ECONOMIC ANALYSIS OF SMALLHOLDER FARMERS' PARTICIPATION IN THE CASSAVA MARKETING VALUE CHAIN IN TAITA-TAVETA AND KILIFI COUNTIES, KENYA

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Declaration

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

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Publications

The following papers have been written from this thesis:

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Dedication

This work is dedicated to my family and friends for their love, care and support.

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It is by God's Grace that I have come this far. May all the Glory and Honour be unto Him.

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Abstract

Cassava is an important food crop with high production potential for different agroecological zones across the world. Therefore, cassava has a great potential as both a food security crop and other industrial purposes. However, the cassava industry and value chain in Kenya is still underdeveloped since there are many cassava marketing opportunities that are yet to be exploited. This study analyses the participation of smallholder farmers in the cassava marketing value chain in Taita-Taveta and Kilifi Counties in Kenya. Data was collected using semi-structured questionnaires from a sample of 250 smallholder cassava farmers and 105 cassava traders. Descriptive statistics were used to analyse the socio-economic characteristics of respondents and to map both the cassava marketing channels and the marketing value chain. A binary Probit model was used to analyse the socio-economic factors that influence farmers participation in cassava marketing while an Ordered Probit model was used to analyse the cassava commercialization levels in the study area.

The results show that most cassava farmers participate in cassava marketing but at different commercialization levels and cassava trading is dominated by female traders. However, there was little value addition to cassava tubers since cassava is mostly consumed as food and 92 percent of farmers sell fresh roots while 78 percent of traders resale the fresh roots. The results of the binary Probit model show that, access to extension services, price of cassava product and quantity harvested had a positive and significant influence on market participation decision while years of schooling, household size and farm size had a negative and significant influence on the market participation decision. On the other hand, the Ordered Probit results show that, pest management, seed buying and access to extension services had positive and significant influence on commercialization level while household size and distances to the nearest market place had negative and significant influence on commercialization level. Therefore, based on the findings, the study recommended policy interventions targeting organization and

coordination of the cassava marketing system and provision of appropriate incentives to farmers and traders in the bid to develop the cassava marketing value chain.

Key Words: Cassava, Participation, Commercialization Level, Marketing, Farmers, Traders

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List of Abbreviations

FAO	Food and Agricultural Organization
FDG	Focus Group Discussion
HCI	Household Commercialization Index
HL	Hosmer-Lemeshow
IITA	International Institute of Tropical Agriculture
KAPAP	Kenya Agricultural Productivity and Agribusiness Project
KNBS	Kenya National Bureau of Statistics
MT	Metric Tonnes
NGO	Non-Governmental Organization
R & D	Research and Development
SID	Society for International Development
SSA	Sub-Saharan Africa
SWOT	Strengths, Weaknesses, Opportunities, Threats
VIF	Variance Inflation Factor
YPARD	Young professional for agricultural development

CHAPTER ONE

INTRODUCTION

1.1 Background Information

Cassava (*Manihot esculenta*) is one of the most popular and widely consumed food crops in Africa. It was introduced to sub-Saharan Africa (SSA) in the sixteenth century by Portuguese traders from Brazil (Koplez; IITA, 2009). Its production has since spread to 40 of the 54 countries in Africa and this accounts for approximately 61 percent of global production (Dunstan and Chuma, 2017). The leading cassava producers in SSA are; Nigeria (59 million MT), DRC (32 million MT), Ghana (18 million MT), Angola (12 million MT), and Mozambique (9 million MT) (FAOSTAT, 2017). Cassava is therefore commonly referred to as cornerstone of food security in Africa due to its importance as a source of food for many people and adaptability to diverse ecological conditions in the region. According to YPARD (2014), cassava plant produces excellent harvests in adverse conditions even when other crops have failed. The report shows that, cassava is becoming an important raw material for industrial production due to its competing need in production of food, animal feed and biofuels. In addition, the rapid population growth in Africa has led to increased demand for staple foods like cassava leading to improved livelihood of several smallholder farmers in the cassava business.

In Kenya, cassava farming is practiced on approximately 90,394 hectares of land throughout the country producing about 1,112,000 MT per year. Consequently, its productivity stands at 12.3 MT/ha which is far much below the potential 50MT/ha (FAOSTAT, 2016). Cassava production is concentrated in the Coastal, Central and Western regions of Kenya. The Coastal region is characterized by lowland ecology, low altitude, high rainfall, warm and humid temperatures; the Central region is characterized by low to high altitude areas mainly semi-arid areas, cool and warm temperatures; and Western Kenya is characterized by mid altitude,

medium to high rainfall areas, warm and humid temperatures. About 90 percent of cassava produced in Kenya is consumed as food and therefore there is need to increase its production in order to expand its value chain to meet other industrial requirements including animal feed, starch and ethanol production as processing cassava increases the net benefits earned. Besides, cassava is an advantageous crop since it fits varied farming and food systems, has a high yielding ability and it is easy to cultivate, hence has low labour requirements. Moreover, it is relatively tolerant to low soil fertility and drought, and it can remain in the ground for over two years without spoilage; making it an ideal famine reserve crop (Koplez; IITA, 2009). However, according to KAPAP (2012), the production and utilization of cassava in Kenya remains unexploited despite all this potential. Furthermore, its production is characterized by low use of inputs, use of outdated technology, large post-harvest losses, minimum value addition, inconsistent supply, low quality products, low producer prices, costly marketing structure and low utilization of cassava in the industrial sector

In Kenya, cassava is mainly consumed as snacks or with tea after boiling and its utilization is concentrated in the western and coastal regions. Besides, cassava is dried and milled into flour and used as blends when preparing *ugali* (stiff porridge), porridge and for home baking. On the other hand, cassava leaves are also used by some people as vegetables and feed for livestock (GoK, 2007). KARI (2006), shows that despite introducing value addition technologies to smallholder farmers in Eastern Kenya, to spur entrepreneurial activities and enhance cassava commercialization, none of the farmers used the technologies. According to the report, the few farmers who practiced commercial cassava farming, sold raw tubers. Commercialization of cassava is mainly hindered by the bulkiness of cassava tubers which makes it costly to transport to distant markets and processing places. Similarly, cassava tubers require quick utilization after harvesting due to their high perishability nature. This perishability problem can only be solved by processing harvested cassava tubers, for example by Chipping and drying. However,

affordability of the required equipment, skills and technologies may be out of reach for most smallholder farmers. One of the major challenges facing commercialization of cassava farming and cassava utilization is limited farmer entrepreneurial orientation. This is because, farmers that have adequate entrepreneurial orientation, take advantage of market intelligence in an attempt to exploit prevailing profitable opportunities.

There are no standard regulations for cassava and its products in Kenya since the cassava industry is not fully developed. Cassava production is inconsistent in terms of both quality and quantity making it difficult for processors to maintain their commercial operations. According to GOK (2007) report, Kenya does not have an external trade framework for cassava products since the industry is still unexploited for commercial purposes. The report shows that Kenya has a narrow range of cassava value added products while other countries like Brazil, Thailand, Japan and Malaysia, enjoy a wide range of cassava processed products including cassava flour used in the confectionery industry, cassava starch used for various purposes and cassava animal feed. Mulu-Mutuku (2013) argued that the narrow range of cassava processed products can be explained by the inadequate research being done on cassava industry in the country.

However, the cassava industry is most likely to improve with the quest of the Kenyan government realization of the 'Big Four Agenda'. One of the pillars of the 'Big Four Agenda' is to ensure food security for all Kenyans by boosting smallholder farmers' productivity. The ministry of agriculture has drafted a policy that will compel flour millers to blend cassava, millet and sorghum in flour to ensure sufficient production of food as well as promote commercialization of locally produced grains (Farmbizafrica, 2018). Therefore, flour millers are expected to provide a ready market for cassava hence boost cassava production in the country. It is against this background that the study intended to analyse the cassava marketing value chain with focus on smallholder farmers' participation.

1.2 Statement of the Research Problem

Cassava is a perishable crop and has a shelf life of approximately three days in its raw form after harvest (George *et al*., 2016). Cassava is grown in 40 of the 54 countries in Africa and it is very adaptive to the tropical climate and soils. It has the ability to thrive in areas where other crops have failed like in the semi-arid regions and in less fertile soils. Cassava is widely consumed in many African countries and has significantly contributed to solving food insecurity problems in the continent. Nigeria which is the largest producer of cassava in the world, consumes 70 percent of its cassava produce as food (Kehinde and john, 2015). Cassava can be farmed using varied systems, it has low labour requirements, it can do well in less fertile soils and can withstand drought. In addition, cassava tubers can be processed into different products and it is termed as a famine reserve crop due to its ability to remain in the ground for over two years without spoilage (Infonet, 2018; Koplez; IITA, 2009).

Despite all this lofty potential, the Kenyan cassava marketing value chain is underdeveloped and continue to receive low quantities of cassava products with limited value addition (GOK, 2007). The marketing system is poorly financed and characterized by low competition and high post-harvest losses (George *et al*., 2016). These, coupled with poor market conduct and structure translates itself into poor market performance (KAPAP, 2012). This study therefore aims to assess the cassava marketing value chain in the context of market participation and commercialization of cassava farming in Taita-Taveta and Kilifi counties.

1.3 Overall Objective

To analyse smallholder farmers' participation in the cassava marketing value chain in Taita-Taveta and Kilifi Counties in Kenya

1.4 Specific Objectives

1. To characterize the cassava marketing value chain in Taita-Taveta and Kilifi counties
2. To assess the determinants of participation decision in cassava marketing in Taita-Taveta and Kilifi counties
3. To determine factors that influence the level of commercialization among smallholder cassava farmers in Taita-Taveta and Kilifi counties

1.5 Hypotheses

The hypotheses for the second and the third objectives are;

1. Ho: Socio-economic determinants have no influence on cassava market participation in Taita-Taveta and Kilifi counties
2. Ho: There is no difference in the level of commercialization among smallholder cassava farmers in Taita-Taveta and Kilifi counties

1.6 Justification of the Study

The results of this study provide information which is important and helpful to cassava value chain actors in doing SWOT analysis before making decisions on the specific part of the marketing value chain to participate. The study helps in informing the restructuring of the marketing value chain to improve coordination and enhance efficiency in the system. Farmers, traders and processors are informed on efficient channels for purchasing and delivering their products to the market and the best form in which to sell their products in order to earn high returns. Therefore, this study is key in the process of attaining two of the seventeen Sustainable Development Goals which are; ending poverty in all its forms everywhere, and end hunger, achieve food security and improved nutrition and promote sustainable agriculture.

Achieving the objectives of these study and providing extension services to farmers will help in poverty reduction of farming households since they will be able to make informed decisions on the levels of cassava production, cassava planting time, harvesting time, value addition, marketing channel and selling price of cassava products. In the process, farmers will practice sustainable agriculture, increasing food production which in turn reduce hunger and increase food security in the coastal region. On the other hand, due to increased production by individual farmers, traders will enjoy economies of scale and sustainable supply of cassava products from the farmers thus they will in turn increase their scale of operation hence increasing their profit margins. This will in turn improve the living standards of cassava value chain actors.

CHAPTER TWO

LITERATURE REVIEW

2.1 Cassava Value Chain

The scope of a value chain as described by Gereffi (1994) can be broken down into five major components namely; the technical structure, the chain actors, the territorial structure, the input-output structure and the governance structure. Similarly, while giving guidelines for value chain analysis for FAO, Jon Hellin and Madelon Meijer (2006) defined a value chain as "the full range of activities which are required to bring a product or service from conception, through the different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final customers, and final disposal after use." This definition is in line with Kaplinsky and Morris (2001) definition who described a value chain as, "a full range of activities which are required to bring a product or service passing through the intermediate phases of production to delivery to consumers and final disposal after use". A visual diagrammatic value chain can be represented as follows;

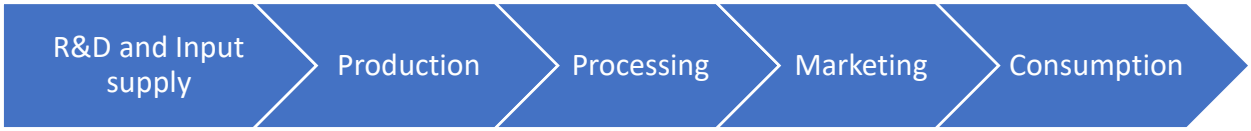


Figure 2.1: The Core of a Value Chain

Source: FAO (2014)

A value chain is a connected series of organizations, resources and knowledge streams geared towards generating and delivery of value to the consumer. It has many components that require a lot of resources, including time to be studied satisfactorily. Therefore, studying, analyzing and discussing a value chain of a specific commodity where time and other resources are constrained is difficult. This study is going to focus on the marketing part of the chain which will include cassava marketing actors, their respective actions and the channels they coordinate.

2.2 Marketing Value Chain

Different approaches are used in value chain analysis though the aim of any given enterprise is to pursue one or more end markets. In some instances, participants along the value chain may integrate horizontally or vertically to take advantage of competitive advantage but in some cases, this may happen unknowingly (Aderibigbe, 2007). According to Nilofer (2009), the marketing value chain comprises five major components highlighting the movement of a product from the point of production through to the point of consumption;

Figure 2.2: A Simplified Marketing Value Chain Representation
Source: Nilofer (2009)

Figure 2.2 is a diagrammatic representation of a simple Marketing Value Chain which is a process that starts after producing a given commodity to take to the market. Product management involves defining the specific markets and consumers that the product is targeting and developing a business model to facilitate marketing of the product. On the other hand, product marketing focuses on product positioning, valuing and differentiation while field marketing focuses on generating consumer interest and maintaining/ developing the business product channels. Lastly, brand management deals with consistency in providing the market with the best product experience in reaching consumer needs (Nilofer, 2009).

A marketing chain shows different successive markets through which a product pass from the point of production to the final consumer. It is important in describing the relativeness of each exchange point along the entire value chain of a product in the marketing system. According to Bukar *et al*. (2015), marketing chains involve a series of transformation, economic processes

and changes in ownership of a given product from the point of production through to the point of consumption. Each commodity has its own unique marketing chain and networks since different intermediaries along the chain perform different functions leading to various transactions. Thorbeeke (1992) contends that, products gain value through space, storage and transformation while they progress from the point of production to the point of final consumption. According to Thorbeeke (1992), a marketing chain is important in analyzing the relativeness of various markets and exchange points within a marketing system and therefore a long marketing chain reveals that there are many intermediaries within the marketing system. Many intermediaries result to many transactions which results to high costs and therefore a huge difference between prices paid at the point of production and at the point of final consumption. Harieth *et al*. (2010) shows this process where transaction costs and marketing costs contribute to the price of the final product since every actor along the marketing chain wants to maximize their utility.

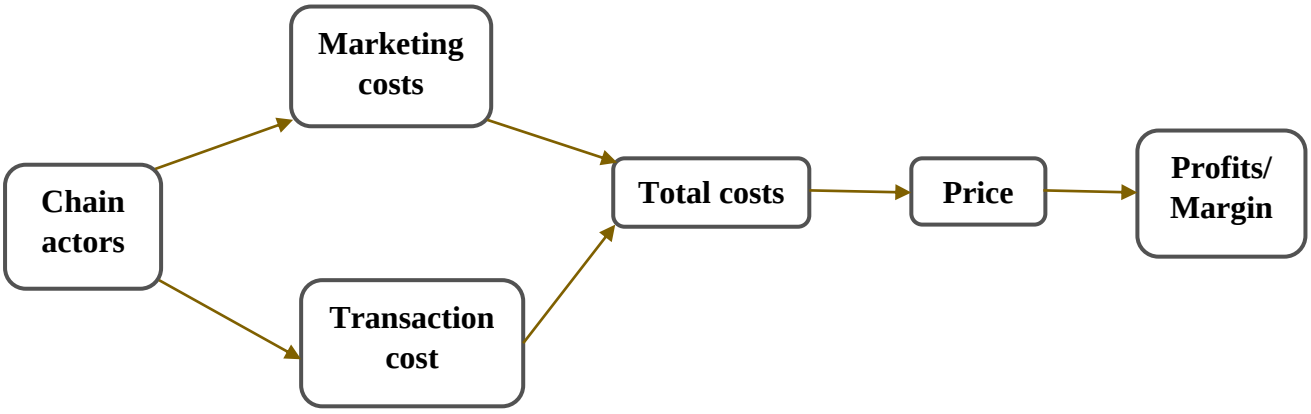


Figure 1.1: Utility maximization along the marketing value chain
Source: Harieth *et al*. (2010)

2.3 Marketing Channels

A marketing channel is the path followed by a product from its point of production through to the point of consumption (Hay, 1975). A marketing channel is a set of practices or activities necessary to transfer the ownership of goods, and to move goods, from the point of production to the point of consumption and, as such, consists of all the institutions and all the marketing activities in the marketing process (Bundles Marketing, 2019). According to Olukosi and Isitor (1990), marketing channels can be described using two broad categories, this is, centralized and decentralized channels. A centralized channel involves products being moved from their different points of production to one established large central market place from where they are purchased by wholesalers, processors or retailers. In contrast, a decentralized channel is where wholesalers, processors or retailers move around purchasing produce directly from individual farmers. On the other side, while studying Cassava Commercialization in Southern Africa, Steven *et al*. (2012), describes the cassava marketing chain using six different channels which have been adopted in this review. The cassava marketing chain as described by Steven *et al*. (2012) covers major channels that should exist in any developed cassava marketing value chain.

Channel 1. Farm Household Consumption

Cassava, just like any other food crop, can be harvested, processed and consumed at the farm level. Cassava farmers may therefore choose to practice either subsistence or commercial cassava production or both. A study by George *et al*. (2016), on Post-Harvest Practices, Constraints and Opportunities Along the Cassava Value Chain in Kenya, shows that all cassava farmers at the Coast, Eastern and Western Kenya, use cassava for household consumption and majority of these farmers also sell cassava products. According to George *et al*. (2016), 19 percent of cassava farmers at the coast, grow cassava for household consumption only. Steven

et al. (2012) shows that 90 percent of cassava produced in Zambia and Mozambique annually is used for on-farm consumption while 70 percent of annual cassava production in Malawi is consumed by the farm household. On the contrary, only 15 percent of total cassava production in Nigeria is used for farm household consumption (Phillips *et al*., 2004).

Channel 2. Fresh Cassava Marketing

Cassava can be marketed as either fresh tuber from the farm or as cassava processed products. Marketing of fresh cassava is viable in high-concentrated settings where transport costs are low and distances from the farm to the market are short like in Malawi, because fresh cassava tubers are bulky and have a short shelf life of three days after harvesting. According to IITA/SARRNET (2003), fresh cassava markets account for the majority of cassava markets in Malawi. IITA/SARRNET (2003) reveals that fresh cassava markets are growing at a slow rate due to the long distance of the markets from cassava growing regions.

Channel 3. Marketing of Dried Cassava Tubers and Flour

Fresh cassava tubers can be sundried when in form of peeled cassava tubers, cassava chips or cassava flour. According to FAO (2013), cassava tubers are peeled and sliced lengthwise before sun-drying them and dried cassava tubers (*gaplek)* are either stored or taken to the market for sale. According to FAO (2013), sun-drying cassava tubers is less labour demanding but it is less effective in removing cyanogen. Sun-drying also increases the shelf life of harvested cassava tubers to between six to twelve months thus making it possible for long distance cassava transit through the complex marketing chains and also storage/supply of cassava throughout the year. According to Steven *et al*. (2012), a large percentage of cassava sold in the northern cassava belt and dual-staple zones of Zambia is in form of dried cassava tubers and flour. Zambia exports dried cassava tubers to the mining towns of Democratic Republic of

Congo while dried cassava is sold in the coastal markets and to urban markets of Mozambique. Steven *et al*. (2012) also shows that, the selling price of dried cassava tubers doubles their purchasing price when cassava is out of season.

Channel 4. Processed Foods

When cassava flour is not fermented, it can be used as a substitute to wheat flour in the confectionary industry. This type of cassava flour is prepared by peeling, washing, grating, pressing, disintegration, sifting, drying, milling, screening, packaging and storing cassava tubers thus it is referred to as *High quality cassava flour* (HQCF). *Farinha*, a cassava product, is prepared in Brazil by roasting grated fresh cassava tubers from which cyanide containing liquid has been squeezed out. In Africa, different procedures are used by different countries to process fresh cassava tubers into different products such as gari and fufu in Nigeria, *attiéké* in Côte d'lvoire and Benin, and *chickwangue* in Democratic Republic of the Congo (FAO, 2013). In the southern part of Africa, the main cassava processed food product is *rale* while in western Africa *gari* is the main processed food product from cassava. *Rale* is mainly produced in homesteads by women but small factories have emerged to process and package it well for urban dwellers and other retail markets (Steven *et al*., 2012). At the Kenyan Coast, cassava is processed into; cassava chips, cassava flour, cassava crisps, half-cakes and composite flour. In Eastern Kenya, cassava is mainly processed into cassava chips and cassava flour while in Western region cassava is mainly processed into cassava chips and composite flour (George *et al*., 2016).

Channel 5. Livestock Feed

Cassava livestock feed products are either informally processed at the farm level or processed commercially as industrial products. Both the tubers and leaves of the cassava plant can be

used as on-farm animal feed or as an ingredient in commercial animal feed. However, fresh cassava tubers or leaves are fed to livestock in small quantities because of their high cyanide content. Fresh feed should be spread on the floor and be left overnight to release some of the cyanide through evaporation. The feed can also be sun dried to remain with 12 percent to 14 percent moisture content or fermented to make silage for future usage. In southeastern Africa, Zambia is the leading processor of cassava livestock products due to almost immediate market of the products created by large commercial livestock farming. Livestock farmers and companies in Zambia have highly experimented on cassava-based feed rations and found cassava-based feed to be a better means of reducing the cost of livestock production (Steven *et al*., 2012).

Channel 6. Industrial Products

Industrial production of cassava-based starch, sweeteners and biofuels in cassava producing countries in the world has attracted both public and private interest. However, industrial utilization of cassava is still low in the African continent since most of the cassava produced is utilized as food. According to FAO (2013), countries such as Thailand and China, have fully mechanized starch factories where daily output of cassava starch goes as high as 300 tonnes. Modified starch products are assimilated in food products or used as feedstock for production of sweeteners, fructose, alcohol and monosodium glutamate. In addition, modified starch is also used along with high quality cassava flour in the production of plywood, paper and textiles. Cambodia, China, Colombia, Thailand and Viet Nam, have already set up cassava-based fuel ethanol factories which are already operating. In Africa, according to Steven *et al*. (2012), both medium and large-scale firms for industrial cassava production have emerged and this has taken the effort of both the public and private sectors. The first largest of these was set up in 1990s, a parastatal cassava starch company located on the Zambian Copperbelt but failed to

pick up due to the collapse of government funding. Since then other firms have been set up in Malawi, Zambia and Mozambique for production of cassava-based starch, sweeteners and biofuels. Cargill, the world's leading manufacturer of food, has already set up 75,000-ton starch-to-sweetener plant in Nigeria (Cassava World Africa, 2014).

2.4 Market Participation

Households can participate in the market from the demand side as buyers or from the supply side as sellers. Market participation is based on the optimization theory since households are rational and they aim at maximizing their utility subject to their budget constraint and non-tradable constraints (Burrett, 2008). Like any other profit-making business, farmer's decision to participate in the cassava market depends on the profit margins, meaning only those farmers who expect to benefit net of costs, from cassava farming will choose to participate in the cassava market. According to De Janvry *et al*., (1991); Goetz, (1992); and Key *et al*., (2000), many households fail to participate in the commodity market due to high transaction costs and market failure. In addition, high transaction costs and imperfect markets makes it costly to discover marketing opportunities and therefore, poor market access increases the cost of observing market prices leading to reduced household participation in the market (Enete and Igbokwe, 2009).

2.5 Commercialization of Cassava Farming

Farmers are considered to be commercialized when their production decision is aimed at markets and not when they participate in markets due to surplus production (Pingali and Rosegrant, 1995). Agricultural commercialization therefore involves farming with a sole aim of meeting market demand for either processed or unprocessed agricultural products (Abbott, 1987). Abbott (1987) further argues that, well developed markets facilitate commercialization

of subsistence farming and this is key in promoting economic growth as well as reducing poverty. Besides, farmers should sell the largest percentage of what they produce and use the income they get to purchase farm inputs and satisfy other needs in order for this to happen. Reardon *et al*. (2005) argues that economic growth has a counter-relationship with market participation, a perspective which Gebremedhin *et al*. (2010) maintains in their work that market participation links the output and input agricultural markets and this in turn spurs economic growth. According to Mathenge *et al*. (2010), market participation of small holder farmers with dismal harvests is low and these farmers are the poorest. Smallholder farmers who practice commercial oriented farming based on Jayne *et al*. (1995) argument, have improved welfare as a result of declining real food prices due to increased market competitiveness in agricultural markets. Market incentives, marketing information and market returns promote productivity for farmers who highly participate in agricultural markets (Brian and Barret, 2014)

In their study on Cassava commercialization in Southeastern Africa, Steven *et al*. (2012) found that only 10 percent of cassava produced annually in Zambian and Mozambican is marketed while the rest is used for on-farm consumption. Moreover, 70 percent of cassava produced in Malawi annually is used for on-farm consumption and only 30 percent is marketed. In contrast, cassava commercialization in Western Africa is high in both scale and composition. According to Phillips *et al*. (2004), more than 75 percent of cassava produced in Nigeria is marketed and more than a half of these is processed to *gari* which is sold as a pre-cooked urban convenience food. Therefore, commercialization of cassava farming differs from one country to another and from one region to another. This is because, commercialization depends on socio-economic factors and other support systems which differ from one country to another.

CHAPTER THREE

METHODOLOGY

3.1 Conceptual Framework

Most households in rural Kenya practice either subsistence or commercial farming or both. Cassava farming can also be practiced for either subsistence or commercial farming or both. Participation in cassava marketing value chain is therefore a choice but such a decision is pegged on the social, economic, farm-specific and institutional factors as shown in figure 3.1 below.

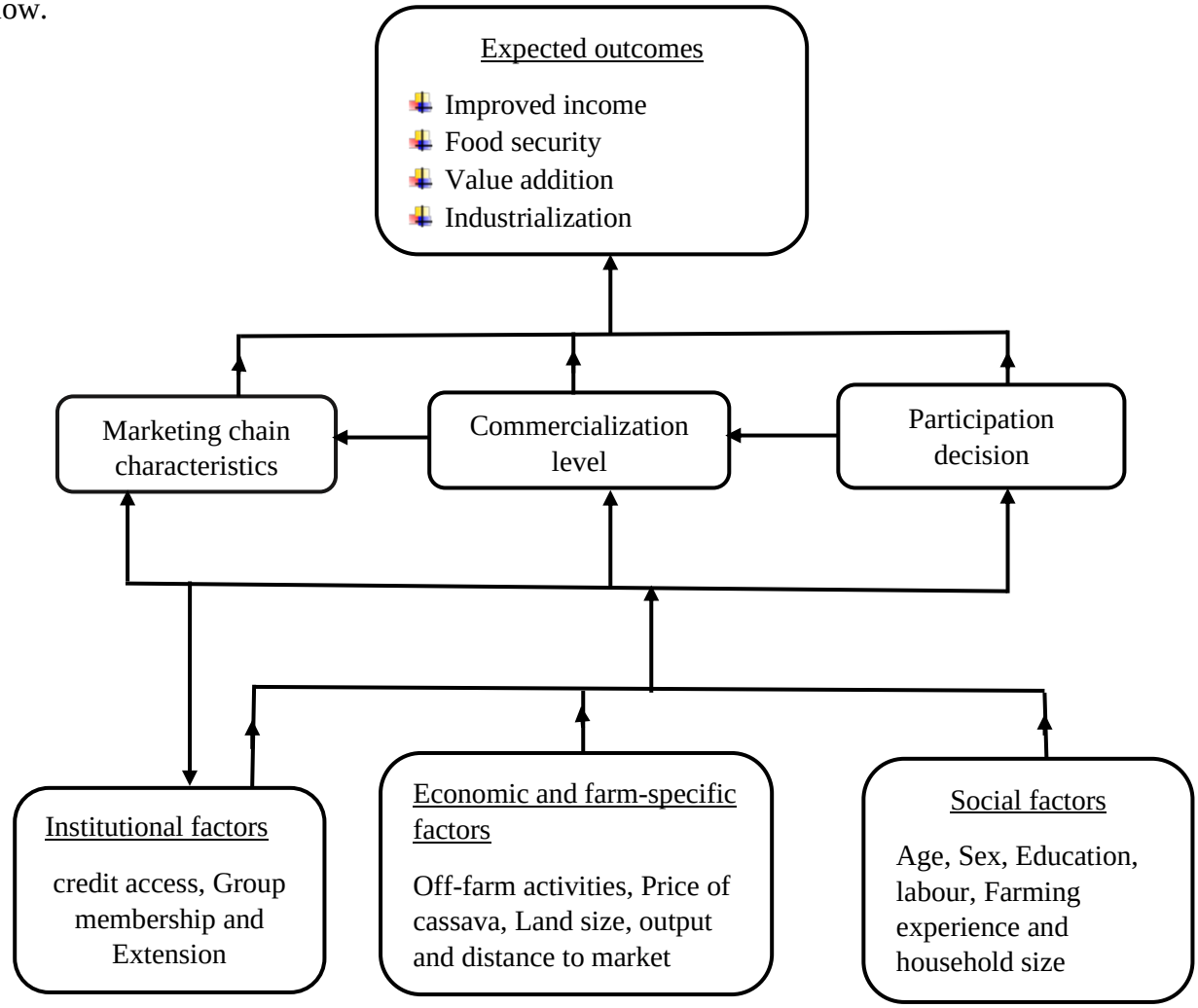


Figure 3.1: The Conceptual Framework
Source: Author

Figure 3.1 above shows the interaction among different variables along the cassava marketing value chain that lead to given outcomes. Smallholder farmers' participation decision and level of commercialization as well as the marketing value chain characteristics, depend on the social, economic and institutional factors. Furthermore, there is an interdependent relationship between the institutional factors and the marketing value chain characteristics, the level of commercialization and market participation. On the other hand, the marketing value chain characteristics depends on the level of commercialization which in turn depends on the market participation decision.

The decision by smallholder farmers to participate in a well characterized cassava marketing value chain at a given commercialized level results into improved income, food security, value addition and industrialization. Therefore, fulfillment and coordination of all these characteristics is key in the achievement of the desired outcomes.

3.2 Theoretical Framework

This study is anchored on the decision theory which is concerned with the goal-oriented behavior of human beings in presence of options (Sven Ove, 2005). This implies that, the decision-making process aims at reaching certain goals and since human beings are rational in nature, they tend to maximize their utility when faced with different options. The decision theory is therefore, concerned with the reasoning underlying an agent's choices (where an agent is an entity, usually an individual person, that is capable of deliberation and action) (Steele *et al*., 2015). According to Brim *et al*. (1962), the decision process can be subdivided into five steps including; identifying the problem, acquiring information, suggesting different solutions, evaluation of the solutions, and selecting the best performance strategy. Therefore, the decision to take a given alternative solution is based on individual preference and choice. Furthermore, making a decision or choosing between options involves trying to get the best outcome

according to one's own or given standards. The theory assumes that choices are based on moral philosophy which sets the decision-making value standard (Sven Ove, 2005). In addition, decisions are made under either of the three broad conditions of certainty, risk and uncertainty (Bradley, 2014).

Smallholder farmers may choose either to participate in cassava farming or not. Those who choose to participate in cassava farming, have to decide whether to farm for subsistence or commercial purposes or both and the quantity sold to the market. Producing cassava for commercial purposes depends on land allocation, input use, crop maintenance and quantity produced. Farmers producing for commercial purposes also decide on the level of commercialization and the channels they use to deliver their product to the market. Farmers make all these decisions based on their preferences and utility maximizing principles.

3.3 Empirical Framework

Objective 1 on characterizing the cassava marketing value chain was analysed using descriptive statistics. Therefore, it mainly involved mapping the cassava marketing channels and describing the cassava marketing value chain from the point of production to the point of final consumption.

Objective 2 on assessing the determinants of participation decision in cassava marketing was analysed using a Probit model. However, the Logit model could also be used in this case since both are binary outcome models. A household may decide either to participate in the cassava market or not to participate. The household may also decide to participate in the market from the supply side (selling) or the demand side(buying).

Salisu (2016), describes the difference between the Probit and the Logit model and states that binary outcome models are used to estimate the probability that Y=1 as a function of the independent variables such that:

$$p = \mathrm{pr}\,[\mathrm{y} = 1|\mathrm{x}\,] = \mathrm{F}(\mathrm{x}'\beta) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(1)}$$

The difference between the Logit and Probit models is their functional forms i.e. $[\mathrm{F}(\mathrm{x}'\beta)]$. The functional form of the Logit model is the cumulative distribution function (cdf) of the logistic distribution such that:

$$\mathrm{F}(\mathrm{x}'\beta) = \wedge(\mathrm{x}'\beta) = \frac{e^{(\mathrm{x}'\beta)}}{1+e^{(\mathrm{x}'\beta)}} = \frac{\exp(\mathrm{x}'\beta)}{1+\exp(\mathrm{x}'\beta)} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(2)}$$

On the other hand, the functional form of the Probit model is the cumulative distribution function (cdf) of the standard normal distribution such that;

$$\mathrm{F}(\mathrm{x}'\beta) = \emptyset(\mathrm{x}'\beta) = \int_{-\infty}^{(\mathrm{x}'\beta)} \emptyset(z)\, dz \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(3)}$$

Both the Probit and Logit models are estimated using the maximum likelihood method, and the predicted probabilities are limited between 0 and 1 in both models. Therefore, both the Probit and Logit models can be applied in this case since the marginal effects from both models are almost identical. The only difference is with the coefficients due to the difference in functional forms of the *F* function such that;

$$\beta_{logit} = 1.6\,\beta_{probit} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(4)}$$

It is recommended that the Logit model be given priority to the Probit model where the independent variables, in a binary estimation, are too many since it would be difficult for the Probit model to converge.

However, this study adopted the use of the Probit model since other related studies have used the model to evaluate factors that influence farmers' market participation decision including; Musah *et al*., (2014); Abera G., (2009); Omiti *et al*., (2009); and Muricho *et al*., (2015).

CMPD = $\beta_0 + \beta_1 age + \beta_2 sex + \beta_3 educ + \beta_4 famlabor + \beta_5 landsize + \beta_6 offfarm + \beta_7 accesscred + \beta_8 distmark + \beta_9 membership + \beta_{10} extension + \beta_{11} markexp + \beta_{12} cassquantity + \beta_{13} famsize + \beta_{14} SP + \varepsilon i$

Where ***CMPD is Cassava Market Participation Decision***

Objective 3 on analyzing factors that influence the level of commercialization among smallholder cassava farmers was analysed using an Ordered Probit model. Before running an Ordered Probit model, a Household Commercialization Index (HCI) was calculated and used to categorize farmers into four groups indicating their market participation and level of commercialization. These groups include; none participants, low level participants, medium level participants and high participants. The HCI ranges from zero to one and it measures how a farmer is market oriented. Different studies including; Abera G., 2009; Florence *et al*., 2017; Muricho *et al*., 2015; Musah *et al*., 2014; Martey *et al*., 2012; and Omiti *et al*., 2009; have used the HCI to categorize different farmers into different commercialization levels. The general assumption is that, the closer to one the index is, the greater the farmer is market oriented and therefore a higher market participation. Farmers with index value zero are said to be non-market participants, farmers with index value between 0.01 to 0.25 are said to be low level market participants, farmers with index value between 0.251 to 0.50 are said to be middle level market participants while farmers with index value above 0.50 are said to be high level market participants.

$$\boldsymbol{HCI = \frac{Gross\ value\ (Quantity) of\ cassava\ sales}{Gross\ value\ (Quantity) of\ all\ cassava\ produced}}$$

CCL = $\beta_0 + \beta_1 age + \beta_2 sex + \beta_3 educ + \beta_4 famlabor + \beta_5 landsize + \beta_6 offfarm + \beta_7 accesscred + \beta_8 distmark + \beta_9 membership + \beta_{10} extension + \beta_{11} markexp + \beta_{12} Cassquantity + \beta_{13} famsize + \beta_{14} SP + \mu i$

Where ***CCL is the Cassava Commercialization Level***

Green *et al.* (2009) describes the Ordered Probit model and states that, the categorical outcome y_i of the Ordered Probit, is related to the latent variable specified as;

$$y_i^* = x'_i\beta + e_i \quad \text{..... (5)}$$

The latent variable y_i^* is not observable but is only known when it crosses a certain threshold such that;

$$y_i = j \text{ if } \alpha_{j-1} < y_i^* \leq \alpha_j \text{..... (6)}$$

Therefore, the commercialization categories can be observed as follows;

$$y_i = 1 \text{ if } \alpha_0 < y_i^* \leq \alpha_1 \text{..... (7)}$$

$$y_i = 2 \text{ if } \alpha_1 < y_i^* \leq \alpha_2 \text{..... (8)}$$

$$y_i = 3 \text{ if } \alpha_2 < y_i^* \leq \alpha_3 \text{..... (9)}$$

$$y_i = \text{J if } \alpha_j < y_i^* \text{..... (10)}$$

The functional form (*F)* of the Ordered Probit is the cumulative distribution function (cdf). The probability that observation *i* will select alternative *j* can be presented as;

$$p_{ij} = p(y_i = j) = p\left(\alpha_{j-1} < y_i^* \leq \alpha_j\right) = F(\alpha_1 - x_i'\beta) - F\left(\alpha_{j-1} - x_i'\beta\right) \text{..... (11)}$$

Table 3.1: Definition of Variables in the Model

Variable	Variable name	Unit of measurement	Expected sign
Dependent variable			
CMPD	Cassava Market Participation Decision	1=participate, 0=otherwise	NA
CCL	Commercialization Level	Levels 1,2,3,4	NA
Independent variable			
Age	Age of the farmer	Years	+/-
Sex_HH	Sex of household head	1=male, 0=otherwise	+
Sex_farmer	Sex of the farmer	1=male, 0=otherwise	+
Educ	Number of years in school	Years	+
Famlabour	Number of people engaged in the family farm	Count	+
Land size	Size of land under cultivation of farm	Acres	+
Off-farm	Off farm activities	1=participate, 0=otherwise	-
Cassquantity	Quantity of cassava produced	Kg	+
Accesscred	Access to credit	1=participated, 0=otherwise	+
Distmark	The distance to nearest market in kilometers	KM	-
Membership	Cooperative or Group membership	1=member, 0=otherwise	+
SP	Selling price per Kilogram	Sh./Kg	+
Extension	Number of extension visit/year	Count	+
Experience	Number of years engaged in cassava production	Years	+
House size	Number of members of household	Count	-
Purpose	Main reason for growing cassava	1=income, 0=otherwise	+
Seed buying	Frequently buy planting seed	1=Buy, 0=otherwise	+
Pest Management	Manage pests on cassava	1=manage, 0=otherwise	+
Cassava area	Area under cassava	Acres	+

3.4 Study Area

Taita Taveta and Kilifi counties are located at the coastal parts of Kenya as shown in figure 3.2. Taita Taveta county covers a geographical area of 17,083.9 km^2 of which 62 percent is within Tsavo East and Tsavo West National Parks. The remaining 38 percent is occupied by ranches, wildlife sanctuaries, sisal estates, water bodies, hilltop forests and it is also used for residential purposes and other human activities. The county's altitude ranges from 500 m to 2,228 m above sea level and has a population of approximately 274,828 persons with a population density ranging between 3 to 800 persons per km^2 (KNBS and SID, 2013). The county has diverse terrain patterns with rainfall ranging between 440 mm per annum in low lands and 1900 mm per annum in the highland areas. Kilifi county on the other hand, covers a geographical area of 12,245.90 km^2 and it is a home of approximately 1,109,735 people according to the 2009 National census (KNBS, 2009). The temperatures of the county range between 21°C during the coldest months (June and July) and 32°C during the hottest months (January and February). It has two rainy seasons; April to June (long rains) and October to December (short rains) with annual rainfall ranging between 900mm and 1000mm per annum.

Taita-Taveta county has a diverse land terrain and both Taita-Taveta and Kilifi counties are semi-arid areas. Residents of these two counties are therefore, frequently hit by hunger due to drought. On the other hand, cassava has been viewed as a solution to this problem due to its potential of doing well where other crops have failed and in different agroecological zones (YPARD, 2014). Little is documented about cassava production in the study area. However, the study area is within the coastal region which is second in production and consumption of cassava in Kenya after the western region.

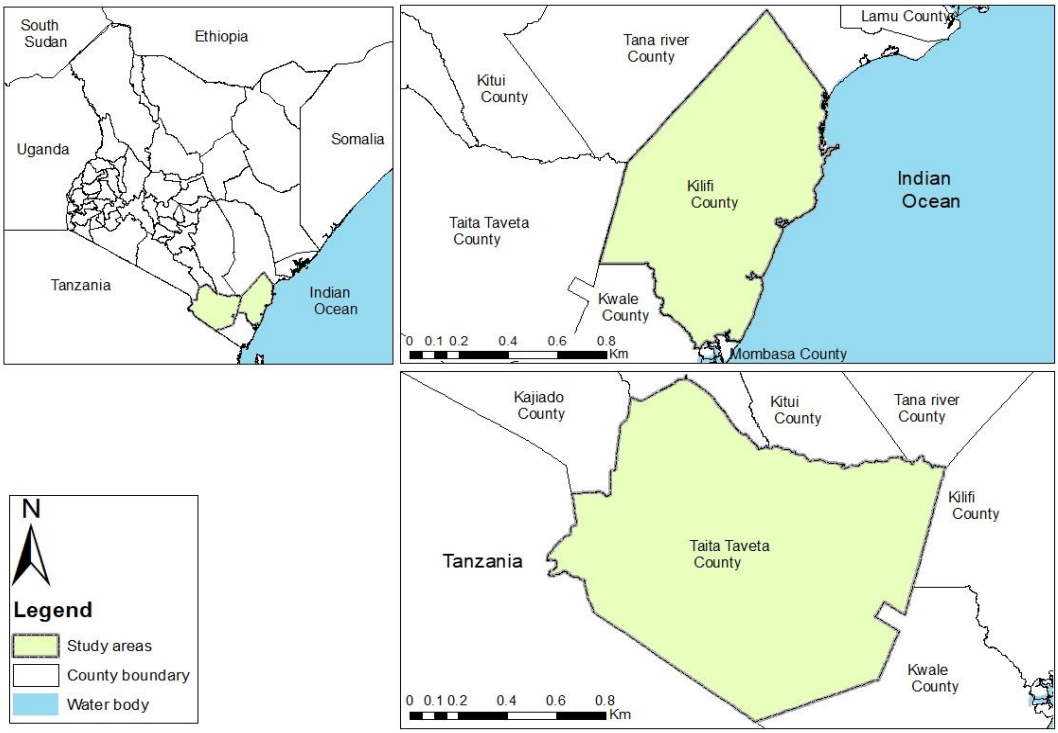


Figure 3.2: The Study Area
Source: IEBC (2018)

3.5 Target Population

This study targeted all cassava farming households in Taita Taveta and Kilifi counties and also cassava traders in main cassava market places at the Kenyan coast. The study focused on cassava market actors including cassava farmers, bulkers, wholesalers, retailers, and processors. According to the KNBS (2009) report, Kilifi county has 199,764 households. The county has three sub-counties namely Kilifi North with 83,752 households, Kaloleni with 42,692 households and Malindi with 73,330 households. On the other hand, Taita Taveta county is divided into two sub-counties namely Mwatate and Taveta, and the county has a total of 71,090 households. Mwatate has 54,732 households while Taveta has 16,358 households. The main market places that the study targeted include; Kongowea, Marikiti, Mama Ngina Likoni, Majengo, Mtwapa, Kilifi town, Mbololo, Mwatate, old Voi, New Voi (Caltex), Bura, Gange, Wundanyi, Chumvini, old Taveta and new Taveta markets.

3.6 Sampling Procedure and Sample Size

This study purposefully targeted cassava farmers at the Kenyan Coast and therefore, employed a multi-stage sampling procedure. Kilifi and Taita Taveta counties were purposively selected due to increased cassava production in the two counties and their strategic location as well as their farming patterns. In Kilifi county, Kaloleni and Kilifi North sub-counties were purposively selected due to there proximity to major market centers while the whole of Taita-Taveta county was involved in the study due to its diverse terrain pattern and the sparse population. Cassava farming households from the selected areas to participate in the study were selected using systematic random sampling method.

According to Israel Glenn (1992); Singh and Masuku (2014); there are four different ways of determining a sample size which include; carrying out a census for finite and small populations, using tested and published tables, imitating sample sizes of other related or similar studies, and using determined formulae to calculate a sample size. Therefore, this study determined the sample size by imitating sample size used in similar/related studies hence total of 250 households were sampled from both counties. The other related studies which have used sample size equal to or close to this include; Florence *et al*., 2017; Kehinde and John, 2015; Martey *et al*., 2012; Musah *et al*., 2014.

On the other hand, purposive sampling was used to select the main cassava market places at the coast. The selected markets were thereafter used as strata and therefore, all the cassava traders in these markets were taken as part of the sample. Based on the sample sizes used in different related marketing studies, including (Gilbert, 2014; Nsikan *et al*., 2013) a sample size of 110 traders was reached.

3.7 Data Collection Techniques

Focus Group Discussion (FGD) with different stakeholders along the cassava value chain was contacted prior to the baseline survey. The FGD was focused on cassava production, cassava value added products and cassava markets. Information obtained from focus group discussion was used to inform study results in addition to adjusting the baseline survey question.

During the baseline survey, semi-structured questionnaires were used to collect data on traders and household characteristics, institutional support services, asset ownership and marketing information. The questionnaires were administered face to face, to the respondents by enumerators. Moreover, different observations were made during data collection.

3.8 Data Analysis Instruments

Data from questionnaires was captured in SPSS and Stata software for analysis. The first objective on characterizing the cassava marketing chain was analysed using descriptive statistics and this included mapping the cassava/ cassava products marketing channels.

Similarly, the second and third objectives on participation and commercialization respectively, were analysed using econometric models. Selected socio-economic characteristics were run in both SPSS and STATA to estimate their effect on participation and commercialization respectively. Data from focus group discussion was also analysed qualitatively when informing study results.

3.9 Diagnostic Tests

In order for the analysis to be valid, any model used has to satisfy given assumptions. In case the assumptions are not met, some of the problems that may be encountered include; biased coefficient estimates or large standard errors which lead to invalid statistical inferences. In this

study, a number of diagnostic tests were done to help identify any problem that may have caused the model not to run effectively or whether the models used were correctly specified.

3.9.1 Specification Test

This was conducted to confirm whether the probability functions of the two models were correctly specified. The model is correctly specified if '_hat' is statistically significant and '_hatsq' is not (Salisu, 2016). According to the link test results in Appendix 1, both Binary and Ordered Probit models used in this study were correctly specified.

3.9.2 Multicollinearity Test

Multicollinearity occurs where there is a high degree of linear dependency among explanatory variables. This results to coefficients with high standard errors and with few significant variables hence inaccurate estimates (Greene, 2000). Multicollinearity is tested using the Variance Inflation Factor (VIF) and according to Gujarati (2004) and Salisu (2016), any variable with a VIF greater than 10 signifies presence of multicollinearity. The results of the VIF in Appendix 2 show no presence of multicollinearity for the variables included in the model and the average VIF for the Binary Probit and Ordered Probit was 1.35 and 1.48 respectively. The results of the Pearson Correlation Test in Appendix 2 show that the correlation among the independent variables used in the models is not significant. This implies that the variables meet the assumption as required and therefore fit for inclusion in the model.

3.9.3 Heteroscedasticity Test

Heteroscedasticity occurs when the variance of the error term is not constant across observations. However, the variance of the error term is expected not to vary across observations. Therefore, the Breusch-Pagan test was carried out to determine the variance of

the error term (Wooldrige, 2010). The results in Appendix 3 show that, the Breusch-Pagan test for the Binary Probit model was significant and therefore, the null hypothesis that the error term had constant variance across observations was rejected. Therefore, robust standard errors were used in the model to counter the problem of heteroscedasticity. On the other hand, the Breusch-Pagan test for the Ordered Probit model was not significant and therefore, the null hypothesis that the error term had constant variance across observations was not rejected.

3.9.4 Assessing the Goodness of Fit

The goodness of fit test is applied when testing if sample data fits a distribution from a given population. According to Hosmer and Lemeshow (2000), the aim of any overall goodness-of-fit test is to assess whether the fitted model adequately describes the observed outcome experience in the data. Therefore, it's concluded that a model fits well if the differences between the observed and fitted variables are small and if there is no systematic contribution of the differences to the error structure of the given model. Thus, goodness-of-fit tests are usually general tests that evaluate the fitted model's overall departure from the observed data.

The goodness of fit of a model can be assessed using the R^2 and the significance of joint probability. The R^2 results presented in Appendix 4 show that both the Binary Probit mode and the Ordered Probit model were good in demonstrating the relationship between the explanatory and explained variables. Furthermore, Hosmer-Lemeshow test (HL test/ Lfit test) which computes if the observed and the expected event rates in population subgroups match, was used to test for the goodness of fit of the Probit model. The results of the HL test are presented in Appendix 4 and show that the Probit model is a good fit with a P-value of 76 percent.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Socio-Economic and Institutional Characteristics of Cassava Farming Households

Understanding the social, economic and institutional characteristics of smallholder farmers is important since these characteristics greatly influence their decision-making process. Table 4.1 shows different socio-economic characteristics of cassava farming households at the Kenyan Coast. The study involved those farmers that participate and those that do not participate in cassava produce marketing. According to table 4.1, majority of the respondents were market participants at 72 percent for the overall sample which accounted for 84 percent from Kilifi county and 60 percent from Taita-Taveta county. The difference in the proportions of market participants between the two counties is a clear indicator that, more cassava farmers from Kilifi county are involved in cassava marketing as compared to those from Taita-Taveta county.

Table 4.1 Socio-Economic Characteristics of Households by Market Participation

Characteristic		Pooled Data			Kilifi County			Taita-Taveta County		
		Mrkt Participant (n = 180)	Non-mrkt Participant (n = 70)		Mrkt Participant (n = 103)	Non-mrkt Participant (n = 19)		Mrkt Participant (n = 77)	Non-mrkt Participant (n = 51)	
		Mean (SD)	**Mean (SD)**	**t-test**	**Mean (SD)**	**Mean (SD)**	**t-test**	**Mean (SD)**	**Mean (SD)**	**t-test**
Yrs of School		6.03 (4.57)	8.54 (3.78)	4.08***	4.88 (4.59)	7.58 (3.69)	2.42**	7.57 (4.08)	8.90 (3.79)	1.86*
Farmer's Age		47.99	50.61	1.28	47.78	46.58	-0.31	48.27	52.12 (14.66)	1.59
		(14.51)	(14.73)		(15.92)	(14.55)		(12.49)		
House size		6.55 (2.81)	6.94 (3.3)	0.94	7.22 (3.05)	7.89 (4.23)	0.82	5.65 (2.14)	6.59 (2.99)	2.07**
Farm Size		3.59 (4.64)	3.22 (2.98)	0.62	3.49 (4.09)	3.61 (3.14)	0.12	3.72 (5.30)	3.07 (2.93)	0.8
Years of Exp		8.94 (6.85)	8.01 (5.43)	-1.02	7.97 (7.24)	6.63 (5.49)	-0.77	10.25 (6.1)	8.53 (5.37)	-1.64*
LogQ_ harvest		7.33 (1.31)	5.64 (0.82)	10.01***	7.69 (1.19)	6.15 (0.79)	-5.40***	6.84 (1.32)	5.44 (0.75)	-6.83***
Dist to Mrkt (KM)		7.93 (3.93)	12.28 (2.94)	8.37***	6.67 (3.82)	12.32 (2.47)	6.20***	9.62 (3.44)	12.26 (3.12)	4.41***
		Percentage		χ**2** -value	**Percentage**		χ**2** -value	**Percentage**		χ**2** -value
Sex of HoH	Male	67.49	32.51	10.91***	82.47	17.53	1.37	53.77	46.23	10.48***
	Female	91.49	8.51		92.00	8.00		90.91	9.09	
Ext Services	Yes	93.14	6.86	38.18***	92.42	7.58	7.00***	94.44	5.56	24.57***
	No	57.43	42.57		75.00	25.00		46.74	53.26	
Credit Access	Yes	90.74	9.26	12.00***	94.87	5.13	4.76**	80.00	20.00	4.76**
	No	66.84	33.16		79.52	20.48		57.52	42.48	
off-farm activ	Yes	71.91	28.09	0.00	76.74	23.26	2.98*	67.39	32.61	1.57
	No	72.05	27.95		88.61	11.39		56.10	43.90	

***, **, and * are significant levels at 1%, 05% and 10% respectively
Source: Survey Data (2018)

There was an overall significant difference in the average years of schooling between the market participants and non-market participants at the coast and more so, in Kilifi county than in Taita-Taveta county. Non-market participants have a higher level of formal education than the market participants. The higher level of education among the non-market participants is attributed to the fact that they allocate more of their time in doing other off-farm income generating activities in line with their profession.

The mean household size was found to be significantly different between market participants and non-market participants in Taita-Taveta county only. Non-market participants had a bigger household size as compared to market participants in the county. A bigger household size means more people to feed and therefore the cassava produced is only used for home consumption as the household size increases and no surplus for marketing.

The difference in average years of farming experience between market participants and non-market participants was only significant in Taita-Taveta county. Market participants had more experience in cassava farming than non-market participants and therefore were more informed on different aspects of cassava farming. Experience comes along with trial and error experimentation on different varieties, knowledge on different market channeling and thereafter value addition. According to Egbetokun (2012), an increase in years of farming experience increases smallholder farmers' market orientation.

The average quantity harvested was found to significantly differ between market participants and non-market participants. Farmers that participate in the market harvest larger amounts as compared to those who don't participate in the market. This is a clear indicator that those farmers who participate in cassava marketing have allocated more resources to cassava production as compared to those who do not participate in cassava marketing since the results also show that there is no difference in land size owned by the two groups.

The overall average distance from farms of non-market participants to the nearest market, was found to be significantly longer than the average distance from farms of market participants to the nearest market. Longer distances to the nearest market mean higher production and transaction costs for participating in cassava marketing and therefore leading to lower returns. This is consistent with the results of Ouma *et al*. (2010), who found out that increase in time taken by smallholder farmers to reach the nearest market, reduces their probability to participate in marketing. In addition, Ouma *et al*. (2010) argues that, farming households located in remote areas have poor market access leading to increased transaction costs in terms of marketing, transport and information costs.

Results in table 4.1 also show an overall significant difference in proportion of the sex of head of households between market participants and non-market participants and more so in Taita-Taveta. Generally, most household at the coast are male headed (KNBS and SID, 2013) but to the contrary, a larger proportion of cassava farming female headed households participate in cassava marketing as compared to male headed households. This means that, female headed households are more likely to participate in cassava marketing than male headed households.

The proportion of extension services received between market and non-market participants is also significantly different in the two counties and therefore when the data is pooled. A higher proportion of market participants receive extension services from different sources (research institutions, NGOs, Extension officers, other farmers) as compared to non-market participants. Provision of extension services means an increase in knowledge about the subject matter and therefore increase in efficiency of production.

Table 4.1 shows a significant difference in the proportion between market and non-market participants who have access to credit. Farmers from both Kilifi and Taita-Taveta counties who participate in cassava marketing have a higher access to credit services as compared to non-

participants. The overall proportion in the region shows a more significant difference in credit access at the coast between market participants and non-market participants thus a higher access to credit services by market participants in the region.

The difference in proportion between market and non-market participating farmers who engaged in off-farm activities was significant in Kilifi county only. A larger proportion of farmers who don't participate in cassava marketing, participate in off-farm activities as compared to market participants. This means that farmers who have other income generating activities other than farming, are forced to allocate some of their time in carrying out those activities and therefore are unlikely to participate in cassava marketing.

On the other hand, there were no significant differences in average age nor size of land among market participants and non-market participants. This means that, both groups of farmers who participate or don't participate in cassava marketing have almost similar age and farm size on average.

4.2 Socio-Economic Characteristics of Cassava Traders

Different marketing chains have different intermediaries who exhibit unique socio-economic characteristics. Table 4.2 presents descriptive statistics results for 105 traders along the cassava marketing chain that were sampled for the study. The average age of traders was 41 years where the oldest was 71 years while the youngest was 22 years of age. The mean years of formal education was 7- years, implying that most of the traders had attained primary school level of education.

Table 4.2: Socio-Economic Characteristics of Cassava Traders

Characteristic	Mean	Std. Dev.	Min	Max
Age of trader	41.06	11.17	22.00	71.00
Years of schooling	7.07	4.36	0.00	16.00
Buying Price - Kg of fresh tubers	32.75	5.10	20.00	50.00
Distance to the source of cassava	19.70	29.29	0.00	140.00
Years of experience	9.34	8.00	0.10	30.00
Selling Price - Kg of fresh tubers	51.95	5.97	45.00	80.00
	Freq.	**Percentage**		
Sex – Male	32.00	30.48		
Buy from – Farmer	53.00	50.48		
credit access – Yes	48.00	45.71		
Purchases - Fresh tubers	99.00	94.29		
Sells - Fresh tubers	82.00	78.10		

Source: Survey data (2018)

The results in table 4.2 further show that the average buying price of a kilogram of fresh cassava tubers for resale was Ksh. 32.75 while the minimum buying price and maximum buying price was KSh. 20 and KSh. 50 respectively. On the other hand, the average selling price of a kilogram of fresh cassava tubers was Ksh. 51.95 while the minimum selling price and maximum selling price were KSh. 45 and KSh. 80 respectively. The results also show that, the average distance a trader moves to go and source cassava products for resale is 20 KM while the average years of cassava trading experience was 9 years. Most of the traders (70 percent) sampled were female implying that cassava marketing is dominated by the female.

About 51 percent of cassava traders buy their products directly from the farmers while the rest buy from other traders or middlemen. Also, only 45 percent of traders in the sample had access to credit services and the credit was mostly from informal sources. Table 4.2 also shows that about 94 percent of cassava traders purchase fresh cassava tubers for commercial purposes and about 78 percent of the traders resale fresh tubers implying that there is little value addition in cassava marketing.

4.3 Characterizing Cassava Marketing Value Chain in Taita-Taveta and Kilifi Counties

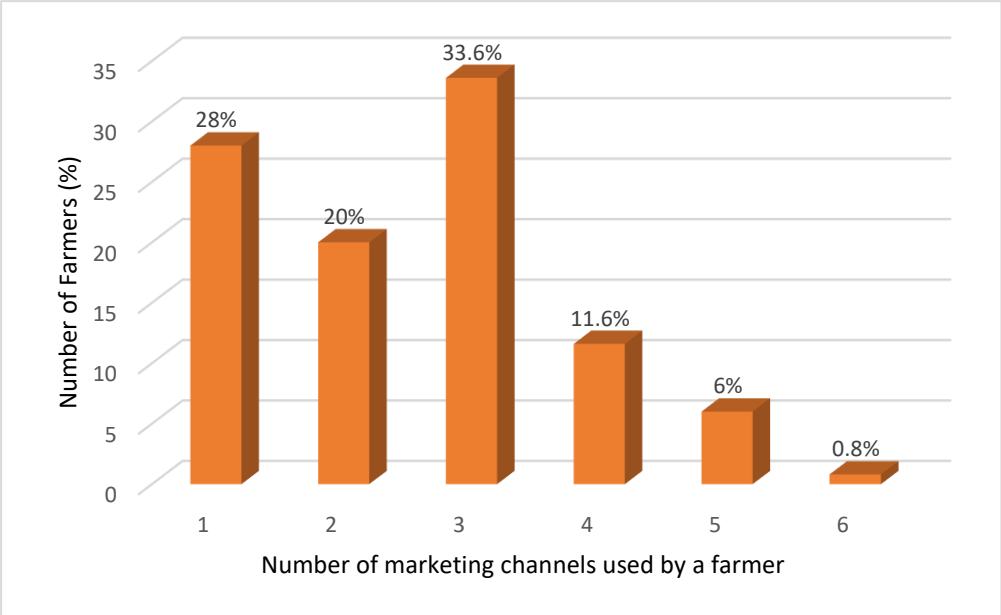
Fresh cassava is bulky and perishable in nature and therefore value addition is key to increase its value, shelf life and ease of transportation. Cassava can be processed into different products for both human and animal consumption, and industrial use. The different products dictate the marketing channels used to distribute the product. For example, fresh cassava tubers are more likely to be distributed using short marketing channels while cassava flour may be distributed using long marketing channels.

4.3.1 Mapping the Cassava Marketing Channels

Different cassava products along the cassava marketing chain take different channels from the point of production through to the point of final consumption. Figure 4.1 presents the number of marketing channels that different cassava farmers at the coast use to sell their products. Farmers may channel their products directly to the consumer or through bulkers, wholesalers, retailers, processors or even consume the products at home. The results show that majority of the farmers (72 percent) use at least two marketing channels to sell their produce to the market.

This is because, fresh cassava tubers are perishable and therefore farmers would want to sell them as fast as possible through all the available channels.

Figure 4.1: Number of Marketing Channels Used by Farmers



Source: Survey data (2018)

On the other hand, Figure 4.2 presents the marketing channels of different cassava products at the Kenyan Coast. Different actors along the value chain perform different activities to create value for the products and maximize their utility. The results in figure 4.2 show how different actors along the cassava value chain are organized to ensure a smooth flow of products from their point of production to the point of consumption. The discussion of the cassava marketing channels in figure 4.2 adopts the approach of Steven *et al*. (2012) in their study on Cassava Commercialization in Southern Africa.

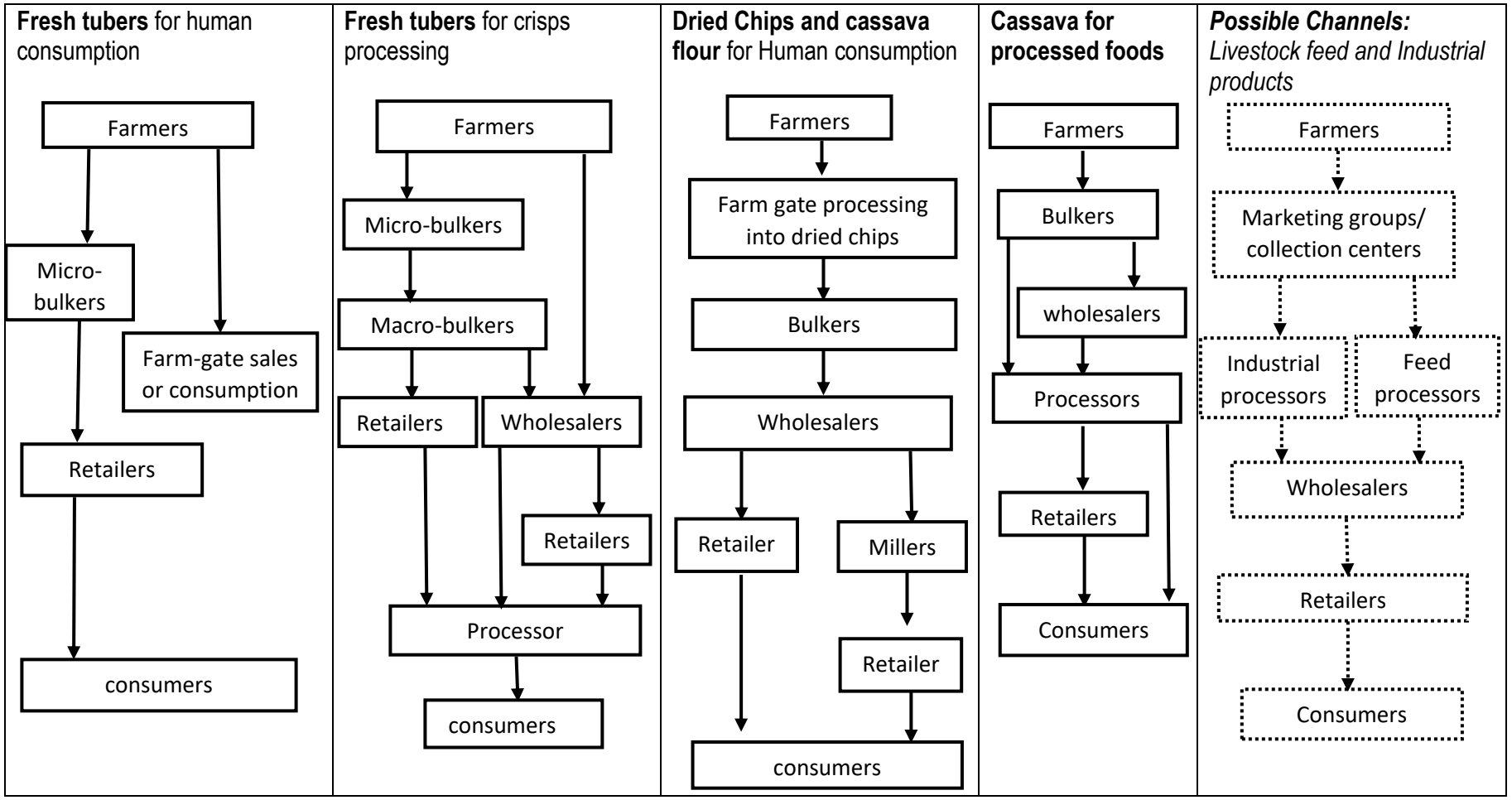


Figure 4.2: Cassava Marketing Channels
Source: Survey data (2018)

Channel 1. Farm Household Consumption of Cassava

Cassava tubers can be consumed at the farm household level after processing or in small amounts in raw form as they have high cyanide content. Results in Figure 4.3 shows that, cassava is grown for both subsistence and commercial purposes at the Kenyan coast and 100 percent of the farming households consume cassava at the farm household level despite the majority of the households (72 percent) commercializing it. The results show that, 16 percent of cassava farmers in Kilifi County, 40percent in Taita-Taveta County and 28 percent at the Kenyan Coast farm cassava for household consumption only. This result is in line with that of George *et al*. (2016), who found out that all cassava farmers at the coast consume cassava at farm household level and majority of the farmers sell cassava products as well.

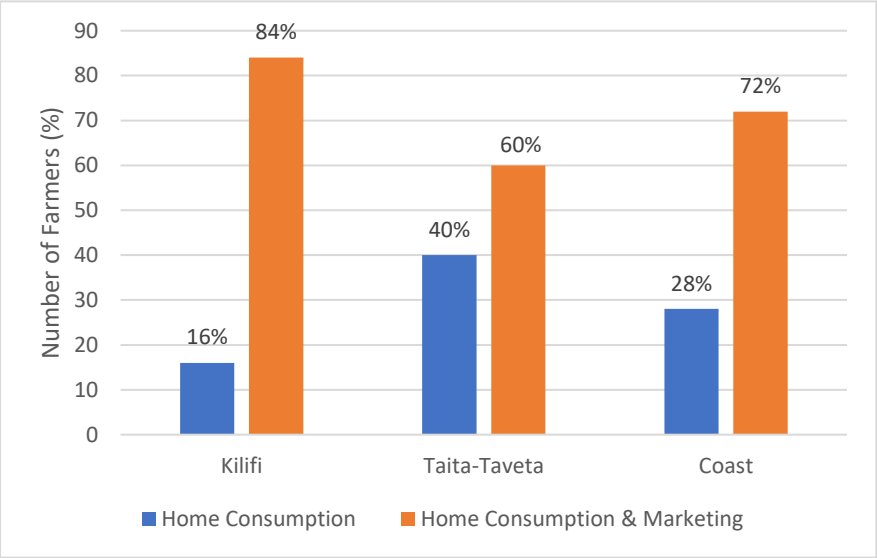


Figure 4.3: Cassava for Home Consumption and Marketing
Source: Survey data (2018)

Channel 2. Fresh Cassava Marketing

The shelf life of fresh cassava is only three days after harvesting. Therefore, marketing of fresh cassava tubers is viable in high-concentrated market settings where transportation costs are low and the distances from farms to the market are short. However, fresh cassava marketing can only be enhanced by developing different technologies to increase the shelf life of fresh cassava

tubers. The results in figure 4.4 show that 92 percent of cassava farmers who participate in cassava marketing at the Kenyan coast market fresh cassava while 78 percent of cassava traders sell fresh cassava. This result corresponds the findings of IITA/SARRNET (2003), that fresh cassava account for majority of cassava markets in Malawi but the markets were growing at a very slow rate due to long distances from cassava farms to urban markets. Similarly, Milcah *et al*. (2013), found that 10 percent of cassava farmers who engage in entrepreneurial activities in Nakuru Kenya, market their fresh cassava tubers in raw form.

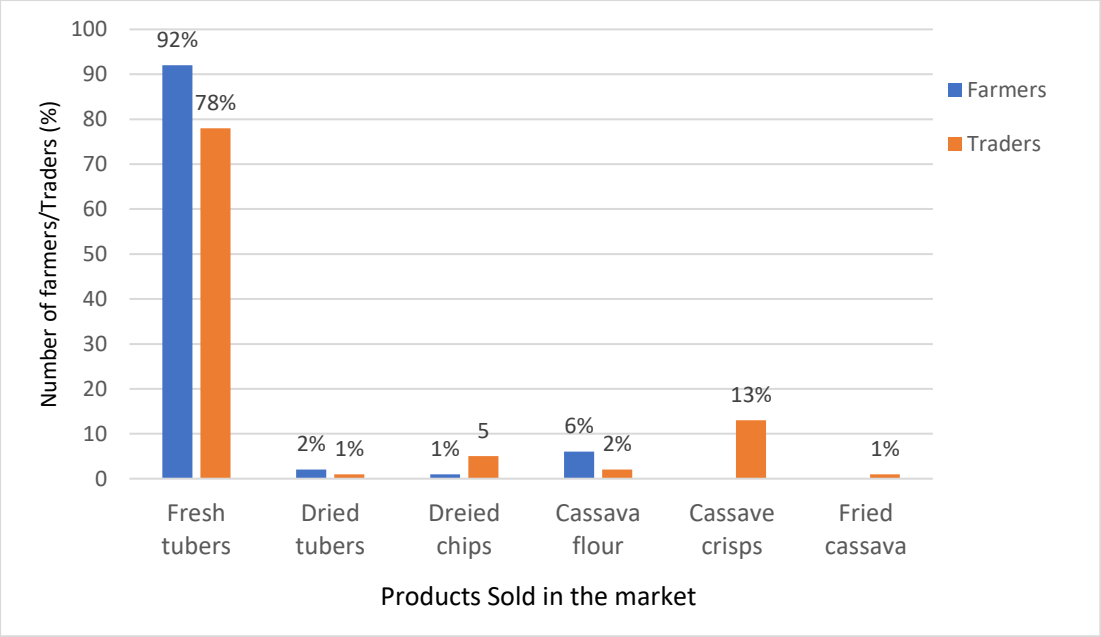


Figure 4.4: Cassava Products Sold by Farmers and Traders
Source: Survey data (2018)

According to focus group discussion, most farmers preserve fresh tubers by leaving them in the ground until they have a ready market for their produce. On the other hand, most traders have not developed technologies to preserve fresh tubers and therefore, only purchase tubers just enough to be resold within a period of two days. According to Meridian Institute (2010), fresh cassava can remain in the soil for quite some time after maturity. However, this method of storing cassava is ineffective and inefficient because the tubers can turn woody, lose their flavor, can be infected by pathogens and the practice renders the land unproductive.

Channel 3. Marketing of Dried Cassava Tubers and Flour

Fresh cassava tubers can be peeled and dried in form of dry cassava tubers or dry cassava chips which can later be milled into flour. According to the results in Figure 4.4, only 9 percent of farmers who participate in cassava marketing at the coast, marketed dried cassava tubers/chips or cassava flour. Similarly, only 8 percent of cassava traders at the coast marketed either dried cassava tubers/chips or cassava flour. This is a clear indicator that there is very little cassava value addition on fresh cassava tubers at the Kenyan coast and therefore the potential of cassava product portfolio diversification has not been met. This result concurs with that of George *et al*. (2016), who found that cassava flour and dried cassava chips are the most widely processed cassava products in Kenya and therefore the most widely marketed cassava products after processing.

Channel 4. Processed Foods

There are different methods applied in processing cassava to different food products. At the Kenyan coast, cassava is processed into foods like *ugali* (stiff porridge), porridge, crisps, chips, *kachiri* (fried cassava) and *Kimanga.* The results shown in figure 4.4 show that, the most processed and marketed food product at the coast is cassava crisps at 14 percent followed by *kachiri* at 1 percent only. According to focus group discussion, other processed food products like ugali, porridge and *Kimanga* are mostly processed in homesteads for household consumption. The cassava food processing industry is still underdeveloped and unexploited due to its low commercialization level, poor organization and lack of diversification into other cassava processed food portfolios like the confectionary and baking industries. According to George *et al*. (2016), cassava at the Kenyan coast is processed into food products like cassava chips, cassava crisps and half-cakes.

Channel 5. Livestock Feed

Figure 4.2 show that cassava marketing as a livestock feed is a missing channel at the Kenyan coast. There are no cassava feed processors at the Kenyan coast and according to focus group discussions, this channel is not established due to the small quantities and inconsistent supply of cassava. Similarly, the marketing system is disorganized due to lack of cassava marketing groups or collection centers which lead to diseconomies of scale for different traders. Cassava livestock feed products can be consumed either directly at the farm level or as processed products. Both the tubers and leaves of the cassava plant can be used as on-farm animal feed or as an ingredient in commercial animal feed. However, fresh cassava tubers or leaves should be fed to livestock in small quantities because of their high cyanide content. Spreading the feed on the floor overnight releases some of the cyanide by evaporation. The feed can also be sun dried to remain with up to 14 percent moisture content or fermented to make silage for future usage (Steven *et al*., 2012).

Channel 6. Industrial Products

The results in figure 4.2 show that cassava processing and marketing as an industrial product is a missing channel at the Kenyan coast. There is no company at the coast involved in production of cassava based industrial products. However, cassava starch production company had been established in Taita-Taveta county but later collapsed due to inadequate and inconsistent supply of cassava. Industrial production of cassava-based starch, sweeteners and biofuels in most cassava producing countries in the world has attracted both public and private interest (Steven *et al*. 2012).

4.3.2 Cassava Marketing Chain

A marketing chain is a component of the marketing channel and it shows different successive markets through which a product passes from the point of production to the final consumer. Figure 4.5 below shows the core of a marketing chain and a complex marketing chain showing the existing and potential cassava marketing value chains at the Kenyan coast. The cassava marketing value chain is important in describing how the exchange points along the entire value chain in the marketing system relate to each other.

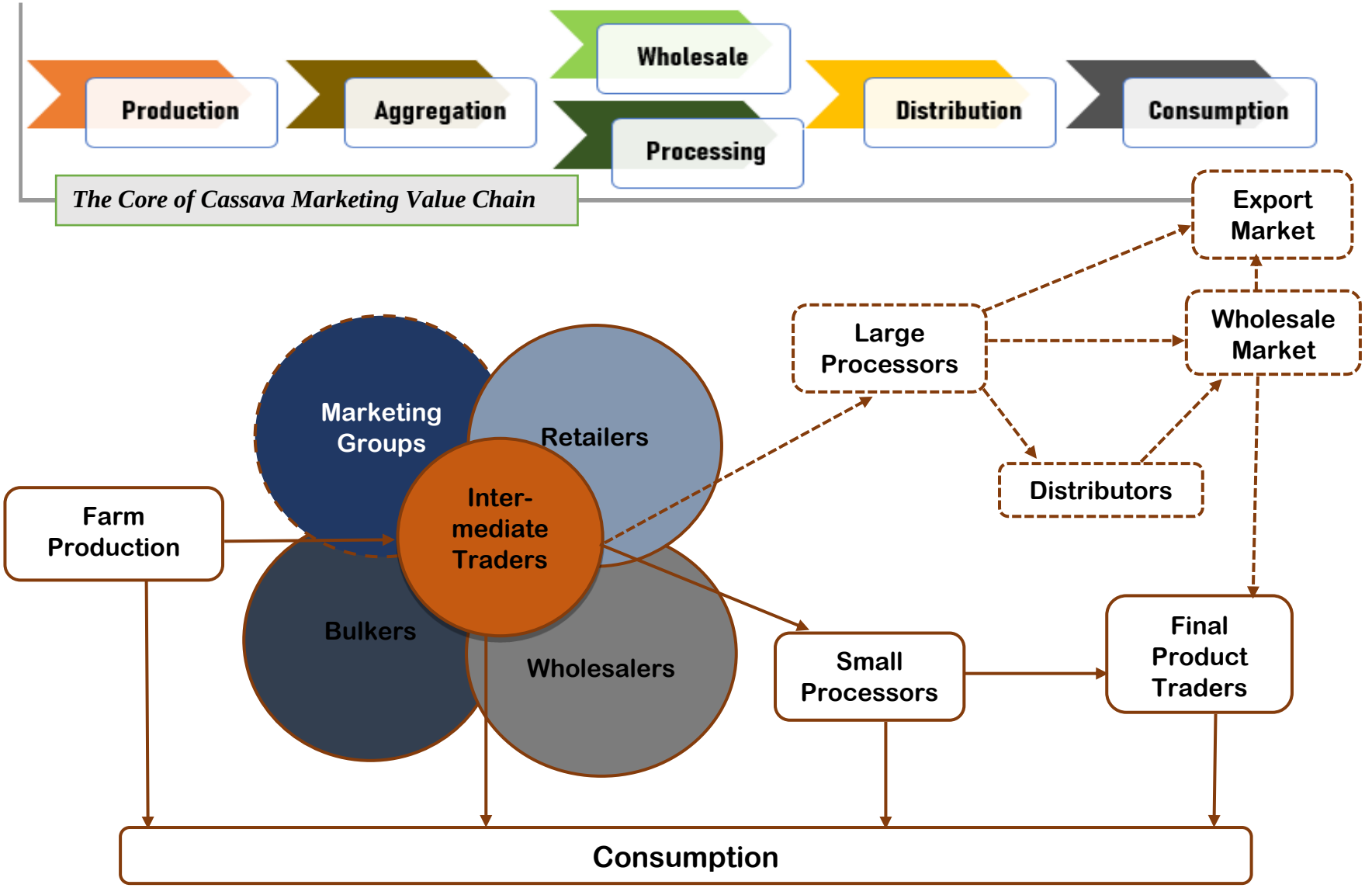


Figure 4.5: Cassava Marketing Value Chain
Source: Survey data (2018)

Figure 4.5 shows that the marketing of fresh cassava is strictly local and this is due to its perishability and low value to bulk ratio. According to the results, interactions between different actors, change of ownership and economic processes undertaken, gives different cassava products unique marketing value chains. Value addition of cassava through drying and processing increases its shelf-life making it possible for long distance marketing. This result is in line with that of Bukar *et al*. (2015) who argued that different products have their own unique value chains. Processing of cassava at the Kenyan coast is only done by small scale processors and therefore there is no exportation of cassava products. On the other hand, large processors are not involved in value chain due to poorly organized marketing system, inconsistent cassava supply and inadequate quantity supplies that cannot support large scale processing. According to Meridian Institute (2010), cassava is less much commercialized in the Eastern parts of Africa compared to the western parts of Africa implying that, cassava is majorly consumed in its fresh form or processed using traditional methods that varies from one country to another.

The marketing channels of cassava products are very dependent on value addition along the different cassava marketing chains. Many intermediaries result to many transactions which results to high costs and therefore a huge difference between prices paid at the point of production and at the point of final consumption. Results in table 4.2 show that the minimum buying price by traders per kilogram of fresh cassava tubers is KSh. 20 while the maximum selling price is KSh. 80. Figure 4.6 shows this process where production costs, transaction costs and marketing costs along the cassava marketing chain contribute to the price of the final product since every actor along the marketing chain wants to maximize their utility.

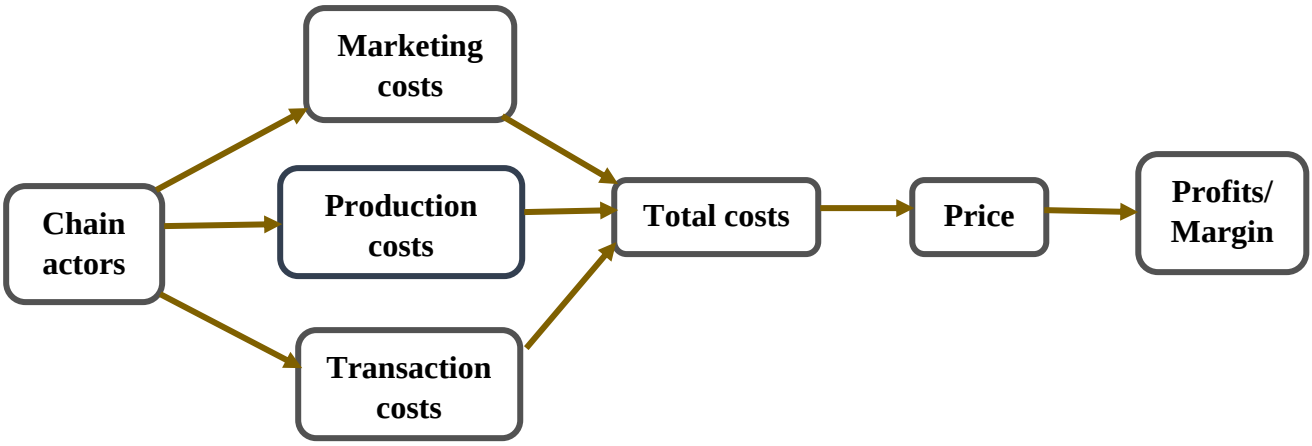


Figure 4.6: Utility Maximization Along the Cassava Marketing Value Chain
Source: survey data 2018

The results in figure 4.6 imply that, longer marketing chains means more intermediaries along the marketing system, each of whom is after maximizing their own utility. Similarly, an increase in the number of chain actors leads to a corresponding increase in the price paid for the final product due to an increase in either production costs, marketing costs, transaction costs or both (Thorbeeke, 1992). Therefore, a well-organized marketing system should have shorter marketing chains in order to reduce the difference in price between the point of production and final consumption. This in turn maximizes utility by increases both consumer and producer surplus.

4.4 Determinants of Participation Decision in Cassava Marketing

Most of the smallholder cassava farmers (72 percent) participate in cassava marketing implying that cassava is an income generating crop for most of the farmers. The farmers make the decision of either participating or not participating in cassava marketing based on their rational nature which is always geared towards maximize utility. However, the decision to participate or not participate in cassava marketing by any farmer is said to be influenced by either socio-economic or institutional factors. Table 4.3, shows different socio-economic and institutional factors, and how they influence smallholder farmers' decision to participate or not participate in cassava marketing. The marginal effects (dy/dx), have been used to interpret the magnitude of the effect where a significant unit change in the specified variable occurred.

Table 4.3: Probit Model Results for Determinants of Participation Decision in Cassava Marketing

	Pooled Data			Kilifi County			Taita-Taveta County		
Mkt_Part	**dy/dx**	**Coef.**	**Robust Std. Err.**	**dy/dx**	**Coef.**	**Robust Std. Err.**	**dy/dx**	**Coef.**	**Robust Std. Err.**
Sex_HoH	-0.12	-0.92***	0.37	0.01	0.15	0.55	-0.30	-1.83***	0.67
Yrs of schooling	-0.01	-0.07**	0.03	0.00	-0.08	0.05	-0.02	-0.07*	0.04
Credit Access	0.04	0.24	0.34	0.06	1.18**	0.57	0.04	0.16	0.48
Family Labor No.	0.01	0.04	0.07	0.00	0.04	0.11	0.00	0.01	0.11
Off-farm activity	-0.04	-0.21	0.25	-0.08	-0.94**	0.45	0.04	0.13	0.33
Farmer Age	0.00	-0.01	0.01	0.00	0.02	0.01	-0.01	-0.03**	0.01
Household size	-0.02	-0.12**	0.05	-0.01	-0.10*	0.06	-0.04	-0.14*	0.08
Ext services	0.14	0.84***	0.31	0.00	0.08	0.41	0.35	1.65***	0.50
Farm Size	-0.01	-0.06**	0.03	-0.01	-0.10**	0.05	-0.01	-0.03	0.04
Selling Price	0.01	0.05*	0.03	0.00	0.02	0.03	0.01	0.02	0.06
LogQuantity harv	0.17	0.90***	0.12	0.06	0.97***	0.20	0.31	1.06***	0.18
Constant		-4.91	1.55		-5.86	2.14		-2.99	2.72
	Number of observations = 250			Number of observations = 122			Number of observations = 128		
	Wald chi2(12) = 74.49			Wald chi2(12) = 32.01			Wald chi2(12) = 57.23		
	Prob > chi2 = 0.00			Prob > chi2 = 0.00			Prob > chi2 = 0.00		
	Pseudo R^2 = 0.47			Pseudo R2 = 0.43			Pseudo R2 = 0.54		
	Log pseudolikelihood = -78.93			Log pseudolikelihood = -30.16			Log pseudolikelihood = -39.66		

***, **, and * are significant levels at 1%, 05% and 10% respectively

Source: Survey Data (2018)

The results in table 4.3 show that, female headed cassava farming households in Taita-Taveta and at the coastal region (pooled data), were more likely to participate in cassava marketing at 1 percent significance level. This result is in line with the findings of Okoye *et al*. (2010), in his study on Transaction Costs and Market Participation by Small-Holder Cassava Farmers in South-Eastern Nigeria. Therefore, an increase by 1 unit of cassava farmers from Taita-Taveta who come from a female headed household increases the probability of participation in cassava marketing by 30 percent. Similarly, an increase in female headed households by 1 unit at the coast as a whole, increases the probability of participation in cassava marketing by 12 percent. The female headed households are more likely to participate in the market because farming activities at the coast are mostly carried out by females unlike men who prefer other jobs. Therefore, the male headed households may make farm allocation decision based on traditionally farmed crops, regardless of utility maximization. On the other hand, female headed households may easily adopt new crops on their farms and allocate them a larger proportion of land to maximize utility since they are engaged directly.

Years of schooling negatively affect market participation. Okoye *et al*. (2010), had a similar observation and argued that educated farmers are more likely to be autarkic. Hence, a cassava farmer at the coast who increases his years of schooling by one year, is 1 percent less likely to participate in cassava marketing. Similarly, a unit increase in years of schooling by a farmer in Taita-Taveta county, results to a 7 percent less likelihood of participating in cassava marketing. Formal education has a negative influence on cassava marketing because, people who are educated go for white collar jobs where they allocate much of their time and just a little for farming. The coast region has low levels of education (KNBS and SID, 2013) and therefore, the few educated people tend to get white collar jobs faster within the region hence a more regular income as compared to farming.

Credit access in Kilifi county had a significant influence on market participation at 5 percent level of significance. This result coincides with that of Adjimoti (2013), who found a positive relationship between credit and market participation in his study on Market Participation Among Cassava Value Chain Actors in Rural Benin. Accordingly, many cassava farmers from Kilifi easily access credit for farming purposes from their farmer groups which are well structured. An increase by one unit in the number of farmers in Kilifi county who have access to credit services makes them 6 percent more likely to participate in cassava marketing. This is because access to credit enables farmers to perform different farming activities at the right time of the year (Gershon *et al*., 1990; Fischer, 2012). According to focus group discussion, the virtue of group membership also helps to monitor the use of this credit to ensure that it serves the right purpose it was borrowed for.

Farmers in Kilifi county who participated in other income generating activities other than farming were less likely to participate in cassava marketing. The results in table 4.3 show that, farmers in Kilifi county who participated in off-farm activities were 8 percent less likely to participate in cassava marketing. This is because, farmers are rational in nature and they would allocate more of their time on those activities that generate higher utility. Therefore, those not participating in other off-farm income generating activities will allocate all their time in farming while those participating in other off-farm activities will allocate more of their time to those activities maximizing their incomes.

Older farmers in Taita-Taveta county are less likely to participate in cassava marketing. Kemisola *et al*. (2013), also found a similar result in his study on Market Orientation of cassava farmers in Nigeria and argued that as farmers get older their ability to perform farming activities reduces. Similarly, Adjimoti (2013) had coinciding results while Okoye *et al*. (2010) results were on the contrary. According to the results in table 4.3, an increase in the famers' age by 1 year in Taita-Taveta county leads to a 1 percent less likelihood by that farmer to

participate in cassava marketing. Abele *et al*. (2007) similarly found a negative significant relationship between age and intensity of adoption of new cassava varieties and argued that older farmers were conservative in nature and held on traditional cassava varieties. The low adoption of new technologies by older farmers means low production and low productivity thus high production costs resulting from production inefficiencies and therefore low or no market participation.

The results also show that, the household size had a negative and significant influence on cassava marketing. An increase in the number of people in the household by 1 person, reduces the likelihood of participating in cassava marketing at the coast by 2 percent, 1 percent in Kilifi and 4 percent in Taita-Taveta. Larger households are less likely to participate in cassava marketing because, they are more likely to have a larger dependency ratio and therefore, most of what is produced is consumed at the household level. This result is in contrast with that of Gani and Adeoti (2011), who found a positive relationship between family size and market participation. Gani and Adeoti (2011), argued that larger households reduce production costs by providing family labour.

Extension services have a significant and positive influence on market participation. Provision of extension services at the coast increases the probability of cassava farmers to participate in cassava marketing by 14 percent. Subsequently, extension services in Taita-Taveta county increases the probability of cassava farmers to participate in cassava marketing by 35 percent. The extension services are provided by different entities including government officials, non-governmental organizations, parastatals and other farmers. Extension services have a huge influence on participation in cassava marketing because they are mainly provided by experts in different areas along the whole value chain. Information provided helps farmers to make important decisions on the level of production, processing, marketing and consumption. Different studies on factors influencing farmers' participation in cassava marketing have found

similar results including; Sarka (2017), Adjimoti (2013), Gani and Adeoti (2011), and Okoye *et al*. (2010),

The larger the piece of land a cassava farmer has at the coast, the less likely they were to participate in cassava marketing. Results show that, an increase in farm size by 1 acre at the coast, reduces the probability of engaging in cassava marketing by 6 percent. Similarly, the probability of participating in cassava marketing is reduced by 10 percent when the farm size increases by 1 acre in Kilifi county. This result agrees with that of Egbetokun and Omonona (2012), who found a negative relationship between farm size and market participation of farmers in food markets in Nigeria. However, Onya *et al*. (2016), had a contrary result that showed a positive relationship between farm size and market participation. Therefore, an increase in farm size at the coast has a negative influence on participation in cassava marketing because, farmers with larger farms tend to farm other crops that they perceive have a lower opportunity cost than cassava and result to higher utilities. During the focus group discussion, farmers ranked maize first as their preferred crop to cultivate. In addition, farmers also prefer to keep cassava production at low levels because of poorly organized cassava marketing system, the perishable nature of cassava tubers and inadequate knowledge on value addition.

The selling price had a significant and positive influence on participation in cassava marketing. This result was consistent with that of Enete and Igbokwe (2009), on Cassava Market Participation Decisions of Producing Households in Africa. An increase in price by 1 Kenyan shilling at the coast, results to 1 percent probability that a farmer will participate in cassava marketing. More farmers would participate in the market to make profits as a result of increased prices, since farmers are rational in nature and therefore utility maximizing agents. This means that, all other factors held constant, the marketable supply will increase and therefore, this result is in line with the law of supply.

The results in table 4.3 show that, cassava farmers were significantly influenced at 1 percent level of significance to participate in cassava marketing by the quantity of cassava they harvested. Sarka (2017) and Gani *et al.* (2011) also found a consistent result in their studies on factors influencing cassava farmers participation in cassava market in Ethiopia and Nigeria respectively. An increase in the quantity harvested by 1 kilogram resulted to 17 percent increase in market participation by cassava farmers at the Coast. Similarly, 1 kilogram increase in the quantity of cassava harvested leads to 6 percent and 31 percent increase in market participation by cassava farmers in Kilifi and Taita-Taveta counties respectively. This is because, an increase in quantity harvested holding other factors constant, means an increase in surplus and therefore, market participation provides the best avenue to dispose the excess produce while maximizing farmers' utility.

4.5 Ordered Probit Model Results for Factors that Influence the Level of Commercialization Among Smallholder Cassava Farmers

There are different commercialization levels among the different cassava farmers at the Kenyan Coast. Table 4.4, 4.5 and 4.6 presents the results of an Ordered Probit regression model showing the different commercialization levels. The results in the three tables respectively, give insights on how different factors influence the level of cassava commercialization for pooled data and when the data for Kilifi county and Taita-Taveta county is run independently. The dependent variable (Level of commercialization) is a categorical variable which has been set into four distinct categories comprising of; Non-participants (Y = 0), Low (Y = 1), Medium (Y = 2) and High (Y = 3) level participants. The Household Commercialization Index (HCI) was used to categorize smallholder cassava farmers. The index ranges from 0 to 1 and therefore was used to lump smallholder farmers into the four categories such that; Y=0: =0, Y=1: >0≤0.25, Y=2: >0.25≤0.50, Y=3: >0.50. The marginal effects of variables that have a significant influence as shown in the tables below have been interpreted in the discussion.

Table 4.4: Ordered Probit Model Results for Factors that Influence the Level of Commercialization Among Smallholder Cassava Farmers in Taita-Taveta and Kilifi

Commercialization Level	**Pooled Data**		**Marginal effects at different levels**			
	Coef.	Std. Err.	Y=0	Y=1	Y=2	Y=3
Years of schooling	-0.023	0.020	0.004	-0.001	0.000	-0.004
Credit access	0.341	0.232	-0.066	0.008	0.005	0.053
Off-farm activity	0.036	0.184	-0.007	0.001	0.001	0.006
Farmer's Age	-0.004	0.006	0.001	0.000	0.000	-0.001
Household size	-0.061*	0.033	0.012*	-0.001*	-0.002*	-0.009*
Pest Manage	0.693***	0.226	-0.134***	0.017***	0.010***	0.107***
Seed buying	0.525***	0.199	-0.102***	0.013***	0.008***	0.081***
Extension services	0.204	0.191	-0.040	0.005	0.003	0.032
Cassava Area	1.469***	0.537	-0.285***	0.036***	0.022***	0.226***
Selling Price	0.013	0.019	-0.003	0.000	0.000	0.002
Log Distance to Mkt	-0.319**	0.138	0.062**	-0.008**	-0.005**	-0.049**
Main Purpose	2.105***	0.220	-0.408***	0.052***	0.031***	0.325***
/cut1	-0.394	0.948				
/cut2	0.622	0.945				
/cut3	1.487	0.953				
Number of obs =	249	LR chi2 (12) =	261.64	Prob > chi2 =	0.000	
Log likelihood =	-198.806	Pseudo R2 =	0.397			

Table 4.5: Ordered Probit Model Results for Factors that Influence the Level of Commercialization Among Smallholder Cassava Farmers in Kilifi County

Commercialization Level	**Kilifi County**		**Marginal effects at different levels**			
	Coef.	Std. Err.	Y=0	Y=1	Y=2	Y=3
Years of schooling	0.001	0.029	0.000	0.000	0.000	0.000
Credit access	0.584*	0.326	-0.084*	-0.006*	-0.003*	0.093*
Off-farm activity	-0.462	0.301	0.067	0.004	0.002	-0.073
Farmer's Age	-0.004	0.008	0.001	0.000	0.000	-0.001
Household size	-0.026	0.042	0.004	0.000	0.000	-0.004
Pest Manage	0.822**	0.379	-0.119**	-0.008**	-0.004**	0.131**
Seed buying	0.232	0.329	-0.034	-0.002	-0.001	0.037
Extension services	-0.122	0.288	0.018	0.001	0.001	-0.019
Cassava Area	1.054	0.663	-0.153	-0.010	-0.005	0.168
Selling Price	0.013	0.026	-0.002	0.000	0.000	0.002
Log Distance to Mkt	-0.344**	0.176	0.050**	0.003**	0.002**	-0.055**
Main Purpose	2.585***	0.347	-0.374***	-0.024***	-0.013***	0.411***
/cut1	-0.542	1.258				
/cut2	0.569	1.248				
/cut3	1.626	1.264				
Number of obs =	121	LR chi2 (12) =	124.94	Prob > chi2 =	0.000	
Log likelihood =	-124.94	Pseudo R2 =	0.413			

Table 4.6: Ordered Probit Model Results for Factors that Influence the Level of Commercialization Among Smallholder Cassava Farmers in Taita-Taveta County

Commercialization Level	Taita-Taveta County		Marginal effects at different levels			
	Coef.	Std. Err.	Y=0	Y=1	Y=2	Y=3
Years of schooling	-0.067**	0.033	0.014**	-0.003**	-0.002**	-0.009**
Credit access	0.320	0.378	-0.068	0.014	0.010	0.044
Off-farm activity	0.283	0.254	-0.060	0.012	0.009	0.039
Farmer's Age	-0.008	0.011	0.002	0.000	0.000	-0.001
Household size	-0.137**	0.063	0.029**	-0.006**	-0.004**	-0.019**
Pest Manage	0.604**	0.295	-0.128**	0.026**	0.019**	0.083**
Seed buying	0.807*	0.438	-0.172*	0.035*	0.025*	0.111*
Extension services	0.426	0.277	-0.091	0.019	0.013	0.059
Cassava Area	2.917**	1.288	-0.620**	0.127**	0.091**	0.402**
Selling Price	-0.005	0.033	0.001	0.000	0.000	-0.001
Log Distance to Mkt	-0.744**	0.337	0.158**	-0.032**	-0.023**	-0.102**
Main Purpose	1.797***	0.330	-0.382***	0.078***	0.056***	0.247***
/cut1	-2.881	1.870				
/cut2	-1.806	1.864				
/cut3	-1.065	1.873				
Number of obs =	128	LR chi2 (12) =	129.14	Prob > chi2 =	0.000	
Log likelihood =	-101.718	Pseudo R2 =	0.388			

***, **, and * are significant levels at 1%, 05% and 10% respectively
Source: Survey Data (2018)

Pooled data results in table 4.4 show that, years of schooling, credit access, off-farm activities, farmers' age, extension services and selling price had insignificant influence on the level of commercialization. However, the results in table 4.4 and table 4.6 show that an increase in the household size has a significant but negative influence on the level of commercialization. Hence, as the household size increases, smallholder cassava farmers are more likely to participate in lower categories of commercialization levels. This result is similar to that of Florence *et al*. (2017) who found out that households with larger number of people in Kilifi county were likely to participate at lower categories of commercialization level because larger households exerted pressure on the limited resources available in the homestead including farm produce. Similarly, Agwu *et al*. (2013) found out that, an increase in the household size reduces

the probability of farmers' orientation towards market commercialization due to its effect on increased domestic consumption needs. The pooled data results in table 4.4 shows that, an increase in the household size by one person at the coast leads to 1.2 percent more likelihood of not participating in cassava marketing, 0.1 percent less likely to be in the low commercialization level, 0.2 percent less likely to be in the medium commercialization level and 0.9 percent less likely to be in the high commercialization level. On the other hand, results from Taita-Taveta county in table 4.6 show that, an increase in the household size by one person leads to 2.9 percent more likely not to participate in cassava marketing, 0.6 percent less likely to be in the low commercialization level, 0.4 percent less likely to be in the medium commercialization level and 1.9 percent less likely to be in the high commercialization level.

The results in table 4.4, 4.5 and 4.6 show a positive and significant influence of pest management on the level of commercialization. Cassava farming households who practice pest management are more likely to be in higher categories of commercialization levels. This is because, farmers who practice pest management incur higher production costs and therefore, are likely to gain higher marginal product due to controlled loss of produce from pest. Consequently, they are more likely to participate in higher categories of commercialization levels to cover the extra costs and to dispose off the excess produce. The results in table 4.4 shows that, farmers who practice pest management are 13.4 percent less likely not to participate in cassava marketing, 1.7 percent more likely to participate in the low commercialization level, 1 percent more likely to participate in the medium commercialization level and 10.7 more likely to participate in the high commercialization level. Similarly, smallholder cassava farmers in Taita-Taveta county and at the Kenyan Coast, who frequently buy clean seed for planting are more likely to participate in cassava marketing at higher levels of commercialization. Results in table 4.4 and table 4.6 show that, farmers who participate in the seed market are 8.1 percent and 11.1 percent more likely to participate in cassava marketing at high commercialization

level respectively. The result on pest management and seed buying is in line with focus group discussion findings where farmers who engaged in these two practices said their cassava productivity was high. The results also concur with Sarka (2017), who found a positive relationship between use of farm inputs and market participation in his study on Factors Affecting Farmers' Market Participation Decision and Amount of Cassava Supplied to the Market in Wolaita Zone, Ethiopia.

Area under cassava is a proxy for the quantity of cassava produced. As the area increases, the quantity produced is more likely to increase proportionately and consequently, the quantity available for marketing (Florence *et al*., 2017). According to the results in table 4.4 and table 4.6, the area under cassava has a positive and significant influence on the level of commercialization. As the area under cassava increases, smallholder farmers are more likely to be in the higher categories of commercialization levels. The results in table 4.4 and 4.6 show that, an increase in the area under cassava by 1 acre, increases the probability of being in the high commercialization level by 22.6 percent and 40.2 percent respectively.

Results in tables 4.4, 4.5 and 4.6 indicate that distance to the market has a negative and significant influence on the level of commercialization. The results show that, as distance to the market increases, smallholder cassava farmers are more likely to be in the lower categories of commercialization levels. According to the results in table 4.4, 4.5 and 4.6, an increase in the distance to market by 1 kilometer the probability of participating at high commercialization level by 4.9 percent, 5.5 percent and 10.2 percent respectively. This is because, an increase in distance to the market increases transport and production costs and therefore reducing gains from cassava farming hence discouraging cassava marketing. This result corresponds with that of Florence *et al*. (2017), Muhammad-Lawal *et al*. (2014), Agwu *et al*. (2013) and Martey *et al*. (2012) who found a negative relationship between distance to the market and

commercialization, whereby Florence *et al*. (2017) concluded that it was due to increase in transport and transaction costs.

When farmers make a decision to plant any crop on the farm, there is always a main purpose behind it like income generation or otherwise. Results in tables 4.4, 4.5 and 4.6 show that, when the main purpose of growing cassava is to generate income, smallholder farmers are more likely to be in the higher categories of commercialization levels. Hence, an increase in the proportion of farmers who plant cassava for income purposes, increases the probability of being in the high commercialization level by 32.5 percent, 41.1 percent and 24.7 percent respectively.

Results in table 4.5 show that an increase in credit access has positive and significant influence on being in the higher categories of commercialization level. According to the results, increasing the proportion of farmers who access credit by 1 percent, increases the probability of being in the high commercialization level by 9.3 percent. This is because, access to credit enables farmers to perform farming activities in good time as well as acting as an incentive to work hard and participate in marketing for repaying the credit awarded. According to Agwu *et al*. (2013), credit enhances farmers' skills and knowledge through enabling them to acquire modern technology including farm inputs and machinery thus increasing their productivity which in turn induces market orientation hence market participation at higher commercialization level categories.

Table 4.6 shows that years of schooling have a negative and significant influence on the level of commercialization. Adenegan (2013), found a similar result in his study on Smallholder Cassava Commercialization in Nigeria. Florence *et al*. (2017) also found a similar result for Kilifi county but a contrary result for Siaya county and argued that as farmers in Siaya county advanced in formal education, they got endowed with different skills in production, processing, management and information access which are critical in making farming decisions, an

argument supported by Obisesan (2018). However, due to low literacy levels at the Kenyan coast, the few people who advance in formal education are easily absorbed in office work and get off-farm income more lucrative than farm income (Muhammad-Lawal *et al*., 2014). According to Table 4.5, an increase in the years of schooling in Kilifi County by 1 year, increases the probability of being a non-market participant by 1.4 percent, reduces the probability of being in the low commercialization level by 0.3 percent, reduces the probability of being in the medium commercialization level by 0.2 percent and reduces the probability of being in the high commercialization level by 0.9 percent. Years of schooling have a negative effect on the level of commercialization because, as people at the coast get more learned, they shift from farming to office work and therefore allocating more of their time to off-farm activities.

CHAPTER FIVE

SUMMARY, CONCLUSION AND POLICY IMPLICATION

5.1 Summary

Cassava is an important food crop in Africa that does well in different agroecological zones. Cassava farming is practiced in many countries in Africa but the level of production differs from one country to another. Similarly, different countries process cassava to different products and the level of value addition of cassava tubers differs from country to country. Cassava can be processed into food, feed and industrial products. In Kenya cassava is mainly produced for food and its production and consumption is mainly concentrated in the western, central and coastal regions. However, its production is still low thus the Kenyan cassava industry remains unexploited. The industry is faced by low value addition and the cassava marketing system is unorganized and characterized with poor market conduct and structure which translates into poor market performance. Therefore, this study was aimed to assess the cassava marketing value chain in the context of market participation and the level of commercialization of cassava farming at the Kenyan Coast.

The study was based on the decision theory which is concerned with the reasoning underlying an agent's choices and therefore, the goal-oriented behavior of human beings in presence of options. Hence, the theory informed the use of descriptive statistics, the Binary Probit model and the Ordered Probit model in achieving the specific objectives of the study. The study involved a sample of 250 smallholder cassava farmers from Kilifi and Taita Taveta Counties and 105 cassava traders from major market places at the Kenyan Coast. Data was collected using semi-structured questionnaires and later analysed using Stata and SPSS software. Thereafter, diagnostic tests were carried out to test the suitability and justify the models used in the study.

The results show that most smallholder cassava farmers participate in cassava marketing. However, there was a significant difference in some socio-economic and institutional factors among market participants and non-market participants which included; years of schooling, quantity of cassava tubers harvested, distance to the nearest market, sex of the head of household, access to credit services and participation in off-farm activities. For instance, non-market participants had significantly more years of schooling as compared to market participants. On the other hand, cassava traders had an average age of 41 years and were dominated by female and most of the traders bought fresh tubers and sold the fresh tubers without any form of processing. The results also show that cassava products are sold locally in the country and different marketing channels are used to reach the final consumer. However, there is low value addition on cassava tubers at the Kenyan coast and therefore most of the cassava is consumed as food.

The results of the binary Probit model show that, access to extension services, price of cassava product and quantity harvested had a positive and significant influence on market participation decision. Such that, an increase in any one of the factors increased the likelihood of market participation proportionately. On the contrary, sex of the head of household, years of schooling, household size and farm size had a negative and significant influence on market participation decision. Such that, an increase in any one of the factors reduced the likelihood of market participation proportionately. This study therefore rejected the null hypothesis and concluded that socio-economic determinants have an influence on cassava market participation among smallholder cassava farmers in Taita-Taveta and Kilifi counties

The Ordered Probit results show that smallholder cassava farmers who practice pest management, buy planting seed frequently, have access to extension services and have their main reason for farming cassava as income generation, are more likely to participate in cassava marketing at higher commercialization levels. On the contrary, the results show that

smallholder cassava farmers who have larger household size and cover longer distances to reach the nearest market place, are more likely to participate in cassava marketing at lower commercialization levels. This study therefore rejected the null hypothesis and concluded that there was a difference in the level of commercialization among smallholder cassava farmers in Taita-Taveta and Kilifi counties

5.2 Conclusion

Cassava production and marketing is important for improving food security, income generation and industrialization. However, results show that, the cassava industry at the Kenyan Coast is still unexploited. There is inconsistent and low-level cassava production at the coast hence making it a challenge for trading and industrialization. Similarly, there is very little value addition on cassava products and the industry is marred with a poorly organized marketing system leading to exploitation of farmers by middlemen. Therefore, cassava is mostly consumed as food at the Kenyan coast and there is no industrial utilization of cassava.

The decision to participate in cassava marketing is pegged on social, economic and institutional factors in environments within which different actors operate. The results show that cassava marketing has a great potential and cassava production can be improved by provision of incentives to farmers in terms of marketing and extension information, quality inputs including planting materials and infrastructure for value addition and access to markets. In addition, actors along any marketing value chain of cassava products should be minimized as much as possible to shorten the marketing channels for farmers to realize maximum returns.

5.3 Policy Implication

The results point out a poorly organized marketing system and therefore the county governments should come up with policies that help in coordination and formation of

marketing groups in order to foster certainty in production of cassava. This will enable the creation of a consistent supply of cassava products, create a ready market, reduce the long marketing channels and increase profit margins for smallholder cassava farmers. The results also show that different socio-economic and institutional factors influence participation in cassava marketing and therefore, provision of appropriate incentives like extension services on pest management practices and seed, quality inputs and infrastructure would encourage increased participation in cassava marketing.

5.4 Suggestions for Further Studies

This study focused on the socio-economic and institutional factors that influence participation in cassava marketing value chain, and mapping out the cassava marketing channels and the marketing value chain. However, there still exists three major gaps along the cassava marketing value chain that give an opportunity for further research and these are;

a) To analyse the marketing efficiency along the cassava marketing value chain
b) To determine factors that influence consumer demand for cassava products
c) To analyse the effect of cassava market participation decision on food and nutrition security

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APPENDICES

Appendix 1: Specification Test

Probit Model

Mkt_Part	Coef.	Std. Err.	P>z
_hat	1.11	0.15	0.00
_hatsq	-0.11	0.07	0.11
_cons	0.07	0.13	0.59

Ordered Probit Model

Commer_Level	Coef.	Std. Err.	P>z
_hat	1.10	0.37	0.00
_hatsq	-0.01	0.05	0.79
/cut1	2.55	0.60	
/cut2	3.61	0.63	
/cut3	4.49	0.64	

Appendix 2:

Multicollinearity Test

Probit Model

Variable	VIF	1/VIF
Fam_Labor_No	1.46	0.68
Sex of Farmer	1.46	0.68
Farmers' Age	1.42	0.70
House_size	1.41	0.71
Sex_HoH	1.38	0.73
Credit_acces	1.38	0.73
logQ_harvested	1.36	0.74
Educ_Years	1.35	0.74
Farm_Size	1.33	0.75
Ext_services	1.33	0.75
Offfarm_activity	1.19	0.84
Selling_Price	1.08	0.93
Mean VIF	**1.35**	

Ordered Probit Model

Variable	VIF	1/VIF
logQ_harv	2.97	0.34
Main_Purpose	2.33	0.43
Seed_buying	1.60	0.63
Ext_services	1.42	0.71
logDist_Mkt	1.33	0.75
Farm_Size	1.32	0.76
Farmers' Age	1.32	0.76
Educ_Years	1.25	0.80
House_size	1.22	0.82
Credit_acces	1.22	0.82
Offfarm_activity	1.14	0.87
Pest_Manage	1.08	0.93
Selling Price	1.07	0.94
Mean VIF	**1.48**	

The Pearson Correlation Test Matrix

	Sex_HoH	Educ_Yrs	Exper_Yrs	Credit_access	Fam_Labor_No	Dist_Mkt	Offarm_Acty
Sex_HoH	1.000						
Educ_Years	0.234	1.000					
Exper_Yrs	-0.144	-0.129	1.000				
Credit_acces	-0.245	-0.097	-0.128	1.000			
Fam_Labor_No	-0.032	-0.109	0.077	0.213	1.000		
Dist_Mkt	0.035	0.166	0.086	-0.109	-0.087	1.000	
Offarm_acty	-0.070	0.159	-0.147	0.117	-0.261	0.133	1.000
Seed_buying	-0.106	-0.278	0.037	0.216	0.213	-0.325	-0.093
Farmer_Age	-0.195	-0.150	0.489	-0.054	0.127	0.094	-0.222
House_size	-0.145	-0.226	0.143	0.024	0.330	-0.050	-0.134
Ext_services	-0.121	-0.178	-0.079	0.375	-0.012	-0.247	0.046
Farm_Size	0.028	0.116	0.159	0.032	0.158	0.141	-0.070

	Seed_buying	Farme_Age	House_size	Ext_services	Farm_Size
Seed_buying	1.000				
Farmer_Age	0.055	1.000			
House_size	0.221	0.303	1.000		
Ext_services	0.372	-0.008	0.007	1.000	
Farm_Size	0.107	0.326	0.121	0.029	1.000

Appendix 3: Heteroscedasticity Test

Probit Model	Ordered Probit Model
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity Ho: Constant variance Variables: fitted values of Mkt_Part chi2(1) = 21.63 Prob > chi2 = 0.0000	Breusch-Pagan / Cook-Weisberg test for heteroskedasticity Ho: Constant variance Variables: fitted values of Commer_Level chi2(1) = 0.33 Prob > chi2 = 0.5666

Appendix 4: Goodness of Fit

Probit Model		Ordered Probit Model	
Number of observations	= 250	Number of obs	= 249
Wald chi2(12)	= 74.49	LR chi2 (12)	= 261.64
Prob > chi2	= 0.00	Prob > chi2	= 0.000
Pseudo R^2	= 0.47	Log likelihood	= -198.806
Log pseudolikelihood	= -78.93	Pseudo R2	= 0.397

Probit model for Mkt_Part, goodness-of-fit test - Hosmer-Lemeshow test (HL test/ Lfit test)		
number of observations	=	250
number of covariate patterns	=	246
Pearson chi2 (233)	=	217.20
Prob > chi2	=	0.7637

Appendix 5: HOUSEHOLD BASELINE SURVEY QUESTIONNAIRE

Economic Analysis of Smallholder Farmers' Participation in the Cassava Marketing Value Chain in Taita-Taveta And Kilifi Counties, Kenya 2018

This research survey is being conducted by the Department of Agricultural Economics, University of Nairobi in collaboration with the Department of Plant Science and Crop Protection and RUFORUM. The purpose of the study is to obtain opinions, views, experiences and suggestions regarding cassava markets. This questionnaire is meant to collect data on cassava farming, processing, utilization and marketing. Information obtained in the process is strictly for academic and research purposes only. Responses obtained will be treated with confidentiality and will not be released to the public without respondent's consent. This interview is voluntary and will take approximately 1 hour. Your participation will be highly appreciated.

Do you agree to participate? Yes [1] No [0]

Do you grow cassava on your farm? Yes [1] No [2]

If Yes, proceed but if No, terminate the interview

Questionnaire No.	Interview Date
Enumerator's name	

A. Respondent details

1

County .....:
Sub-county .....:
Location .....:
Village .....:

Ward .....:
GPS Coordinates
Longitude (E).....:
Latitude (S) .....:
Altitude .....:

2 **Name of Farmer**
…….
Sex: Female [0] Male [1]

Age of farmer: ..... **Years**

Youth	**< 35**	**[1]**
Middle aged	**36 - 50**	**[2]**
Upper middle aged	**51 - 60**	**[3]**
Retiree	**> 60**	**[4]**

3 **Head of household (sex)**
Female [0] Male [1]

Household size (Number of members)**.....**.

Own Farm size ..... **acres**

< 2	**[1]**
2 - 5	**[2]**
6 – 15	**[3]**
> 15	**[4]**

Rented farm size (if any)..... **acres**

4

Respondent main occupation	Formal Employment	**[1]**
	Casual Employment Time	**[2]**
	Business Person	**[3]**
	Full Farmer	**[4]**
	Other	**[5]**
	(Specify)……	

Do you participate in other off-farm activities?
Participate [1] otherwise [0]
Specify .....

5 **Academic Qualification**

Level of education attained	None	**[1]**
	Primary	**[2]**
	Secondary	**[3]**
	Tertiary	**[4]**

Years of schooling ……

Marital status	Single	**[1]**
	Married	**[2]**
	Divorced	**[3]**
	Widowed	**[4]**
	Separated	**[5]**

B. Farm characteristics

Proportion of land cultivated and the specific crop grown		
Crop planted	Proportion of land	Size in acres
1.		
2.		
3.		
4.		

C. CASSAVA MARKET PARTICIPATION

PRODUCTION

1. How do you prepare your land for crop production?

Tractor	[1]
Ox-plough	[2]
Hand hoe	[3]
Minimum tillage	[4]
Other	[5]

(Specify)…….

2. What is the total current area under crops in acres? ..... Acres

< 0.5	[1]
>0.5 to 1	[2]
>1-2	[3]
> 2	[4]

3. How many years of experience do you have in cassava farming? ..... Years
4. What is the total current area under cassava in acres? ..... Acres

< 0.5	[1]
>0.5 to 1	[2]
>1-2	[3]
> 2	[4]

b) Clarify on the cassava spacing in the farm in either of the measurements

Measurement	**Spacing (length by width)**
Metres	
Feet	
Steps	

5. a) What quantity do you harvest from the farm in one season? ..... Kg

   b) What is the quantity harvested per stem? ..... Kg

6. a) Do you intercrop cassava?

   Yes [1] No [2]

b) If Yes, which crops do you usually intercrop with cassava? (list)

Crop	
Maize	[1]
Cowpea	[2]
Green gram	[3]
Pigeon pea	[4]
Beans	[5]
Okra	[6]
Other (specify)…….	[7]

7. a) Do you use fertilizer or manure on cassava?

   Yes [1] No [2]

   b) If yes, which one and when do you apply the fertilizer and/or manure?

Which one?		**When?** During land preparation [1] During planting [2] After planting [3]
Fertlizer	[1]	
Manure	[2]	
Both	[3]	

8. a) What is the main reason you grow cassava?

   Food [1]
   Income [2]
   Soil conservation [3]
   Others [4]

   Specify……

9. Where do you source your cassava planting material and how reliable is the source?

Source	(you may tick more than one)	**Reliability** : Extremely reliable [1] Moderately reliable [2] Low [3]
1. Local market	[1]	
2. Own seed	[2]	
3. Neighbors	[3]	
4. KALROs	[4]	
5. Other, Specify……	[5]	

10. How frequently do you source your cassava planting materials from KALRO?

Every planting season	[1]
After more than one planting season	[2]
Never	[3]

11. a) Which varieties have you grown for the last two years in order of preference?

Varieties grown		Rank best 2
Tajirika	[1]	
Shibe	[2]	
Kibandameno	[3]	
Nzalauka	[4]	
Karibuni	[5]	
Karembo	[6]	
Girikacha	[7]	
Others	[8]	
(specify)……		

b) Why do prefer that variety (list)

Properties	**Variety 1**	**Variety 2**
High yield	[1]	[1]
Drought resistant	[2]	[2]
Disease and pest resistant	[3]	[3]
Low cyanide level	[4]	[4]
Taste	[5]	[5]
Others	[6]	[6]
Specify…….....		

12. a) Do you experience diseases/pest infestation on cassava?

Yes [1] No [2]

b) If Yes, do you practice diseases/pest management on cassava?

c)Which disease/pest management practices do you use?

Rogueing and destroying	[1]
Chemical control	[2]
Fallowing	[3]
Crop rotation	[4]
None	[5]
Others	[6]
Specify.....	

13. Production costs for cassava

TYPE OF OPERATION	COST PER UNIT	TOTAL UNITS	TOTAL COSTS
Labour/ mechanical costs:			
Land clearing			
Ploughing			
Furrowing			
Harrowing			
Planting			
Weeding			
Fertilizer application			
Irrigation			
Harvesting			
Other (specify)……..			
Input costs:			
Seed/ cuttings			
Seed transportation			
Fertilizer/ Manure			
Fertilizer transportation			
Herbicides/ Pesticides			
Pesticides transportation			
Other (specify)……...			
TOTAL COSTS			

14. a) Do other members of the family work on the family farm? Yes [1] No [2]

b) If Yes, How many members of your family are involved in the farm activities? .....

MARKETING INFORMATION

15. What quantity of the harvested cassava do you;

consume at home	Give as gifts	Sell

16. a) Do you do any value addition to the cassava before selling? Yes [1] No [0]

b) If yes, what do you do to it?

Wash [1] cook [2] fry [3] dry [4] Mill into flour [5] mixed with other products [6] package [7] process into .....

c) If Yes, What were the costs for adding value? KSh.....

Selling of cassava or cassava products

cassava or cassava products sold (Code)	At what points do you sell? (Code)	To who do you sell? (Code)	How much per Kg (KSh./Kg)	Total Quantity sold (Kg)	Total sales (KSh.)	Distance to the nearest market (KM)	Mode of transporting to the market (Code)	Cost of transport to the market per trip (KSh.)	Quantity carried per trip (Kg)	Total costs of transporting

1. Fresh tuber 2. Dried tuber 3. Dried granules/chips 4. Cassava flour 5. Other (specify)	1. Farm-gate sales 2. Rural open-air market 3. Urban open-air market 4. Other (specify)	1. Final consumer 2. Bulker/ assembler 3. Wholesaler 4. Retailer 5. Processor 6. Other (specify)	1.Truck 2.Tuktuk 3.Bicycle 4.Motorbike 5.Ox-cart 6.Back/head lots 7.Other (specify) .....

17. Other costs incurred when selling cassava

Cost type	Per unit	No. of units	Total
Loading costs	/trip		
Offloading costs	/trip		
Council levy	/day		
Calling costs	/day		
TOTAL COSTS			

18. Who sets the selling price of the cassava or cassava product? Negotiation [1] By the market [2] the farmer [3] The buyer [4] Other (specify.....

19. a) When your cassava or cassava products are ready, do you sometimes find it difficult to get a buyer? Yes [1] No [2]

    b) If Yes, what causes such situations? Inaccessibility of market [1] Lack of market information [2] Low price offered [4] Others (specify) .....

20. During which period/ month of the year do cassava tubers fetch the highest prices?

    .....

21. a) what's the mode of transaction payment for the cassava or cassava product?
    Cash sales [1] credit sales [2] Both [3]

    b) If its credit sales, how long does it take before you are paid? ..... days

22. Do you take your cassava or cassava product(s) to the market in isolation or you assemble together with other farmer'(s) products before taking to the market?
    In isolation [1] otherwise [0]

23. a) Does any of your harvested cassava go to waste or spoil? Yes [1] No [0]

b) If Yes, how much quantity is wasted (spoils) in one season? .....Kg

c) What is the main cause for this spoilage?

Mechanical damage [1] Overstaying [2] Pests and Diseases [3]

Other (specify).....

24. a) Are you a member of any cassava related organization? (group or co-operative)
    Yes [1] No [2]

b) If yes, which one? .....

25. a). Do you ever receive any information on cassava production?

Yes [1] No [2]

b) If yes, what is/are the source(s) of the information, what kind of technical information do you receive? and how often?

information	**Source of information** Extension staff [1] Media - Radio/T.V/Newspaper [2] Agro input dealer [3] From other farmers [4] Research [5]	**Frequency** Weekly [1] Monthly [2] Quarterly [3] Semiannually [4] Annually [5]
Sources of Planting materials		
New varieties		
Crop husbandry		
Pest and disease management		
marketing		
Utilization/processing		
Others		

26. a) Do you have access to credit to support your farming activities? Yes [1] No [2]

b) If Yes, which source? Formal credit [1] informal credit [2]

c) Specify the source..... friends [1] family [2] Group [3] Cooperative [4] micro-finance [5] bank [6] other specify .....

27. What challenges do you face in cassava farming? (you may tick more than one)

Challenge	
Drought	[1]
Floods	[2]
Inadequate planting materials	[3]
Pest and diseases	[4]
Low market prices	[5]
No standardized measure of produce when selling	[6]
Perishability	[7]
Others Specify.....	[8]

Appendix 6: TRADERS' QUESTIONNAIRE

Economic Analysis of Smallholder Farmers' Participation in the Cassava Marketing Value Chain in Taita-Taveta And Kilifi Counties, Kenya 2018

This research survey is being conducted by the Department of Plant Science and Crop Protection, University of Nairobi in collaboration with Department of Agricultural Economics and RUFORUM. The purpose of the study is to obtain opinions, views, experiences and suggestions regarding cassava markets. This questionnaire is meant to collect data on cassava farming, processing, utilization and marketing. Information obtained in the process is strictly for academic and research purposes only. Responses obtained will be treated with confidentiality and will not be released to the public without respondent's consent. This interview is voluntary and will take approximately 1 hour. Your participation will be highly appreciated.

Do you sell cassava or cassava product(s)? Yes [1] No [0] ***(If yes, proceed and if no, terminate the interview)***

Questionnaire No.	Interview Date
Enumerator's name	

A) General information

County		Location
Constituency		Market name
Ward		
GPS coordinates	Longitude (E)..... latitude (S) ..... altitude.....	

B) Respondent details

Name		
Sex	Female [0]	Male [1]
Age (years)		
Level of education attained	None [0] Primary [1] Secondary [2] Tertiary [3]	
Years of schooling		
Marital status	Single [0] Married [1] Divorced [2]	
	Widowed [3] Separated [4]	
Main occupation	Formal Employment [0] Casual Employment Time [1]	
	Farmer [2] Business Person [3] Other (Specify) ..	

C) Buying (sourcing)

1. Purchasing cassava or cassava products for sell.

cassava or cassava products bought (Code)	Where do you buy the product (Code)	From who do you buy? (Code)	Purchasing price per unit of Quantity bought (KSh./Kg)	Frequency of buying from the source per week	Frequency of buying from the source per month	Total expenditure per month (KSh.)	Distance to the point of purchase (KM)	Mode of transporting from the point of purchase (Code)	Cost of transporting from the point of purchase per day (KSh.)	Total costs of transporting from the source per month

1. Fresh tuber 2. Dried tuber 3. Dried granules/chips 4. Cassava flour 5. Cassava animal feed 6. Composite (mixed with other products) 7. Other (specify) ……	1. Farm-gate buying 2. Rural open-air market 3. Urban open-air market 4. Processor 5. Other (specify) ……	1. Farmer 2. Bulker/ assembler 3. Wholesaler 4. Retailer 5. Processor 6. Importer 7. Other (specify) ……	1. Truck 2. Tuktuk 3. Car (matatu) 4. Bicycle 5. Motorbike 6. Cart 7. Head/back lots 8. Other (specify) ……

Where are the cassava tubers produced? ……

2. Other costs incurred when buying cassava

Cost type	Per unit	No. of units	Total
Loading costs	/trip		
Offloading costs	/trip		
Council levy	/day		
Calling costs	/day		
Packaging costs			
Other (specify)			
TOTAL COSTS			

3. a) Do you sometimes find it difficult or fail to get supplies when in need? Yes [1] No [2]

   b) If Yes, what causes such situations? Inaccessibility of source [1] Lack of information [2] High prices offered [4] Lack of supplies [5] Others (specify) .....

4. When you go for the cassava products, do you bring yours alone or also for other traders?

   Mine alone [1] mine and for others [2]

5. When the source supplies you with cassava products, does he bring yours alone or he brings also for other traders?

   Mine alone [1] mine and for others [2]

6. Who sets the selling price of the cassava or cassava product? Negotiation [1] By the market [2] The source [3] You the buyer [4] Other (specify_____

7. a) what's the mode of transaction payment for the cassava or cassava product?

   Cash sales [1] credit sales [2] Both [3]

   b) If its credit sales, how long does it take before you pay the source? ..... Days

8. During which period/ month of the year are cassava tubers or products most expensive to purchase? .....

9. a) Do you have any variety of cassava that you prefer sourcing? Yes [1] No [0]

   b) If yes, which one? .....

10. a) Do you check for quality when sourcing cassava or cassava products?

    Yes [1] No [0]

b) If yes, what has been the trend in quality?

Increasing [1] Constant [2] Decreasing [3] Fluctuating [4]

11. a) Have you ever stopped purchasing due to lack of supply? Yes [1] No [2]

    b) If Yes, what is the longest time ever? .....

    c) Which year was this? .....

12. a) Do you have access to credit for your cassava business? Yes [1] No [0]

    b) If Yes, which source? Formal credit [1] informal credit [2]

    c) Specify the source friends [1] family [2] Group [3] Cooperative [4] micro-finance [5] bank [6] other specify .....

D. SELLING CASSAVA

cassava or cassava products sold (Code)	To who do you sell the products (Code)	Selling price per unit of Quantity sold (KSh./Kg)	Total quantity sold per day (Kg)	Frequency of selling to the buyer(s) per week	Frequency of selling to the buyer(s) per month	Total earnings per month (KSh.)

1. Fresh tuber 2. Cooked cassava 3. Fried cassava 4. Dried tuber 5. Dried granules/chips 6. Cassava flour 7. Cassava animal feed 8. Composite (mixed with other products) 9. Cassava crisps 10. Other (specify).....	1. Final consumer 2. Wholesaler 3. Retailer 4. Processor 5. Rural open-air market 6. Urban open-air market 7. Other (specify) .....

13. For how long have you been selling the cassava or cassava product? .....Years

14. Do you sell at a fixed price or do you allow bargaining? Fixed price [1] otherwise [0]

15. Who sets the selling price of the cassava or cassava product? Negotiation [1] By the market [2] You the seller [3] The buyer [4] Other (specify)_____

16. a) Do you sometimes find it difficult to get a buyer for the cassava products?

    Yes [1] No [2]

    b) If Yes, what causes such situations? Inaccessibility of market [1] Lack of market [2] Low price offered [4] Poor cassava quality [5]

    Others (specify) .....

17. a) what's the mode of transaction payment for the cassava or cassava product?

    Cash sales [1] credit sales [2] Both [3]

    b) If its credit sales, how long does it take before you are paid? .....Days

18. a) Does any of the of the cassava or cassava product you handle go to waste during the whole process of exchange? Yes [1] No [0]

    b) If yes, how much quantity; daily .....Kg weekly ..... Kg Monthly.....Kg

19. a) Do you do any kind of advertising to the cassava or cassava product?
    Yes [1] No [0]
    b) If yes, which technique do you use to advertise?.....

20. Do you face any kind competition for your cassava products?
    Yes [1] No [0]

21. a) Have you ever stopped selling due to lack of supply? Yes [1] No [2]
    b) If Yes, what is the longest time ever?.....

    c) Which year was this? .....

22. a) Do you have access to credit for your business? Yes [1] No [0]
    b) If Yes, which source? Formal credit [1] informal credit [2]
    c) Specify the source...friends [1] family [2] Group [3] Cooperative [4] micro-finance [5] bank [6] other specify .....

23. what is the main challenge facing the cassava trade?

Inadequate market [1] Inconsistent supply [2] Perishability of cassava [3] Lack of knowledge on value addition [4] High transaction/transportation costs [5] Poor cassava quality [6]

Other (specify) .....

THANK YOU FOR YOUR TIME