farmers are inclined to appreciate benefits of certain technologies practiced by some members of their organizations and try out the innovations in their own fields. Collective marketing decisions made within farmers' organizations such as cooperatives, associations and clubs tend to influence its members to make certain adoption decisions about a wide variety of agricultural practices. The organizations also serve as entities within which extension services are efficiently and easily delivered to the members. More importantly, the collective marketing functions undertaken by farmer organizations help them maximize returns on their enterprises and increase their financial capacity to invest in technology (Tey, 2013).

2.11 Identified Gaps in Existing Knowledge on Improved Cassava Processing Technologies

A significant number of studies on factors influencing adoption of technologies have been conducted both in developing and developed countries (Kassie *et al.*, 2015). However, none of these studies have focused on improved cassava technologies in Migori County where cassava remains an important food crop. There is also little literature on the socio-economic and institutional factors that influence adoption of improved cassava technologies especially among small scale farmers in Migori County. The situation therefore calls for efforts to bridge this gap in order to address the issue of low adoption of improved cassava technologies. Due to this necessity, this study is aimed at examining the socio-economic and institutional factors influencing adoption of improved cassava processing technologies among small scale farmers in Migori County, which is relatively high in cassava production, is vulnerable to climate change and has high poverty levels (County Government of Migori, 2015).

2.12 Theoretical Framework

The study is guided by Diffusion of Innovation (DOI) theory (Rogers, 2003). This theory seeks to explain how, why and at what rate new concepts and technologies spread. Diffusion is a process whereby an innovation is communicated over time among members of a social system. There are four main elements that influence the spread of a new ideas, these are; communication channels, time, social system and the innovation itself. Diffusion manifests itself in different ways and is highly subject to the type of adopters and innovation-decision process. The innovation possesses a certain degree of uncertainty which is minimized through acquisition of relevant information for effectively evaluating new practices among potential adopters. This therefore can be influenced by the level of education of a farmer which is one of the socio-economic factors in this study. Farmers with formal education tend to access and evaluate information on technologies more easily as compared to the illiterate ones.

The adoption process can also be influenced by a wide of other socio-economic factors such as age, experience and income level. The time element in the DOI theory helps establish relative lengths of time within which different individuals use information to make decisions of whether to adopt or reject an innovation. This could be influenced by the age of an individual as well as years of experience. Most likely, the more years of experience, the more likely they are to make decisions easily about whether or not to adopt a certain technology. Different categories of potential adopters may require varying number of years to make informed decisions about a technology (Hornor, 1998). Furthermore, the theory emphasizes on the role of a social system in influencing adoption decisions of its units. Each system has a structure which provides certainty, predictability and stability in the way individuals behave and communicate (Rogers, 2003). This study therefore, recognizes the potential influence of a set of institutional factors such as access to extension services, access to credit facilities and membership in farmer organizations.

2.13 Conceptual Framework

The conceptual framework in the figure 1 below depicts how the variables in the study interact.

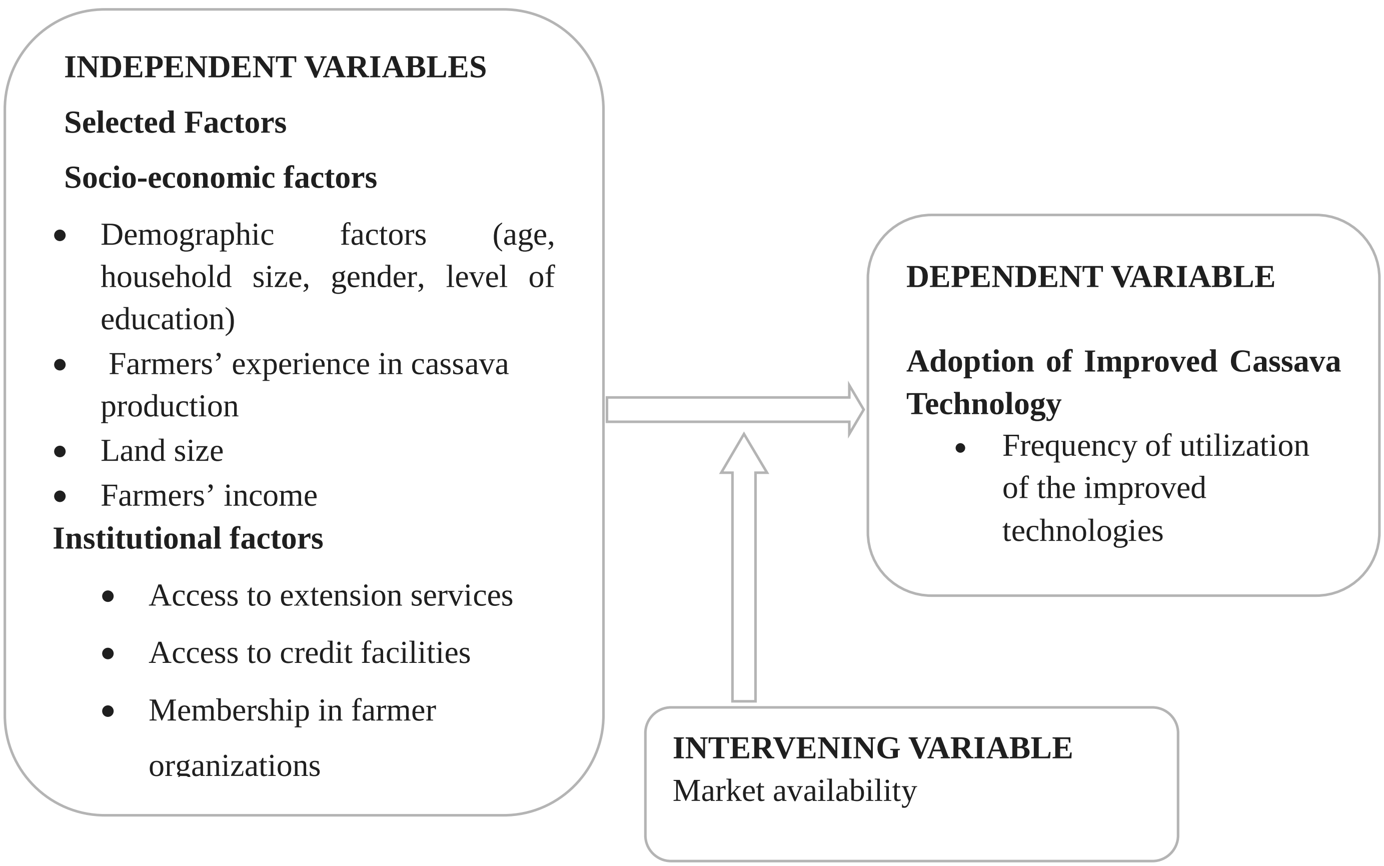

Figure 1: Influence of Socio-economic and Institutional factors on the Adoption of ICPTs in Migori County

The independent variables of this research are the socio-economic and institutional factors that predict adoption of cassava processing technologies among small scale farmers. The selected socio-economic factors include demographic factors (age, household size, gender, level of education), farmer experience in cassava production, land size and farmers' income. The institutional factors include; access to extension services, access to credit facilities and membership in farmer organizations.

The dependent variable is adoption of cassava processing technologies which was measured by the frequency of utilization of improved cassava processing technologies among small scale farmers. The strength of the relationship between independent and dependent variables is regulated by an intervening variable which is the availability of market for cassava products. This variable was controlled by including both categories of farmers who marketed their products and those who did not. Also, randomization helped in controlling the intervening variables.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

This chapter drafts out the methodology that will be used to meet the objectives of the study, respond to the research questions and statistically test the hypotheses. It presents the research design, the study location, population of the study, sampling procedures, instrumentation, validity, reliability, data collection and data analysis.

3.2 Research Design

The study employed a cross-sectional survey research design. It is a survey in the sense that a common measurement tool which was a researcher administered questionnaire was used to collect data. It was cross-sectional in that the data was collected at a single point in time without repetition from the representative population (McMillan & Schumacher, 2001). A combination of descriptive and correlational research methods was used which helped in describing, explaining and determining the relationship between variables (Babbie, 2001).

3.3 Study Location

This study was carried out in Migori County which covers an area of 2,596.5 km^2 and with a population 1.116 million (Kenya National Bureau of Statistics [KNBS], (2019). Migori County was selected as it is one of the highest cassava producing counties in Kenya. Moreover, cassava is a staple food crop in this County occupying about 8800 ha with mean yields of 6 and 12t/ha for local and improved varieties respectively. It acts as an insurance crop due to its tolerance to drought and low external input requirements. Despite the economic benefits that cassava offers, Migori still has high poverty level. Approximately 43% of the population live below the poverty line (KNBS, 2015). Migori County is located between latitude 0^o 24' South and 0^o 40'South and Longitude 34^o East and 34^o 50'East. It has eight Sub-Counties (Suna-East, Suna-West, Nyatike, Uriri, Rongo, Kuria-East, Kuria-West and Awendo) and 40 Wards. It is located in Nyanza and borders Homa Bay to the north, Tanzania to the south and south west, Narok to the east and south east, Kisii to north east and Lake Victoria to the west. The capital is Migori town, which is also its largest town. The county is predominantly inhabited by the Luo community, other tribes found here include the Kuria, Luhyas, Kisiis, among others. The age distribution was 0–14 years

49%, 15–64 years 48% and over 65 years 3% (KBSS, 2007). Data was collected in Kuria west and Suna west sub-counties. The main economic activities include agriculture, mining, fishing and manufacturing (County Government of Migori, 2015). The average annual temperature of 21.2 °C and annual precipitation averages 1369 mm. The warm climatic conditions favour production of cassava (CLIMATE-DATA.ORG, 2018).

3.4 Population of the Study

The study involved small scale cassava farmers in Migori County. The target population was small scale cassava farmers, according to Migori County government (Migori County Fact File, 2018)., there are about 2000 small scale cassava farmers in Migori County, the accessible population was 26% of the target population, that is 520 small scale cassava farmers who were distributed in Kuria west and Suna West sub-counties. These were farmers who actively showed interest in cassava farming by participating in county activities such as trainings, distribution of planting materials, among others. Out of the 520 farmers, 400 were from Kuria West and were spread in five sub-counties (Bukira East, Masaba, Tagare, Ikerege and Isibania). The remaining 120 farmers were distributed in all the wards in Suna-west sub-county (Wiga, Wasweta II, Ragana-Oruba and Wasimbete).

3.5 Sampling Procedure and Sample Size

The study followed a purposive sampling procedure in which Migori County was purposively selected on the basis of magnitude of cassava production. Data was collected in 9 wards which were spread in Kuria west and Suna west sub-counties where the accessible population was distributed. Proportionate random sampling method was used to determine the number of farmers to be interviewed in each Ward from the calculated sample size. The list of small-scale farmers was obtained from the County cassava coordinator and the respondents were drawn through simple random sampling using bucket method. In this method, all names of the members were written on pieces of paper and put in a bucket, then the required number of pieces of paper was pulled out randomly. This gave every member an equal chance of being selected. The sampling procedure is summarized in the figure 2 below:

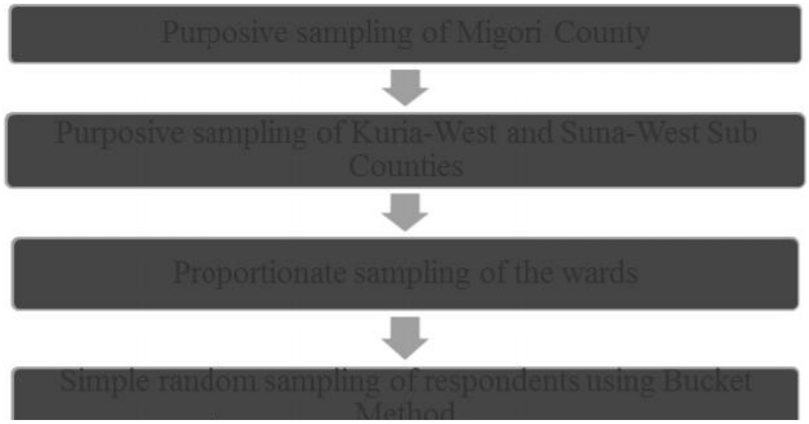

Figure 2: Sampling Framework of the Study

The sample size was determined using the mathematical formula by Nassiuma (2000). This formula is used when the population of study is known; in this case it is the accessible population which is 520 small scale cassava famers. The formula is as follows:

$$\mathbf{n} = \frac{\boldsymbol{NC^2}}{\boldsymbol{C^2} + (\boldsymbol{N} - \mathbf{1})\boldsymbol{e^2}}$$

Where:

n= The required sample size,

N= The population within the study area,

C= Coefficient of Variation,

e= Standard error.

The sample would be obtained using coefficient of variation. Nassiuma (2000), asserts that a coefficient of variation is in the range of 21% ≤ C ≤ 30% in most surveys or experiments, and a standard error in the range of 2% ≤ e ≤ 5% is usually acceptable. Therefore a coefficient of variation of 25% and a standard error of 2% was used for this study. The lower limit of the standard error is selected so as to ensure low inconsistency in the sample and diminish the degree of error. For this study N = 520 households, C =25% and e =2%

$$n = \frac{520\times(0.21)^2}{(0.21)^2+(520-1)(0.02)^2}$$ =120 respondents

Having determined the total sample size on the basis of the accessible population, the number of respondents to be interviewed in each of the two sub-counties was selected proportionately. The proportion of Kuria-West is 77% which translates to 92 respondents and 23 % in Suna-West which is 28 respondents. The distribution of the sample size for the two sub-counties are shown in table 1 below.

Table 1: Distribution of the Sample Size

County	Sub-County	Ward	Proportionate (%)	Sample Size
Migori	Kuria-West (92 Respondents)	Bukira East	15	18
		Masaba	15	18
		Tagare	15	18
		Ikerege	15.8	19
		Isibania	15.8	19
	Suna-West (28 Respondents)	Wasimbete	5.8	7
		Wiga	5.8	7
		Wasweta II	5.8	7
		Ragana_Oruba	5.8	7
	TOTAL		**100**	**120**

3.6 Instrumentation

The study used researcher administered semi-structured questionnaire to gather data in regards to the objectives of the study. In this case the researcher used the questionnaire to read the items to the respondents and the responses were written down. The tool was chosen on the basis that the data was to be collected by engaging the farmers on one on one basis to avoid misinterpretation of the questions. The tool had three sections as follows; Section A collected data on the socio-economic characteristics which include; Age, household size, gender, education level, farmer experience in cassava production, land size and income level. Section B collected data regarding the current status of cassava technologies in the area. Whereas section C collected data regarding the institutional factors which include; access to extension services, access to credit facilities and membership in farmer organization.

3.6.1 Validity

The instruments of the study were reviewed and scrutinized for face and content validity through the researcher seeking opinion of the supervisors from the Department of Applied Community Development Studies and Department of Dairy and Food Sciences. This was achieved by assessing the accuracy of the instruments in providing representative data relating to the variables of the study. According to Zamanzahdeh, Ghahramanian, Rassouli, Abbaszadeh, AlaviMajd & Nikanfar (2015), face validity assessment checks whether the instruments logically measures what it is designed to quantify or qualify. This ensured that the items are clear, concise, complete, comprehensive, well organized and unambiguous before being used in the field. It was done by subjecting the instrument and objectives of the study to scrutiny by specialists and their comments were used to improve the validity of the instrument. The instrument was also subjected to content validity scrutiny to determine whether the data collected will realistically and fully reflect the indicators or content of concepts relevant to the study. Suitability and complexity of the items was checked and reframing was done where necessary (Mugenda & Mugenda, 2003).

3.6.2 Reliability

The questionnaire was pilot-tested on 20 % of the sample size from Rongo Sub-county in Migori County. These areas have similar characteristics to the main area of study. According to Sackett, Borneman and Connelly (2008), at least 20 percent of the main study sample is considered an acceptable size for a pilot study, in this case it was 30 respondents. The questionnaire was subjected to a reliability test. This assessment was done to determine the degree of internal consistency of the instrument in producing results or data after repeated trials. Reliability tests help in identifying and minimizing random errors which arise from a number of factors such as researcher bias, fatigue (of both the researcher and respondent), poor test construction, inaccurate coding, and inadequate clarity of instrument's items (Mugenda & Mugenda, 2003). A coefficient Cronbach's alpha was used to test reliability and the results gave a coefficient of 0.79. The minimum value of (α) coefficient of 0.7 is acceptable and recommended for education and social science research (McMillan & Schumacher, 2001). The reliability test results helps in refining the instrument whereby, if the coefficient is below 0.7, questions that were not relatable to the study objectives are adjusted accordingly, before embarking on data collection exercise (Mugenda & Mugenda, 2003).

3.7 Data Collection Procedures

A letter of clearance was sought from the Egerton University Board of Post Graduate Studies, to enable the researcher obtain a research permit from National Commission for Science, Technology and Innovation (NACOSTI). The researcher notified the Migori County Agricultural office on the intention to collect data. Agricultural officers in the two sub-counties were also informed. Actual data collection involved visiting the farmers in their homes and asking them the questions using the questionnaire. Their consent to participate in the research was sought verbally where respondents were free to participate or not participate in the study. If they were conversant with English or Swahili, the researcher interviewed them alone. However, if they only understood the local dialects which were either Luo or Kuria, the researcher relied on the translator to do the interpretation.

3.8 Data Analysis

The analysis of data of this study relied on both descriptive and inferential statistics using Statistical Package for Social Scientists (SPSS). Descriptive statistics provided the description of the population through tables and graphs while the inferential statistics deduced the properties of the factors by testing the hypotheses and deriving estimates. This study used binary logistic regression because the dependent variable is dichotomous in nature (Adopter and non-adopter) and the independent variables (Institutional and socio-economic factors) are either categorical (nominal, ordinal, dichotomous) or continuous (interval or ratio-level). The model was therefore employed to predict influence of socio-economic and institutional factors on adoption of improved cassava processing technologies. Binary logistic regression has the following assumptions: The observations should be independent of each other, there should be little or no multi-collinearity among the independent variables and the sample size should be large. Ten cases minimum for each independent variable (Chao-Ying *et al.*, 2002).

The following is the Logistic regression equation:

$$[Y/(1 - Y)] = B_0 + B_1X_1 + B_2X_2 + \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots B_nX_n$$

Where: Y/(1 – Y) = Odds ratio (yes/no)

Y= (dependent variable) probability of an even happening, that is; the probability of adoption of improved cassava technologies

Bo: The constant/ intercept term

$\beta_{n:}$ *(1, 2, 3, 4,……,n)* coefficients of the independent variables (the change/slope in Y, given change in X_n)

X_n = $X_1, X_2 \ldots\ldots X_n$ are independent variables (socio-economic factors and institutional factors).

The following table data show details analysis in relation to research objectives.

3.9 Ethical Considerations

The respondents were informed about the purpose and procedures of the research and they gave their consent to participate before collection of data. The respondents were also assured that the research is for academic purposes only and participation was voluntary. They were also assured of confidentiality of the information they give, and asked to feel free to withdraw from participation without fear of penalization. The participant's opinions were respected and treated with utmost confidentiality during the entire research process.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents the findings of the study conducted in Migori County on small scale cassava farmers. The study was carried out to determine the influence of socio-economic and institutional factors on adoption of improved cassava processing technologies among small scale farmers in Migori County, Kenya. The purpose of this study was to establish the influence of selected socio-economic and institutional factors on adoption of improved cassava processing technologies. This will facilitate formulation of effective strategies that can be employed to address the constraints hindering adoption of cassava processing technologies among smallholder farmers in Migori County. The specific objectives whose results are presented in this chapter were:

(i) To describe the types of improved cassava processing technologies that small scale farmers utilize in Migori County.

(ii) To determine the influence of selected socio-economic factors on adoption of improved cassava processing technologies among small scale farmers in Migori County

(iii) To determine the influence of selected institutional factors on adoption of improved cassava processing technologies among small scale farmers in Migori County

The study was carried out in the sub-counties of Kuria West and Suna West sub-counties which were purposively selected based on the prevalence of cassava farming. The target population was small scale farmers which had a population of about 2000 farmers. The accessible population was 520 small scale farmers available in the two sub-counties. A random sampling method was used to select a sample of 120 cassava small scale farmers who were proportionately selected from the two sub-counties. A cross sectional survey research design was used. This design was appropriate for this study because it intended to collect data at one point in time and generalize to the target population. Data was collected through a researcher administered structured questionnaire. A combination of descriptive and correlational research methods was used to analyse the data which helped in describing, explaining and determining the relationship between variables.

4.2 The Current Status of Adoption of Cassava Processing Technologies in Migori County

The first objective of this study was to establish the current status of adoption of cassava processing technologies in the area of study. This section is characterized by the technologies that small scale farmers are aware of, and have adopted, their reasons for use and the challenges that they face in the process of adopting technologies. The awareness of cassava processing technologies was at 100%, in that; all the respondents were conscious of the existence of cassava processing technologies. Whereas, 98.3% had at least used one or more of the technologies in the last one year.

In this study, adoption is defined as the acceptance and frequent utilization of cassava processing technologies. In order to come up with adopters and non-adopters; a four point likert scale (never, sometimes, often and very often) was used to collect this information. During analyses, 'Never and sometimes' responses were considered as non-adopters while 'often and very often' were regarded as adopters.

4.3 Status of Adoption of Traditional Cassava Processing in Migori County

Figure 3 below shows the current status of traditional technologies that the small scale farmers in Migori County

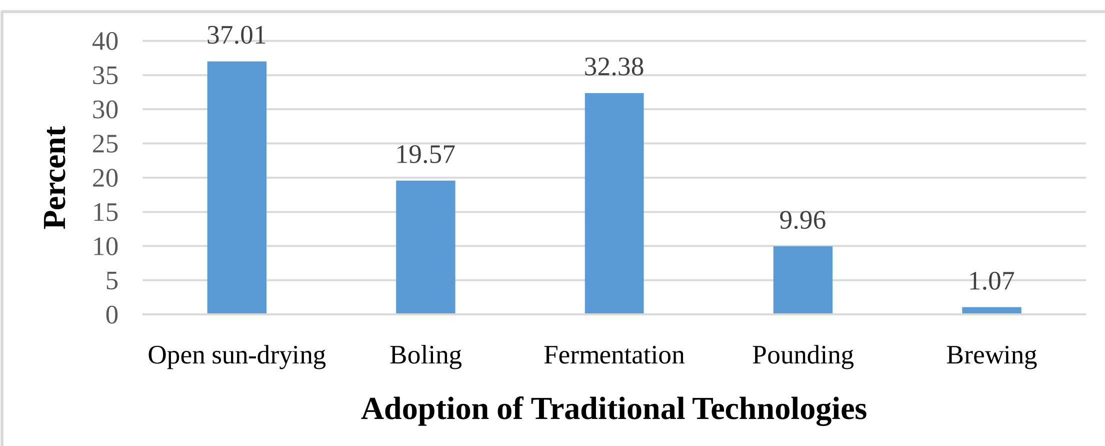

Figure 3: Adoption of Traditional Technologies in Migori County

The results indicate that the most widely adopted traditional technologies were open sun-drying, (37.01%) and fermentation (32.38 %). Boiling and pounding are also relatively higher in use whereas only 1.07% brewed cassava traditional beer. Sun-drying is most common as it is simple and does not require fuel or labour. It is an important process because it reduces moisture, volume and the cyanide content of the roots, thereby prolonging shelf life of the product (Westby, 2002). Fermentation is also common because it does not only increase the shelf-life but also improves the palatability of the food products like porridge (Hillocks *et al*., 2001).

4.4 Improved Cassava Processing Technologies in Migori County

Figure 4 below shows the current status of improved cassava technologies used by small scale farmers in Migori County.

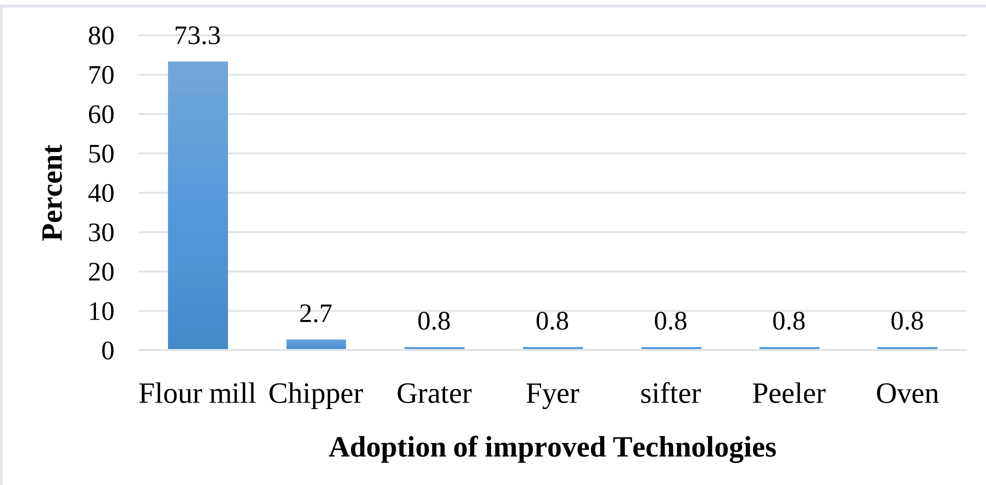

Figure 4: Improved Cassava Processing Technologies in Migori County

The results indicate that flour mill is the widely adopted improved cassava processing technology, which is 73.3% of the respondents. Although most of the farmers were aware of the other improved technologies, only 2.7% of the respondents adopted the chipping machine and 0.8% adopted the grater, fryer, sifter, peeler and the oven as shown below. These finding could be attributed to the cultural appropriateness of these technologies (Suri, 2011) given that the staple food of this area is *ugali*, the flourmill is the most applicable technology. Additionally, the flourmills are readily available for use in the trading centres at a small fee and are multipurpose as they not only mill cassava but also, maize and other grains. Similarly, given that acceptance of new food products depends on possible benefits associated with the products, there seems to be very low market for processed products. Rural communities are inclined to consuming traditional meals and therefore farmers are hesitant to invest in processing technologies and making products that may not have market (Van Boekel *et al.*, 2010).

4.5 Influence of Selected Socio-economic factors Adoption of ICPTs

Objective 2 of this study was to determine the influence of selected socio-economic factors on adoption of improved cassava processing technologies among small scale farmers in Migori County. The socio-economic factors investigated in this study included age, household size, gender, level of education, farmer experience in cassava production, land size and the farmers' income.

4.5.1 Gender of the Respondents

Gender is an essential characteristic in the process of adoption of improved cassava processing technologies. Table 2 below presents the results on gender responses:

Table 2: Response by Gender

	Frequency	**Percent**
Female	49	40.8
Male	71	59.2
Total	**120**	**100**

The results indicate that out the 120 respondents, 59.2% were male whereas 40.8% were female. This implies that both male and female are involved in the cassava value chain. It is also an indication of many female headed households in the two sub-counties and therefore their involvement in the decision making process in the adoption of agricultural technologies. This concurs with a study carried out by Boithi *et al*., (2014) who found a similar pattern of gender composition (53.95 % and 46.1 % of male and female respectively), who participated in the use of agricultural water technology in Lare ward of Nakuru County.

4.5.2 The Age of the Respondents

The researcher further established the distribution of the respondents based on age. The age categories are presented in table 3 below.

Table 3: Response by Age Categories

	Frequency	Percent
Below 35	42	35
36-60	62	52
Over 61	16	13
Total	120	100.0

The results show that only 35% of young people (below 35 years) engage in agricultural activities. The majority (52 %) of small-scale farmers are between the ages of 36 and 60 years. These results concur with those of Kipserem *et al.*, (2011), who concluded that the young people tend to avoid agricultural activities. His findings indicated that the average age of farmers was 39 years in Keiyo valley. According to FAO (2018), the younger population may be open to new ideas and innovations in agriculture but may not recognize adoption of technologies as an important economic activity for them to undertake.

4.5.3 Household size and Farm Size in acres of the Respondents

In order to understand the farmers' family size, the respondents were requested to indicate the number of members dependent on household head. The study also established the total land size that the farmers owned in acres. The findings from analysis are presented in table 4 below.

Table 4: Household and Farm Size in acres of the Respondents

	N	Minimum	Maximum	Mean
Household size	120	1	26	7
Total size in acres	120	.25	5.5	3.6
Land size under Cassava	120	0.13	5	1.4

The average household size of the respondents was 7 people. The findings concur with the traditional African communities that tend to have large families. The larger the household size the more likely it can enhance availability of labour required for the farm operations and therefore has a more likelihood to increase adoption of the processing technologies (Effiong, 2005). However, large families may discourage adoption of new technologies if the technology is perceived to be having a risk of reducing the farm income, given the fact that large families have a higher number of dependents (Tey, 2013).

In regards to the land size, study only considered the small scale farmers (those that practice farming on 5 acres of land or below). The average land size was 3.6 acres while the average size under cassava was 1.4 acres. Majority of the respondents practiced mixed farming where they incorporate different types of crops in their farms as well as livestock. According to Mohammad (2012), small scale farmers face challenges in the process of adoption of technologies, with most of them not willing to take any risk to adopt new agricultural technologies on their farms. Furthermore, the findings show that smaller land sizes have delayed the adoption of some modern agricultural technologies because they cannot access financial services from different institutions due to lack of enough collateral. Also the land being a limiting factor, the production is low. Large scale farmers are better informed and take larger risks and have the ability to experiment with new technologies.

4.5.4 Level of Education of the Respondents

The findings on figure 5 indicate that the highest percentage of the respondents, that is, 66 % had either attained only primary school level or had no formal education.

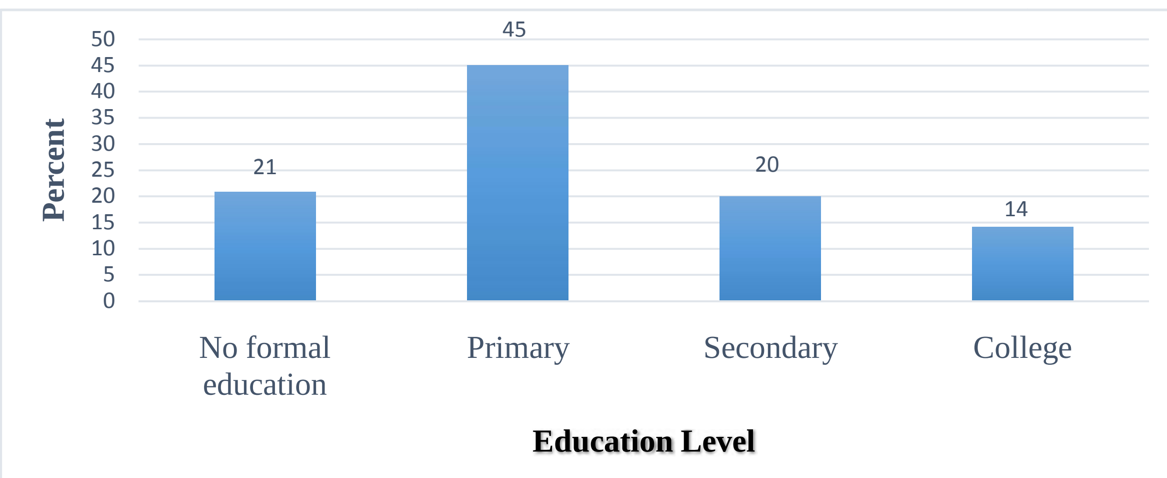

Figure 5: Level of Education of the Respondents

These results concur with Ogola and Kosgey (2010) whose findings indicated that small scale farmers in Nyanza, Coast and Rift valley provinces of Kenya have lower education with 51.9 %

having secondary school level and below, while 28.7% are illiterate. According to Mutuku *et al.*, (2016), education has been found to influence adoption of agricultural related technologies. This is because education tends to create a favourable mental attitude for the uptake of new ideas. Education is also an important tool for effective transmission and application of knowledge. Low education level for farmers translates to difficulty in searching for technical knowhow from different sources of information like the internet, newspapers, among others. Also considering the low level of contact with the extension, it becomes hard for them to access technical information. According to Oluwasola (2010), low level of education also reduced the ability to use new technological innovation and even access credit facilities from financial institutions. The result obtained stresses that education plays significant role in the adoption of improved technologies. When the literacy level is high among farmers, then they are more efficient, knowledgeable and have a higher capability to adopt new innovations.

4.5.5 Years of Experience in Cassava Farming of the Respondents

The research established the duration for which the respondents had been growing cassava. The findings from analysis are presented in figure 6 below.

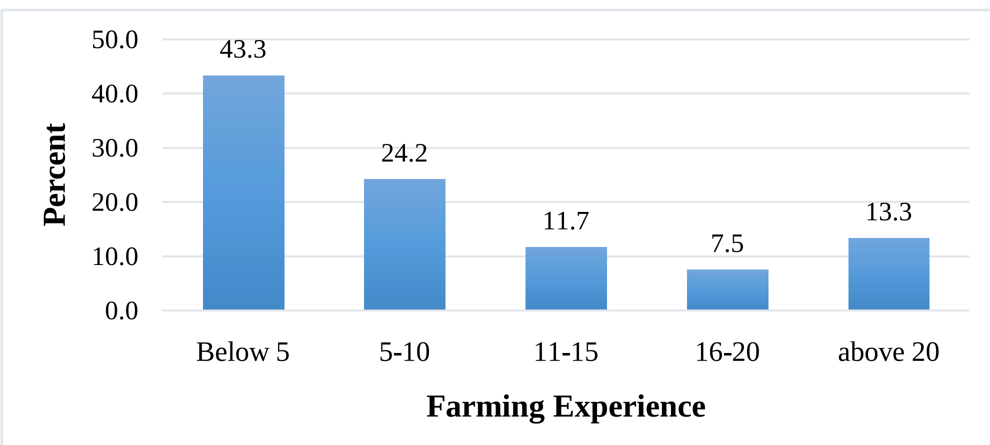

Figure 6: Years of Experience in Cassava Farming

From the results obtained, majority of the farmers, (43.3 %) had below 5 years of experience in cassava farming. This duration may not be long enough to influence adoption of improved technologies. According to Kassie *et al.* (2009), the more experienced the farmers, the more they possess information and knowledge that help them make informed evaluations and decisions related to a particular practice or idea. Therefore, such farmers are more likely to adopt improved cassava technologies when they have a significant experience in the practice.

4.5.6 Average Yearly Income of the Respondents

The study sought to find out the average farmer's income in the two sub-counties. The results are presented in figure 7 below.

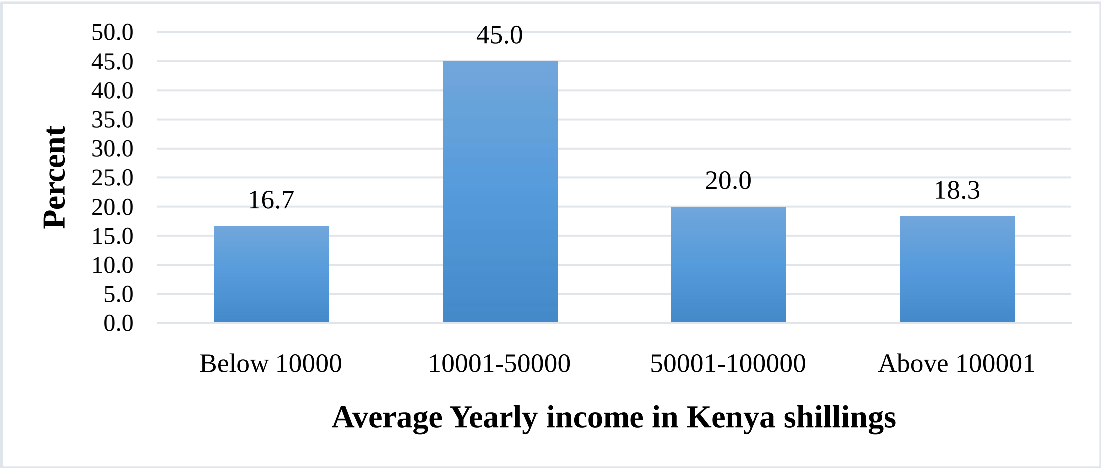

Figure 7: Average Yearly Income of the Respondents

About 61.7 % of the respondents earn below 50,000 Kenyan shillings per year. This implies that the respondents are living below the international poverty line of 1.90 US dollars per day (World Bank, 2018). All the respondents (100 %) depended on farming as their main source of income. Whereas 20.8 % had a second source of income, with 80 % of second income source being off-farm business like local kiosks, motorbike services among others. 20% had official employment or pension as their other source of income. These results concur with the Global Food Policy report by International Food Policy Research Institute (IFPRI, 2016) which indicated that small scale farmers are the world's poorest and hungry with agriculture being their main source of livelihood and predominantly live in the rural areas. Again, Kinyajui (2012) indicated that in Kenya, poverty is widespread and continues to afflict larger segments of the rural population. Since adoption of technologies has costs, farmers with lower income levels are not likely to adopt improved agricultural technologies (Tey, 2013).

4.5.7 Relationship between the Socio-economic Factors and Adoption of ICPTs

$H0_{1:}$ The selected socio-economic factors [age, household size, gender, education level, farmer's experience in cassava production and land size] have no statistically significant influence on the adoption of cassava processing technologies by small scale farmers of Migori County. Binary logistic regression was carried out to ascertain this hypothesis and the results are presented on the table 5 below:

Table 5: Relationship between the Socio-economic Factors on Adoption ICPTs

							95% C.I. for EXP(B)	
	B	**S.E.**	**Wald**	**df**	**Sig.**	**Exp(B)**	**Lower**	**Upper**
Age	.177	.048	13.630	1	.000	1.194	1.087	1.311
Gender	-1.613	.877	3.379	1	.066	.199	.036	1.113
No Formal Education			12.757	3	.005			
Primary Level	3.692	1.123	10.814	1	.001	40.108	4.443	362.072
Secondary Level	4.179	1.364	9.388	1	.002	65.314	4.508	946.354
College Level	3.971	1.390	8.161	1	.004	53.022	3.478	808.306
Household size	.388	.152	6.569	1	.010	1.475	1.096	1.984
Income Level	1.500	.502	8.934	1	.003	4.481	1.676	11.980
Farming Experience	-.106	.049	4.731	1	.030	.899	.817	.990
Farm Size	.062	.250	.062	1	.803	1.064	.652	1.736
Constant	-12.377	3.022	16.780	1	.000	.000		

Omnibus test: χ^2= 84.74, df= 9, P-Value=.000

Nagelkerke Pseudo R^2 = .738

Hosmer and Lemeshow Test = .914

N=120

The binary logistic regression model was statistically significant, $\chi^2 = 84.74$, $p < .0005$ and explained 73.8% (Nagelkerke R^2) of the variance in adoption and correctly classified 73.3% of cases (from the classification table in the appendix). This model therefore fits the data significantly well in relation to the null model with no predictors.

Farm size and gender contributed insignificantly to adoption of technologies (p = 0.803 and 0.066 respectively). This could be attributed to the fact that the farmers sampled in the study owned small pieces of land, below 5 acres. This could point to low income; yet, adoption of technologies requires massive investments (Tey, 2013). Though in this study gender contributed insignificantly to adoption of improved cassava processing technologies, the results indicated that women are more likely to adopt technologies than men as shown by a negative B value (Male was coded as 1 and female 0). In the recent past, there has been mobilization of women to adopt agricultural technologies because they play an important role in the household. Contrary to some literatures that claim that women are slow adopters, Rogers (2003) argues that women are likely to adopt technologies that enhance their economic status. Nevertheless, their contribution could be insignificant because the land tenure system is inflexible and therefore they are limited in terms of affordability of the investment requirement.

Age, education level, income level, farming experience and household size variables individually contributed significantly to the model, since their individual p-values were less than 0.05. An increase in age, education level and income level were associated with an increased likelihood of adopting improved cassava processing technologies (B values are positive). The age factor could be attributed to the fact that older farmers are more likely to possess information and knowledge that help them make more informed evaluations and decisions related to a particular practice or idea. These farmers are more likely to adopt improved cassava technologies which have a significant number of beneficial attributes (Kassie *et al.*, 2009).

With regards to income, small scale farmers with more income holdings have a higher likelihood of adopting cassava processing technologies because of their increased flexibility to allocate income for purchase of technological equipment (Murendo *et al.*, 2016). In regard to education level, farmers with a higher formal education level are more likely to comprehend and easily make informed decisions about an innovation due to their capacity in pursuing and assessing appropriate facts about a technology. Therefore, they are more likely to embrace improved processing technologies with ease as compared to those with lower level of education or those with no formal education (Abdulai & Huffman, 2014).

An increase in farming experience was associated with a reduction in the likelihood of adopting cassava processing technologies (B value is negative). According to Abdulai and Huffman (2014), the more experienced farmers are, the more equipped they are with traditional knowhow and they tend to hold on to the techniques they are familiar with and are reluctant to try new technologies. Also, more experience in farming means that the farmers have facts that help them make informed evaluations and decisions related to a particular practice or idea.

Collectively, the influence of the selected socio-economic factors [age, household size, gender, education level, farmer's experience in cassava production and land size] is statistically significant. Therefore, the null hypothesis that stated that; the selected socio-economic factors have no statistically significant influence on the adoption of cassava processing technologies by small scale farmers of Migori County, was rejected.

4.6 Influence of Selected Institutional Factors on Adoption of ICPTs

Objective 3 sought to determine the influence of selected institutional factors on adoption of improved cassava processing technologies among small scale farmers in Migori County. The institutional factors established in this study are access to extension services, membership in groups and access to credit facilities. Each of these factors and their influence on adoption are discussed below:

4.6.1 Access to Extension services by the Respondents

Table 6 below shows the small-scale farmers responses on access to extension services from the providers for the last one year.

Table 6: Access to Extension Services

Access to Extension	Frequency	Percent
No	64	53.3
Yes	56	46.7
Total	**120**	**100.0**

The results obtained show that most (53.3%) of small scale farmers had not accessed extension services for the last year, while 46.7% of the respondents agreed to had accessed extension services before.

4.6.2 Extension Providers in Migori County

The figure 8 below shows the percentages of the extension providers in Migori County.

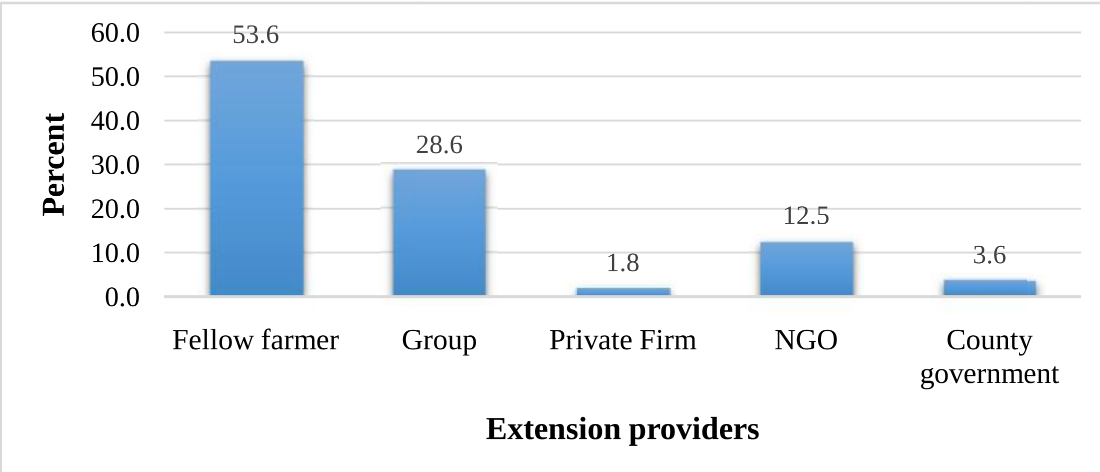

Figure 8: Extension Providers

The main extension provision is from the fellow farmers and farmer groups which account for 82.2% followed by the non-governmental organisations at 12.5%. Other extension providers include private companies. These results concur with those of Jayne and Muyanga (2006), who indicated that private and government extension provision in Kenya is poorly served in marginalized regions with low value crops. Whereas non-profit organization providers target these areas more but their scope is limited. Farmer groups and farmer to farmer form of extension is the most common.

4.6.3 Frequency of Extension Services

The figure 9 below represents the small scale farmers' responses on the frequency of access to extension services.

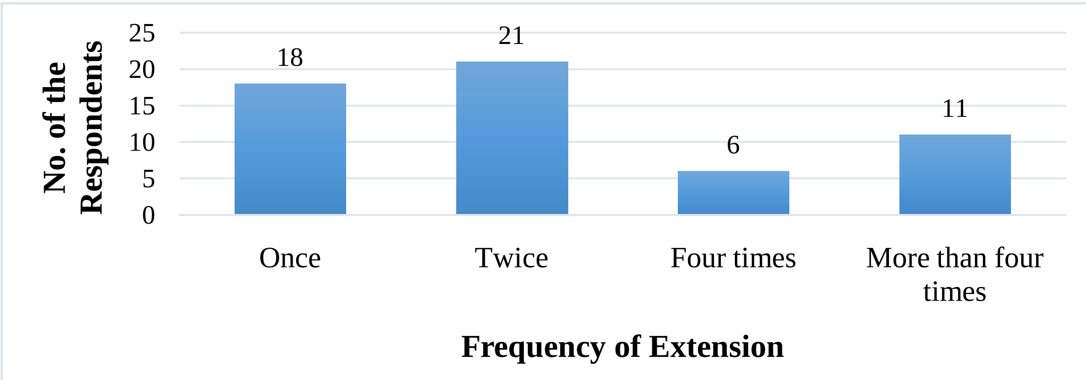

Figure 9: Frequency of extension services

The results indicate that majority of the respondents received extension services once or twice per year (39 respondents out of 56 who received extension services). These results concur with the findings by Jayne and Muyanga (2006), who indicated that the low percentage of farmers that received extension services do not receive it on regular basis. Frequent availability of extension services has the potential to influence the rate of adoption of improved technologies in agriculture. Therefore, lack of regular formal extension in the study area could negatively influence adoption of the processing technologies. Delivery of extension services on improved agricultural technologies can only be effective if there is constant and more regular contact between the extension providers and the farmers to facilitate the process.

4.6.4 Access to Credit Facilities by the Respondents

Data collected on access to credit facilities by small scale farmers was analysed to determine its influence on the adoption of improved cassava technologies by small scale farmers. The results are shown on table 7 below.

Table 7: Access to Credit Facilities

	Frequency	**Percent**
No	64	53.3
Yes	56	46.7
Total	**120**	**100.0**

From the 120 respondents, 53.3% had not accessed any form of credit for the last one year while 46.7 % had accessed credit. The main source of credit for farmers was farmer groups, 46%

followed by table banking and then county government which accounted for 14.3% each as shown in the figure 10 below:

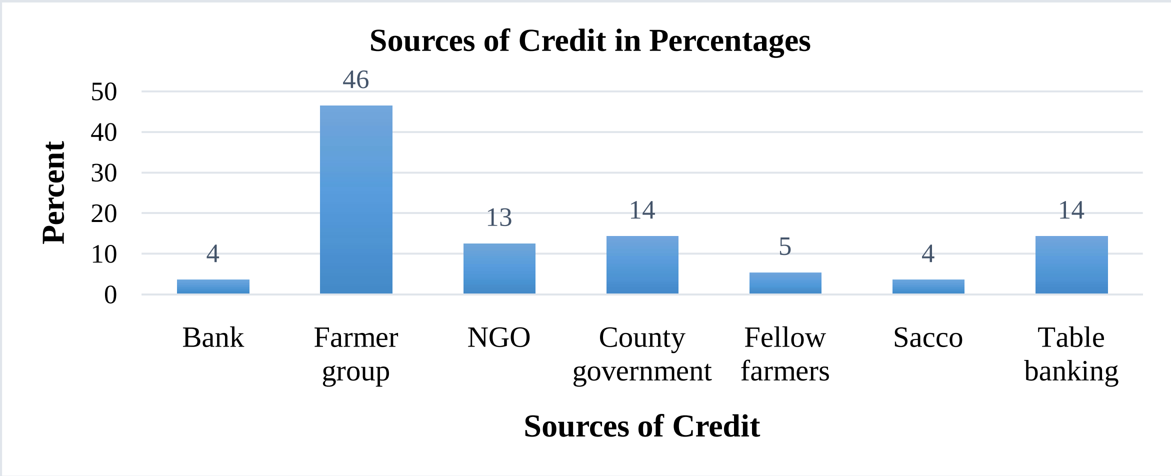

Figure 10: Sources of Credit

The average amount of credit accessed by the respondents per year is 13887.50 Kenya shillings (Table in the appendix). Generally the amount of credit accessed is low compared to what is required to invest in cassava processing technologies. Low access to credit limits the financial resources available for the required technologies and therefore negatively impacting on the adoption process. The findings agreed with Oluwasola (2010), who indicated that limited access to technologies hinders investment in technologies and innovations.

4.6.5 Membership in Farmer Organizations

Table 8 below presents the small scale farmer's responses on membership to farmer groups

Table 8: Membership to farmer organizations

	Frequency	Percent
No	33	27.5
Yes	87	72.5
Total	120	100.0

The results show that most 72.5% of the respondents belong to farmer groups. However, even though these groups considered themselves as farmer groups, only 39.5% of the groups engaged in farming activities and purchasing of farm inputs as shown in table 9 below. The rest, 60.5% mainly engaged in table banking, saving and acquiring loans as shown in the table below:

Table 9: Group activities

Group activities	**Frequency**	**Percent**
Table banking	25	29.1
Loans and savings	27	31.4
Farm inputs	3	2.3
Farming	32	37.2
Total	87	100.0

Farmer groups that undertake processing activities together tend to influence their members to make certain adoption decisions at their household level. They also tend to practice collective marketing which brings higher returns and therefore increase the capacity to invest in improved technologies (Tey, 2013). However the majority of the groups in which the respondents were members were not greatly involved in farming activities and therefore, they may not have an influence on the adoption decisions.

4.6.6 Relationship between the Institutional Factors and Adoption ICPTs

$H0_2$: Selected Institutional Factors [Access to Extension Services, Access to Credit Facilities and Membership in Farmer Organizations] have no Statistically Significant Influence on Adoption of Improved Cassava Processing Technologies. A binary logistic regression was carried out to ascertain this hypothesis and the results are presented on table 10 below:

Table 10: Relationship between the Institutional Factors on Adoption of ICPTs

Variables	B	S.E.	Wald	df	Sig.	Exp(B)
Group Membership	0.65	0.489	1.765	1	0.184	1.915
Access to Credit	1.492	0.514	8.424	1	0.004	4.448
Access to Extension	-1.345	0.48	7.834	1	0.005	0.261
Constant	0.672	0.43	2.446	1	0.118	1.959

Omnibus Tests of Model Coefficients; χ^2= 18.457, df =3, p=.000

Pseudo R^2 = .20.8

Hosmer and Lemeshow Test = .990

N=120

The results indicate that access to credit and access to extension services are significant predictors of adoption of improved cassava processing technologies as their p-value are less than 0.05. Whereas, group membership contributed insignificantly to the model; its probability value is greater than 0.05. The three institutional factors of this study explains 20.8% (Pseudo R^2 = .20.8) variation in adoption of improved cassava processing technologies.

The negative beta coefficient (B) on extension indicates that the more extension services farmers received, the less likely they were to adopt improved cassava processing technologies. This can be explained by the fact that the type of extension services the farmers received was informal (from fellow farmers and farmer groups; 82.2 %). Informal extension is likely to influence the farmers to adopt the technologies they have within the community since they may not have the capacity to access new improved technologies. These results correspond with Beshir (2014), who indicated that access to formal extension services empowers farmers to identify and analyse their agriculture-related problems as well as help them utilize available opportunities to maximize their profits. Formal extension plays an important role in creating awareness about characteristics of particular technologies and enable farmers make informed adoption decisions. Therefore, if the farmers have greater contact with extension agents, they are more likely to adopt improved technologies and vice versa is true.

The results on access to credit also concur with those of Mutuku *et al*. (2016) who established that access to credit is a significant factor influencing adoption of cassava processing technologies. Limited access to credit limits the farmer’s ability to acquire capital to start and expand their use of technologies.

However, the results on group membership differ from those of Tey (2013), who established that membership to farmer groups such as cooperatives, associations and farmer clubs tend to significantly influence its members to make certain adoption decisions about a wide variety of agricultural technologies. Farmers are inclined to appreciate benefits of certain technologies practiced by group members. This could be attributed to the fact that most of the groups the farmers were involved in this study were not necessary for farming purposes but other social activities like merry-go-round, table banking, among others.

Collectively, the influence of the three institutional factors (access to credit, extension and membership to farmer groups) is statistically significant. Therefore, the null hypothesis that stated that; the selected institutional factors [access to extension services, access to credit facilities and membership in farmer organizations] have no statistically significant influence on the adoption of cassava processing technologies by small scale farmers in Migori County was rejected.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The purpose of this study was to establish the influence of socio-economic and institutional factors on adoption of improved cassava processing technologies. This chapter presents the summary of the findings, conclusions and recommendations based on the objectives and findings of the study.

5.2 Summary

The study engaged 120 small scale cassava farmers in Migori County and the majority of the respondents were above 40 years. The average household size of the respondents was 7 people. Majority of the respondents had attained at least primary school education whereas the lowest percentage had college or university level of education. Most of the respondents had below five years of experience in cassava farming and had an average total land size was 3.6 acres. The income level among the respondents was low.

Objective one of this study was to establish the current status of adoption of cassava processing technologies in the study area. The results indicated that all the respondents were aware of cassava processing technologies, and the majority (98.3%) had used either one or more of the processing technologies either traditional or improved for the last one year. The most adopted traditional technologies were open sun-drying (37.01%) followed by fermentation (32.38%). Boiling and pounding were also relatively significant whereas, only (1.07%) percentage brewed traditional cassava beer. Flour mill was the highest adopted improved cassava processing technology with (73.3%) of the respondents. Although most of the farmers were aware of the other improved technologies such as use of a chipper, grater, fryer, sifter, peeler and oven, their adoption rates were low.

Objective two was to establish the influence of socio-economic factors on adoption of improved cassava processing technologies. The results from the binary logistic regression indicated that, age, household size, education level and income level contributed significantly to the prediction of adoption of improved cassava technologies. Whereas gender, land size under cassava and farming experience contributed insignificantly to the model. Collectively, the influence of selected socio-economic factors on the dependent variable was statistically significant. Therefore the null hypothesis that stated; selected socioeconomic factors [age, household size, gender, education level, farmer experience in cassava production and land size] have no statistically significant influence on the adoption of cassava processing technologies by small scale farmers in Migori County was rejected.

Objective three sought to establish the influence of institutional factors on adoption of improved cassava technologies. The results indicated that access to credit and extension services significantly contributed to the prediction of adoption of improved cassava processing technologies. While group membership contributed insignificantly to the model. Collectively, the influence of the selected institutional factors was statistically significant. Therefore, the null hypothesis reject that stated; selected institutional factors [access to extension services, access to credit facilities and membership in farmer organizations] have no statistically significant influence on the adoption of cassava processing technologies by small scale farmers in Migori County was rejected.

5.3 Conclusions

The following conclusions were drawn based on the objectives of this study in relation to adoption of improved cassava processing technologies among small scale farmers;

i) There is low contact between the extension providers and farmers in Migori County. The repercussion of low access to extension services is insufficient transmission of information to the farmers thus influencing the adoption of improved cassava processing technologies negatively

ii) Small scale cassava farmers in Migori County have low average yearly income, own small pieces of land and have limited access to credit facilities. These are essential factors for investment in adoption of improved cassava processing technologies

iii) Majority of farmers in Migori County have low education level and this is significantly influencing adoption of technologies negatively. Education creates a positive attitude for the uptake of new ideas and is important for effective transmission of information and application of knowledge gained.

5.4 Recommendations

To the Government:

i) Employment of more extension providers at the Ward level in the devolved system, this will increase awareness of the existence of improved cassava processing technologies.

ii) Subsidy of the prices of improved technologies and provision of credit facilities to small scale farmers, this will make the improved cassava processing technologies more affordable

iii) Integration of demonstrative trainings so that the teachings are more inclusive regardless of low education levels

To institutions

iv) Flexibility of credit providers in extending loans to the small-scale farmers making therefore making credit more accessible.

v) Farmers should come together to form farmer groups and associations in order to pool resources so as to invest in improved cassava processing technologies.

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APPENDICES

Appendix 1: Questionnaire for Small Scale Farmers

Dear respondent,

My name is Elizabeth Muthoni Nderitu, a student at Egerton University pursuing a Master of Science in Community Studies and Extension in the Department of Applied Community Studies). I am conducting a research on Influence of Institutional and Socio-economic factors on Adoption of Improved Cassava Processing Technologies among Small scale Farmers in Migori County, Kenya. You are among the selected households to participate in the study. The information you provide will be treated with highest confidentiality and will be used purely for academic purposes. It is my sincere request that you provide relevant responses to the items of the questionnaire in a voluntary, objective and honest manner. Your participation will be greatly appreciated.

Would you like to participate in the study? Yes ____________ No_____________

Serial number: …………………. Ward: …………………………..

Sub-county: ……………………… Date: ………………………

Village: ………………………….

Instructions

- ✓ Please put a tick where appropriate
- ✓ Any other relevant information that does not fit on the spaces provided can be written at the back of each page

Section A: Information on household socio-economic aspects (Objective 2)

Please, respond to the following items about your household

1. What is your age in years? ……………………
2. Sex of household head (*Tick in the applicable box)*

Male ☐ Female ☐

3. How many people live in your household? …………………………………
4. What is your education level
    i) No formal education
    ii) Primary
    iii) Secondary
    iv) College
    v) University

5. What is the size of your farm in acres? ....

6. How many acres are under cassava? ………………………………………………

7. For how many years have you been growing cassava? ………………………………..
8. What are your sources of income?

    (i) Farming [ ] (iv) Pension [ ]
    (ii) Other off-farm Business [ ] (v) Remittances [ ]
    (iii)Formal employment [ ] (vi) Others (Specify

9. How much is your average yearly monetary income in Kenya Shillings?
……………………..………………………………………………………………………
………………………………………………………………………………..

Section B: Information about the current status on cassava processing technologies (Objective 1)

10. Are you aware of any cassava processing technologies? Yes [ ] No [ ]

11. Have you used cassava technologies in the last one year? Yes [ ] No [ ]

12. If yes to *question 11* above, for what reasons do you process cassava?

………………………………………………………………………………………………………
…………………………

13. Which of the listed cassava processing technologies are you aware of? (*tick where appropriate*)

Traditional technologies	**Yes**	**No**
Open sun-drying		
Pounding		
Brewing		
Boiling		
Fermentation		
Improved technologies	**Yes**	**No**
Flour mill		
Chipper		
Grater		
Dryer		
Fryer		
Sifter		
Peeler		
Oven		
Others (Specify)		

14. Indicate the frequency of use of the cassava technologies listed below?

Traditional technologies	**Never**	**Sometimes**	**Often**	**Very often**
Open sun-drying				
Pounding				
Brewing				
Boiling				
Fermentation				
Others (Specify)				
Improved technologies	**Never**	**Sometimes**	**Often**	**Very often**
Flour mill				
Chipper				
Grater				
Dryer				
Fryer				
Sifter				
Peeler				
Oven				
Others (Specify)				

15. Of all the technologies you use, which ones do you perceive easiest to use?

……………………………………………………………………………………………………
……………………………………………

Section C: Information on institutional aspects associated with the household technologies

I. Membership in farmer organizations:

16. Do you belong to any farmers' group(s)? Yes [ ] No [ ]

17. If no in *question 16*, why not?

…………………………………………………………………………………………………

…………………………………………………………………………..

18. If yes in *question 16,* what is the name of the farmers' group (s)?

..………………………………………………………………………………………………

…………………………………………………

19. How many years have you been a member of the group (s)?

Name of the group	**Membership period**

20. Is the group registered? Yes [ ] No [ ]

21. What are the activities of the group?

……………………………………………………………………………………………………

……………………………………………

II. Access to credit facilities:

22. Have you accessed any credit from any organization in the last 1 year?

Yes [ ] No [ ]

23. (If Yes), what do you use the credit for?

(i) Inputs

(ii) Tools &Equipment

(iii)Labour

(iv)Others (Specify)

24. (If Yes,)Specify the source of credit

(i) Bank

(ii) Farmer group

(iii)NGO

(iv) Government

(v) Fellow farmer

(vii) Fellow farmer

(viii) Table banking

(ix) Others (Specify)

25. Estimate the amount of credit accessed in Kenya shillings in the last one year?

....

....

III. Access to extension services:

26. Have you received extension services on cassava in the last one year?

Yes [ ] No [ ]

27. If yes to *question 26*, who provided the services and what kind of services did you get?

(i) County Government

(ii) NGO

(iii)Private

(iv)Fellow farmers

(v) Others (Specify)

28. If yes to *question 26*, how many times have they provided you with extension services in the last one year?

(i) Once per year

(ii) Twice

(iii)Four times

(iv) More than four times

29. What type of services are offered by extension providers?

…………………………………………………………………………………………………
…………………………………………………………………

IV. Availability of market

30. Do you sell cassava or its products? Yes [ ] No [ ]

31. If yes to *question 30* above, in what form do you sell cassava?

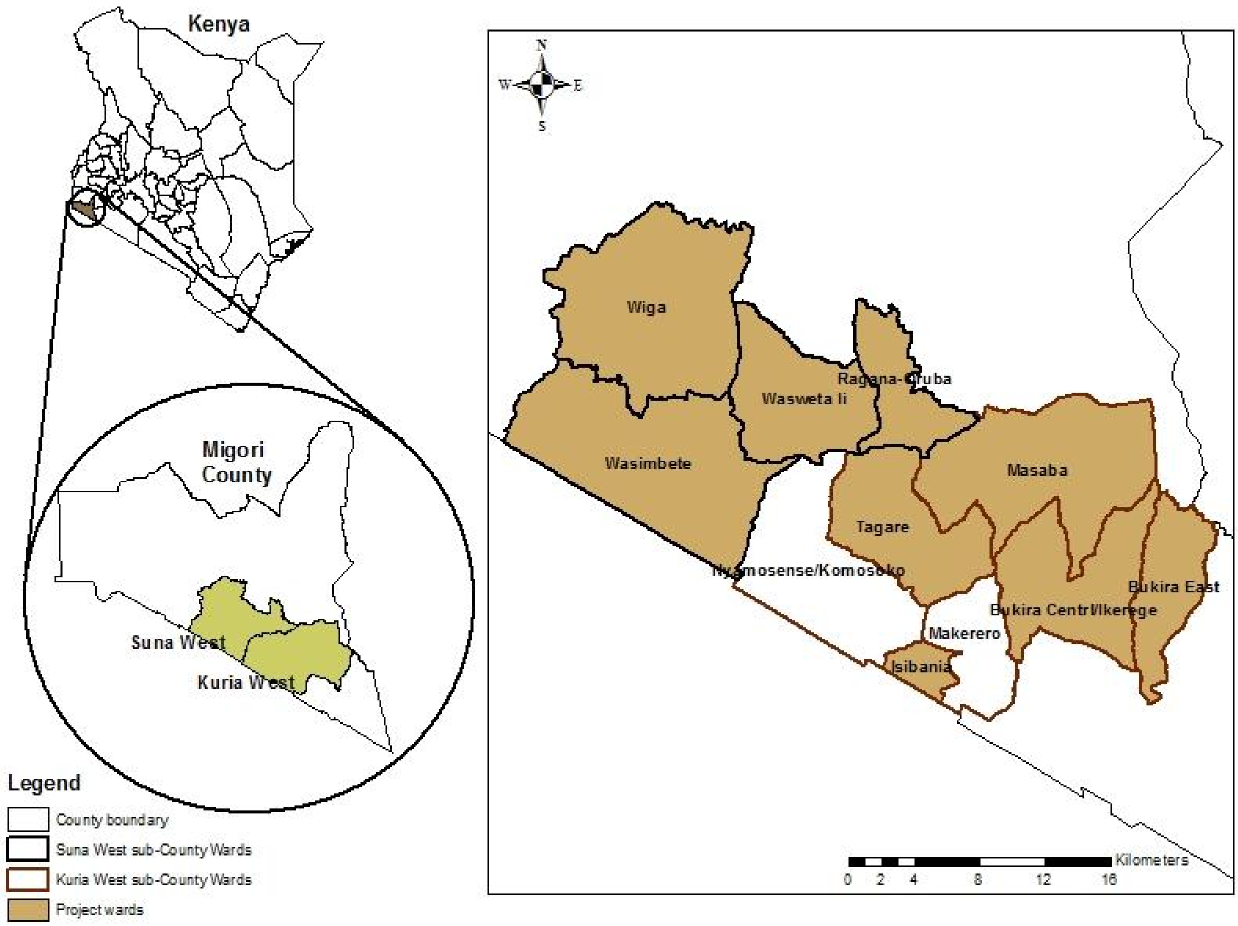
i. Unprocessed
ii. Dried raw cassava crisps
iii. Flour
iv. Cooked (chips, roasted, boiled)
v. Other (Specify)

32. In what markets do you sell your products? i) Locally ii) Regional iii) Export

33. What are the main challenges that you encounter in marketing cassava and its products?
…………………………………………………………………………………………………
…………………………………………………………………………………………………
………………………………………..

THANK YOU FOR YOUR COOPERATION

Appendix 2: Map of Study Area of Migori County



Appendix 3: Diagnostic tests

Pairwise correlation

	Constant	**Age**	**Gender**	**Household size**	**Education Level**	**Farm Size**	**Income Level**	**Experience**
Constant	1.000	-.734	-.012	-.488	-.753	.036	-.570	-.136
Age	-.734	1.000	-.187	.109	.431	.064	.395	-.260
Gender	-.012	-.187	1.000	.029	-.145	.230	-.315	.329
Household size	-.488	.109	.029	1.000	.252	-.249	.198	.143
Education Level	-.753	.431	-.145	.252	1.000	-.220	.280	.062
Farm Size	.036	.064	.230	-.249	-.220	1.000	-.289	-.104
Income	-.570	.395	-.315	.198	.280	-.289	1.000	-.186
Experience	-.136	-.260	.329	.143	.062	-.104	-.186	1.000

Test of Multicollinearity the Socio-economic Factor

	Collinearity Statistics	
	Tolerance	VIF
Age	.804	1.245
Gender	.874	1.144
Household Size	.851	1.175
Level of education	.934	1.071
Farm Size	.904	1.106
Income Level	.902	1.109
Farming Experience	.884	1.131
Mean	**.874**	**1.140**

Total Farm size and farm size under Cassava Statistics

		Total Farm Size	Farm Size Under Cassava
N	Valid	120	120
Mean		3.5646	1.4335
Std. Error of Mean		0.13901	0.09853
Median		4	1
Mode		5	.50a
Std. Deviation		1.52276	1.0793
Variance		2.319	1.165
Skewness		-0.63	1.001
Std. Error of Skewness		0.221	0.221
Kurtosis		-0.952	0.458
Std. Error of Kurtosis		0.438	0.438
Range		5.25	4.88
Minimum		0.25	0.13
Maximum		5.5	5
Percentiles	100	5.5	5

Classification Table

	Observed		Prediction of Adoption		Percent
			Non-Adopter	Adopter	
Step 1		Non-Adopter	24	8	75
		Adopter	8	80	90.9
	Overall Percentage				86.7

Pairwise Correlation Matrix

	Constant	Group Membership	Credit Access	Extension
Constant	1.000	-.604	-.073	-.406
Group Membership	-.604	1.000	-.184	-.117
Access to Credit	-.073	-.184	1.000	-.299
Extension	-.406	-.117	-.299	1.000

Test of Multicollinearity of institutional Factor

	Collinearity Statistics	
	Tolerance	VIF
Credit Access	.894	1.119
Extension Services	.960	1.042
Membership to group	.922	1.085
Mean	**.925**	**1.082**

Collinearity Statistics between the Institutional Factors

	Tolerance	VIF	
Farmer Group Membership	0.923	1.083	
Access to Credit	0.923	1.083	
Dependent: Extension Provision			
		Tolerance	VIF
	Access to Credit	0.961	1.04
	Extension Provision	0.961	1.04
Dependent: Farmer Group Membership			
		Tolerance	VIF
	Extension Provision	0.992	1.008
	Group Membership	0.992	1.008
Dependent: Access to Credit			

Yearly monetary income in Kenya Shillings

	Frequency	Percent	Valid Percent	Cumulative Percent
Below 10000	20	16.7	16.7	16.7
10001-50000	54	45	45	61.7
50001-100000	24	20	20	81.7
Above 100001	22	18.3	18.3	100
Total	120	100	100	

Other sources of Income

	Frequency	Percent
Other off-farm Business	20	16.7
Formal employment	2	1.7
Pension	3	2.5
Total	25	20.8
System	95	79.2
	120	100

Services frequently offered by Extension

	Frequency	Percent
	71	59.2
Training	30	25
Provision of planting materials	14	11.7
Provision of chippers	5	4.2
Total	120	100

Main uses of the credit obtained from different sources

	Frequency	Percent	Valid Percent	Cumulative Percent
Inputs	37	30.8	66.1	66.1
Tools and Equipment	7	5.8	12.5	78.6
Labour	6	5	10.7	89.3
Household care	6	5	10.7	100
Total	56	46.7	100	

Appendix 4: Research Permit

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SOCIETY OF EDUCATIONAL RESEARCH AND EVALUATION IN KENYA

Influence of Institutional factors on Adoption of Improved Cassava Processing Technologies among Small Scale Farmers in Migori County, Kenya

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Abstract

Cassava is a key food crop, a cheaper raw material for animal feed and has various industrial uses. However, cassava utilization is faced with some challenges in that; once harvested, it is perishable if not processed, it is also bulky and has high cyanide concentration. Processing can increase its utilization. In Kenya, improved cassava processing technologies have been developed but their adoption continue to be low especially among small scale farmers. This paper therefore establishes the influence of institutional factors on adoption of improved cassava processing technologies in Kuria-West and Suna-west Sub-Counties. Eight wards were purposively selected based on the magnitude of cassava production, 120 cassava small scale farmers were proportionately and randomly selected. An interview schedule was used to collect data that was analysed. Data analysis was done using descriptive statistics and binary logistic regression to test the hypotheses at a level of significance of $p \leq 0.05$*. Institutional factors of this study explained 20.8% variation in adoption. The Chi-Square value was significant at .000. Therefore, null hypothesis which stated that, selected institutional factors [access to extension services, credit access and group membership] have no statistically significant influence on the adoption of improved cassava processing technologies by small scale farmers in the study area was rejected.The findings of the study can be a basis for interventions to help farmers adopt technologies and guide the government and policy makers in formulating strategies to address the challenges faced in processing and utilization of cassava.*

Keyword: *Adoption, Institutional factors, influence, small scale farmers, Technologies*