

**ANALYSIS OF URBAN MARKETS-LINKED CASSAVA VALUE CHAIN:
A CASE OF MOROGORO RURAL DISTRICT, TANZANIA**

BY

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AGRICULTURAL ECONOMICS OF SOKOINE UNIVERSITY OF
AGRICULTURE. MOROGORO, TANZANIA.**

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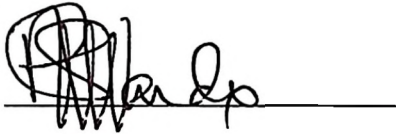
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ABSTRACT

This study was carried out to examine the value chain for cassava in order to determine strategies needed to enhance profitable participation of smallholder farmers in the cassava value chain for reducing income poverty in Tanzania. Specifically, the study intended: (i) To analyse the structure of the cassava value chain and coordination among actors in the value chain, (ii) To analyse profitability of alternative cassava value chain strands and identify determinants of profitability and (iii) To analyse farmers' preferential choice decisions of alternative cassava value chain strands and identify their determinants. A structured questionnaire was used to collect data from 150 farmers from three villages of Morogoro rural district. Data were analysed using descriptive and quantitative methods. Profit and marketing margins along the cassava value chain were computed. ANOVA was employed to measure the variation in profitability among the smallholder farmers. Factor analysis was used to identify the variables for further analysis on likelihood of farmers to participate in alternative cassava value chain strands. Linear and Poisson regression models were estimated to identify the determinants of profitability and farmers' preferential choice decisions in risks respectively. Results show that there was no significant variation in profitability between the villages at $p < 0.05$ level. Profit margins varied significantly among cassava value chain actors. The factors that contributed to the profit margin at farm gate were farm size, experience, total family labour, group participation, non-crop livelihood sources and food insecurity. Results also indicate that farmers have positive risk attitude towards participation in the alternative cassava value chain strands and farm size, experience, female-headed households and land-holding had influenced the farmers' preferential choice decision. Recommendations for enhancing farmers' participation in profitable cassava value chain strands are strengthening coordination, provision of improved cassava varieties and introduction of cassava processing technologies.

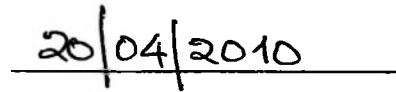
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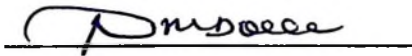
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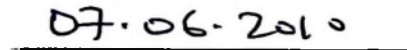
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DEDICATION

To my late father Thomas P. Mlondwa, late mother Scholastica Martin, late sister Bernadetha Thomas and late younger brother Cyprian Thomas, who in one way or another laid the foundation of my education. *“Raha ya Milele uwape Eee Bwana na Mwanga wa Milele Uwaangazie. Wapumzike kwa Amani. Amina.”*

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LIST OF ABBREVIATIONS AND ACRONYMS

AE	-	Adult Equivalents
ASDS	-	Agricultural Sector Development Strategies
ANOVA	-	Analysis of variance
CDTI	-	Community Development Training Institute
CL	-	Cassava Leaves
CSBD	-	Cassava Brown Streak Diseases
CMD	-	Cassava Mosaic Diseases
DFID	-	British Department for International Development
ECAPAPA	-	Eastern and Central Africa Programme for Agricultural Policy Analysis
EU	-	European Union
EUT	-	Expected Utility Theory
FAO	-	Food and Agricultural Organization
FC	-	Fresh Cassava
FRC	-	Fried/Roasted Cassava
HQCF	-	High quality cassava flour
IITA	-	International Institute for Tropical Agriculture
LIMDEP	-	<i>LIM</i> ited <i>DEP</i> endent (Econometric Software)
MCDGC	-	Ministry of Community Development Gender and Children
MDC	-	Morogoro District Council
NEPAD	-	New Partnership for African Development
NGOs	-	Non Government Organizations
PANTIL	-	Programme for Agricultural and Natural Resource Transformation

for Improved Livelihood

- SLF - Sustainable Livelihood Framework
- SNPs - Single Nucleotide Polymorphisms
- SPSS - Statistical Package for Social Science
- SSR - Simple Sequence Repeat
- SUA - Sokoine University of Agriculture
- Tshs - Tanzanian shillings
- UNCTAD - United Nation Conference Trade and Development
- URT - United Republic of Tanzania
- VCA - Value chain analysis

CHAPTER ONE

INTRODUCTION

1.1 Background Information

Cassava (*Manihot esculenta* Crantz) is a perennial, vegetatively propagated shrub, grown throughout the lowland tropics. It is a drought resistant crop grown mainly in dry areas and contributes significantly to the nutrition and livelihood of many farmers. It is also said to be more productive per unit of land and labour than even the high yielding cereals and the highest producer of carbohydrate (Nweke, 2003).

Cassava is originally from South America, probably domesticated in the Amazon region (Olsen and Schaal, 2001; Olsen, 2004). The process of cassava domestication involved selection for root size, growth habit, number of stems and the ability of clonal propagation through stem cuttings (Jennings, 1979). Cassava was first taken to Africa from Latin America as early as the 15th century by European traders as a potentially useful food crop. Cassava spread through Africa by a number of mechanisms. The most important appear to have been initial contacts with the Portuguese-Brazilian culture at the African coasts where the crop infiltrated inland through riverine trade routes. Cassava arrived and diffused first along the West African coast, while it arrived at the East African coast during the 18th century (Jones, 1959; Carter *et al.*, 1992) as cited by Kizito (2006). It was much consumed in Zanzibar also by the end of the eighteenth century (Jones, 1959). Both bitter and non-bitter varieties were grown at an early state after cassava was introduced to Africa.

In some African countries, cassava is being more and more perceived not only as a food security crop, but also as a raw material for various types of industries. Cassava can be converted into a large number of products ranging from traditional and novel food

products, to livestock feeds, ethanol and starch and its numerous derivatives. In such countries, there are concerted efforts on cassava development being initiated, sometimes with strong political support at the highest level (Nang'ayo *et al.*, 2007). For example special presidential initiatives on cassava exist in Nigeria and Ghana to make cassava the engine for economic growth. The New Partnership for African Development (NEPAD) has also recognized cassava as a crops which can reduced poverty in Africa and has recommended a Pan-African Cassava Initiative based on a broad based strategy which emphasizes better markets, better organization of producers for collective action, and better participation by the private sector.

However, in Tanzania cassava is still perceived as a food security crop rather than a raw material for other industries. Cassava contributes to an average of 15% in the national food production basket and is second to maize, which is the leading staple food crop for many Tanzanians (Mtambo, 2007). Moreover, for countries where majority of the people still live below the poverty line as Tanzania (ASDS, 2001), cassava could be used to bridge the income poverty gap.

Land and Uliwa (2007) documented that Tanzania produces about 6.8 million tons of cassava annually, which is 5.5% and 14% of world's and Africa's cassava production, respectively. However, this cassava is predominantly produced by smallholder farmers in many places including Morogoro rural District in Morogoro region. Although differences exist in cassava production, consumption, processing and level of commercialization between areas where cassava is considered as staple food and areas where it is non-staple, it is generally considered as an inferior crop compared with maize and rice. On the other hand the government also recognizes cassava as a food security crop, but little or no effort

has been done to commercialize it. As a result cassava production in Tanzania is generally characterized by low yields and low marketable surplus.

Even where there is marketable surplus, we find individual smallholder cassava farmers suffering from inaccessibility of urban markets. Inaccessibility to such markets is mainly due to small producer volumes aggravated by lack of collective marketing and inability to maintain stable supplies and quality standards of cassava products. In this regard, smallholder cassava farmers obtain low returns from raw cassava or traditionally processed cassava chips sold in local spot markets at low prices. Indeed, such reinforcing problems cluster around one major market problem which is lack of efficient integration of farmers in profitable cassava value chains.

A comprehensive market study conducted by IITA in 2005 in Tanzania, estimated the industrial potential demand of starch and starch based adhesives to be 10 500 tons per year, 73 000 tons per year if cassava flour would be blended in wheat flour at 1% rate and 40 000 tons per year of dried chips for animal feed sector (Abass *et al.*, 2005) cited by Mutabazi *et al.* (2008). Though best practices indicate that, the high quality cassava flour (HQCF) can substitute wheat in bread and other bakery products at 10% or 20% (Gwera, 2009). In addition to these, literature shows that in the mid 1980s, cassava was utilized in the making of poultry and pig feeds by the Tanzania Feeds Company, a practice that was later discontinued as cassava prices were found high compared with grains (Kapinga *et al.*, 1996). This is an evidence that cassava chips for animal feeds are highly demanded since the maize grains' price is increasing due to world food shortage problem, which is expected to escalate with global challenges of climate change and biofuel production. It is obvious from the above stated situation that there are significant and unmet markets for

quality cassava flour, but much of the cassava flour produced in Tanzania is of poor quality due to improper drying, peeling, chipping and milling (URT, 2005).

Therefore, in order to serve this untapped demand for cassava products much has to be done to increase cassava productivity and changing of policy makers and farmers' (as a crop of great potential of commercialization) mindsets towards cassava. This will encourage public and private investments in the cassava subsector also facilitate farmers to actively participate in the value chain effectively. As a result contribute to reducing income poverty among cassava smallholders.

1.2 Problem Statement and Justification

Basing on the background information, two main research problems come into sight. The first problem relates to lack of appropriate processing technologies for adding value of cassava and poor farmers' organization and coordination as a result farmers find it difficult to access demand sectors in urban markets, hence farmers end up complaining that there is unreliable and unprofitable market for their unprocessed or locally processed cassava products. The second problem is related to farmers' mindset as far as cassava production is concerned where farmers perceive cassava as a subsistence food crop, and if sold, it is just roots (fresh) or locally processed cassava grits at local market.

Nevertheless, we have little understanding of the farmers' perceptions in participating in cassava value chain in the study area as far as empirical knowledge is concerned. We are also not well informed on how farmers would behave when they are informed of alternative cassava value chain strands and the factors behind this behaviour. Basing on the above information, this research was set to fill knowledge gaps with regards to:

- Structure of the cassava value chain and coordination among actors along the chain,
- Profitability of the alternative value chain strands,
- Farmers' preferential choice decisions of alternative cassava value chain strands and
- Determinants of profitability and farmers' preferential choice decisions of potential cassava value chain strands.

The structure of cassava value chain which includes product flows, volumes, prices, costs and typologies of actors were documented by Land and Uliwa (2007) in Lake Zone of Tanzania covering Mara, Mwanza, Kagera and Shinyanga regions. But the analysis in this study was based on zonal level, hence failing to express the micro (district) level structure, coordination as well as profitability of the alternative cassava value chain strands. This study sought to fill the gap and contribute to increased understanding of how individual cassava farmers act in the price formation, their relationship with other actors and their respective farm returns at the micro level.

Regarding farmers' perceptions in participating in alternative cassava value chain strands, a few studies have been conducted on cassava value chain analysis in Tanzania by Njau *et al.* (2008) in Eastern Zone. Mnenwa *et al.* (2008) in Mkuranga and Land and Uliwa (2007) in Lake Zone, cassava production, utilization, processing and marketing by Silayo *et al.* (2006) in Tongwe, Kabuku, Chanika and Mikongeni villages and livestock feed in Tanzania by Lekule and Sarwat (2004) but still more has to be done as far as farmers' perceptions of cassava alternative strands is concerned. This study seeks to fill the knowledge gap of inadequate understanding of farmers' preferential choice decisions in situations of alternative cassava value chain strands and how they might behave and act in these situations particularly in case of interventions. Apart from this, the study intended to

identify the factors underlying farmers' preferences of choice decisions of novel cassava value chain strands.

The outcome of the above knowledge can provide clues on how farmers can be helped to participate effectively and efficiently in upgrading cassava products and marketing practices to enhance commercialization of cassava that offers significant potential for improving farmers' incomes, food security and reduce poverty in the rural areas.

1.3 Objectives of the Study

1.3.1 General objective

The general objective of the study was to examine the value chain for cassava in order to determine strategies needed to enhance profitable participation of smallholder farmers in the cassava value chain for reducing income poverty in Morogoro rural district.

1.3.2 Specific objectives

The specific objectives of the study were:

- a) To analyse the structure of cassava value chain and coordination among actors in cassava value chain.
- b) To analyse profitability of alternative cassava value chain strands and identify determinants of profitability.
- c) To analyse the farmers' preferential choice decision of alternative cassava value chain strands and identify factors behind such decisions.

1.4 Hypotheses

The testable hypotheses with respect to these specific objectives were:

- a) There is significant variation in profitability of cassava among cassava smallholder farmers in the study area.
- b) There is no significant difference in farmers' preferential choice decisions between near and remote villages from urban markets for the alternative cassava strands.
- c) There is no significant difference in the determinants of farmers' preferential choice decisions of alternative cassava value chain strands.

1.5 Organization of the Remainder of the Dissertation

The dissertation is organized into five chapters with chapter one being the introduction to the study. The second chapter provides a review of literature on the theory, concepts, structure and coordination of value chain, profitability of value chain, preferential choice decisions and determinants of farmers' preference while chapter three presents the methodology including the description of the study area, sampling design, data collection tools and techniques of analysing profitability and preferential choice decisions of the alternative value chain strands. The fourth chapter presents and discusses results of the study, followed by chapter five which presents conclusions and recommendations based on the findings of the study.

CHAPTER TWO

THEORY AND LITERATURE REVIEW

2.1 Overview

This chapter reviews literature relevant to the study. The chapter is divided into four main sections. The first section reviews the concept of value chain. The second section covers literature on structure and coordination of the chain. The third section presents literature on profitability of value chain whilst the fourth section reviews literature on farmers' preferential choice decisions of alternative value chain strands and past studies on determinants of farmers' preferential choice decisions.

2.2 Concept of Value Chain

The *value chain* describes 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 consumers, and final disposal after use (Kaplinsky, 1999). The worth of a product increases at each stage of value chain. According to Baker (2006) the value chain traces product flows, shows value additions at different stages and identifies key actors and their relationships in the chain. It also identifies enterprises that contribute to production, services and required institutional support. It identifies bottlenecks preventing progress. The concept provides a framework for sector-specific action. It further identifies strategies to help local enterprises to compete and to improve earning opportunities and stakeholders for program planning (also in distant markets). Briefly, such analysis focuses on the interaction of actors along each step of the production system (from producer to consumer) as well as the linkages within each set of actors (UNCTAD, 2000).

For at least twenty years now, there have been theoretical premises or schools of thoughts regarding value chains entailing the vertical integration and disintegration of production and distribution processes. As a concept, value chain has been developed from the following approaches or schools of thoughts:

2.2.1 The filiere concept

This is a French concept: it is a static model describing the linear flow of physical input and services in the production of a final product (a good or a service). The French scholars analyzed the vertical integration and contract manufacturing in French agriculture with the “*filiere*” concept during the 1960s. Later this concept was applied to industrial policies as electronics and communications. As the *filiere* concept is a static model with non changing actors and national boundaries it is less functional to analyze the globalized world economy (Stamm, 2004). It does not indicate growing or shrinking flows either of commodity or knowledge, nor the rise and fall of actors. In general, *filiere* analysis has been applied to the domestic value chain, thus stopping at national boundaries (Kaplinsky and Morris, 2000).

2.2.2 The Porter approach

In the mid 1980s, Porter developed the so called modern value chain analysis (VCA) as an instrument for identifying the value at each step of production unit. Considering the production of companies Porter identified primary and supporting activities that form the chain. The primary value activities are: inbound logistics, operations, outbound logistics, marketing and sales and services. The goal of these activities is to offer the customer a level of value that exceeds the cost of the activities, thereby resulting in a profit margin. These primary activities are supported by the following activities:- Infrastructure of the

company (organizational structure, control systems, company culture), human resources management (employee recruiting, hiring, training, development and compensation), technological development (technologies to support value creating activities) and procurement (purchasing inputs such as materials, supplies and equipment).

The firm's margin depends on its effectiveness in performing these activities efficiently, so that the amount that the customer is willing to pay for these products exceeds the costs of activities in the value chain. It is in these activities that the firm has the opportunity to generate superior value. A competitive advantage may be achieved by reconfiguring the value chain to provide lower costs or better differentiation (Porter, 1990).

2.2.3 Global commodity chains

The global value chains concept was introduced in mid 1990s (Gereffi, 1999). As opposed to the *filière* concept, there are three key dimensions in the chain analysis. First of all, there is a specific physical input-output structure and geography. Raw material is the input on one side of the chain, and this material moves from one link to the next, where it is processed and value is added. The second dimension is the 'governance structure'. In other words, which type of company played the 'driving' or 'lead' role in their elaboration and management and also how they performed this role. The final dimension is the 'institutional framework' or environment for subordinate firms to learn about markets, and possibly to acquire new knowledge and technology. In recent years, the global commodity chain literature has abandoned the term 'commodity chain' and has taken up that of 'value chain' in its place because the latter is thought to better capture a wider variety of products, some of which lack 'commodity' features (Gibbon and Ponte, 2005).

2.2.4 World economic triangle

Authors such as Messner (2002) and Humphrey and Schmitz (2004) pointed out that the combination of strong local linkages within global commodity chains might bring upgrading prospects for regions in developing countries. Messner (2002) has developed the concept of the “world economic triangle”, where actors, governance and regulation systems are determining the scopes of the action to regions in the global commodity chains. He determined six critical aspects in any economic triangle, these are: actor constellations, interests, power structures, situation mindsets, action orientation and trust. This approach is talking about upgrading (*product, process and function*) of whole regions or clusters through their integration in value chains. Detailed information on upgrading can be obtained from Tuan *et al.* (2005), Humphrey and Schmitz (2004), Kaplinsky and Morris (2000) and Gereffi (1999).

In agricultural development, product upgrading focuses on the introduction and delivery of new products within the value chain. In recent years, most of the cassava farmers have been involved in the starch, High Quality Cassava Flour (HQCF) and chips for animal feeds value chain (Tuan *et al.*, 2005). Process upgrading is defined as improvement in the efficiency of production process. In the agricultural sector, this refers to the utilization of more inputs or the introduction of new cultivation techniques (Schmitz, 2005). Farmers experiencing significant change in cultivation techniques, in harvesting or post-harvesting practices have been very limited. However, this is related to the characteristics of cassava farming system which is relatively simple and low-input. It is important to notice that the lack of process upgrading has characterized the cassava value chain irrespective of territorial and geographical characteristics.

IITA has contributed to promoting processing of cassava into quality cassava flour for various uses and the development of new varieties of cassava that are more resilient to major diseases that attack cassava along the coastal areas of Kenya, Mozambique and Tanzania. Currently the seven cassava varieties highly recommended for cultivation in cassava brown streak/cassava mosaic diseases (CBSD/CMD) affected areas of Tanzania are Kiroba, Kigoma Mafia, Nachinyaya, Kalulu, Kitumbua, Namikonga and Naliendele. Zanzibar recently (15 March 2007) released another four new cassava varieties that are tolerant to CBSD, resistant to CMD, and that meet the preferences of consumers in markets (Manyong and Abbas, 2007). Ntawuruhunga (2007) in his study on re-inventory of improved CMD-resistant cassava varieties in Kenya, Uganda and Tanzania observed that multiplications of the new cassava varieties were either at primary or secondary sites in big areas established by NGOs or Government agencies like Research, Local Government or Prison farms. The management was good, and the farms attracted farmers by their good quality. The improved cassava varieties were well spread across the Lake Zone regions.

Meanwhile, functional upgrading is the action of increasing value added by changing the mix of activities conducted within the firm or moving to activities taking place in other links in the value chain (Tuan *et al.*, 2005). The production of dry chips rather than fresh cassava can be considered a form of functional upgrading. Dry chips product has four major advantages: (i) it creates more employment and value-added for cassava producers; (ii) farmers can keep dry chips as savings and speculate for higher prices; (iii) dry chips can be used as animal feed, hence it give more choices to farmers against market risk; (iv) the dry chips product is lighter, hence saving transportation cost. The production of dry chips does not require a big capital investment.

In Tanzania, the processes of upgrading of cassava products is limited, studies have been done in recent years by Sokoine University of Agriculture and the Ministry of Agriculture and Food Security and Cooperative in Magindu and Songabatini Villages in introduction, testing and adoption of chipping and grating machines with reasonable success. These efforts also lead to the invention of Kebab-looking food product (Kibabu) and formulation of wheat-cassava composite flour buns and chaputti (Laswai *et al.*, 2005; Silayo *et al.*, 2004).

2.3 Structure and Coordination of the Chain

2.3.1 Structure of value chain

The structure of a value chain includes all the firms in the chain and can be characterized in terms of five elements. These are end market opportunities, business and enabling environment, vertical linkages, horizontal linkages and supporting markets.

The end-markets are the starting point of the value chain analysis. End-markets are people, not a location. These determine such characteristics as price, quality, quantity and timing of a successful product or service (Dunn *et al.*, 2006). End-market buyers are a powerful voice and incentive for change. They are important sources of demand information, can transmit learning, and in some cases are willing to invest in firms further down the chain or support activities further upstream. End-market analysis assesses current and potential market opportunities through interviews with current and potential buyers, and takes into consideration trends, prospective competitors and other dynamic factors. Chains also operate in a business enabling environment that can be all at once global, national and local and include norms and customs, laws, regulations, policies, international trade agreements and public infrastructure (roads and electricity) as documented by ECAPAPA (2006).

Linkages can be vertical or horizontal where vertical linkages between firms at different levels of the value chain are critical for moving a product or service to the end market. Vertical cooperation reflects the quality of relationships among vertically linked firms up and down the value chain. More efficient transactions among firms that are vertically related in a value chain increase the competitiveness of the entire industry. Odeyale (2007) and FAO (2004) pointed out that when a vertically integrated market develops there are three clusters of producers – those who are already competitive, those that can be helped to make it, and those who will never make it, who will either remain in the informal market or need other sources of income.

But horizontal linkages (formal and informal) between firms at all levels in a value chain can reduce transaction costs, create economies of scale and contribute to the increased efficiency and competitiveness of an industry. Such linkages also facilitate collective learning and risk sharing, while increasing the potential for upgrading (Dunn *et al.*, 2006). For this study three paths of upgrading (processes, products and functional) are of importance.

Supporting markets play an important role in firm upgrading. They include financial services; cross-cutting services such as business consulting, legal advice and telecommunications; and sector-specific services, for example, processing equipments or handicraft design services.

In order to have a better understanding of where the small cassava farmers stand in the value chain, it is important to analyze who the actors are and what their interactions are like. According to Land and Uliwa (2007) and Collinson *et al.* (2000), the main actors of the cassava value chain in Lake Zone – Tanzania and Uganda respectively, included input

suppliers, producers, rural vendors, small and large traders, processors, retailers and consumers.

2.3.2 Coordination of the value chain

Coordination has become prominent internationally where movement away from disaggregation has been pronounced and where governments have been seeking to reassert central direction in order to improve performance (Peters, 2006).

Coordination of the value chain is the act of making all stakeholders involved in the value chain organized. Much of the emphasis on value chains in agriculture focuses on the development of vertically coordinated supply chains, which typically farmers have under contract to provide fresh food to supermarkets as revealed by Fromm and Dubón (2006).

All commercial transactions involve contracts, whether written or verbal, formal or informal. When the terms of a contract are performed over a period of time or over a physical distance, institutions that enforce contracts help to reassure the contracting parties that the other side of the bargain will be kept. Collinson *et al.* (2000) noted that where contract enforcement breaks down, the risks of doing business severely restrict the number of people willing to make anything more than the simplest of spot transactions (where exchange occurs instantaneously and in person). In line with higher risks, transaction costs associated with monitoring and enforcing contract performance increase dramatically.

Furthermore, coordination implies a set of two or more actors (example, network) who perform tasks (example, collaborative value creation) in order to achieve goals. Coordination means managing the dependencies between activities and is therefore a core

aspect of interorganizational value creation. The variety of interorganizational business models leads to a broad variety of coordination tasks (Riemer *et al.*, 2004).

Therefore, contractual arrangements with firms can provide farmers with a number of advantages. The smallholder farmers are expected to enjoy more benefits from contract farming because they need inputs (cultivars and fertilizers) on credits (Tuan *et al.*, 2005). Furthermore, contract farming can play significant role to support quality upgrading of poor cassava farmers. Apart from inputs credit provision to farmers, firms may provide farmers with training, technical assistance and other services, as well as having a guaranteed market for their produce. However, the coordination of cassava would work well if the farmers work in groups or associations (Riemer *et al.*, 2004; Cachon, 2004).

Contrary to what is stated above, sometimes the small scale farmers are coordinated with wholesalers who do not get involved in production support programs and usually do not enter into long term commercial relationships with producers, they generally buy and sell on a day-to-day basis (FAO, 2006). They typically lack the capacity to define, monitor, or enforce a quality or safety standard beyond basic requirements such as refusing decayed produce.

Consequently, greater organization of cassava farmers, through cooperative or association, would help remedy the problems faced by farmers to get their products to large-scale enterprises directly and reduce the rent-seeking behaviour of traders and procurement agents in the chains.

On the other hand there is horizontal coordination among actors at the same node of the value chain. Horizontal coordination is defined by Halligan (2008) as a process of

integrating activities across the organization. It is typically shown through the formation of a production team.

Horizontal coordination involves combining within an organization multiple production-distribution systems that are technically separable for the same product. Examples are two processing lines or two plants to make cassava chips. Incentives for horizontal integration include potential improvement in the match of supply with demand (macro coordination), potential market power, and generally improved ability to control the environment associated with size and economies of scale (Shaffer, 2001).

Szabó and Popovic (2009) summarized the different coordination structures using a SWOT analysis, for which they assumed two theoretical situations: first, when the coordination is initiated by the processor and, second, when it is initiated by farmers. Finally, they came up with a vertical integration in the dairy chain, based on the horizontal coordination of farmers as initiators.

Horizontal coordination can range from informal agreements between farmers to coordinate purchases and sales, to groups that are formally constituted to facilitate collective action (like farmers' associations) and ultimately to groups that elect or hire managers (like farmers' cooperatives and investor owned companies). The latter examples represent horizontal integration, an extreme form of horizontal coordination in which farmers surrender decision-making power to a manager in exchange for a different set of property rights, namely benefit and voting rights (Lyne and Martin, 2008).

While horizontal coordination can reduce transaction costs and improve smallholder access to preferred markets, group arrangements introduce other costs and institutional problems that discourage smallholder participation and investment (Lyne and Collins, 2008; Cook and Iliopoulos, 2000). Indeed, farmer organisations have only a mixed track record of good performance, as do user groups intended to manage common pool resources like communal forests, grazing, fisheries, irrigation water and storage space.

In Tanzanian context, particularly cassava sub sector studies, we have little information with regard to such kind of coordination among the various stakeholders of the sub sector for the alternative value chain strands.

2.4 Profitability of the Value Chain

Profit is the primary objective of most enterprises. Profit can be defined as the difference between the income of the business and all its costs/expenses. It is normally measured over a period of time. In view of the heavy investment, which is necessary for the success of most enterprises, profit in the accounting sense tends to become a long-term objective, which measures not only the success of a product but also of the development of the market for it (Eichhorn, 2007; Herrmanson *et al.*, 1992).

Profitability of any product influences not only trader's attitudes to invest on that particular product but even farmers of a certain produce. Farmers are motivated by returns to what they are growing, but most of them are not aware of the returns to the factors of production involved in production. Worldwide, analysis of profitability and value chain indicators of cassava has attracted attention in countries like Nigeria in recent times not only because the commodity is assuming increasing economic importance in terms of domestic and

industrial demand, but also in view of the current policy attention being focused on export of cassava products. With regard to profitability, studies have shown that cassava enterprises are quite profitable (Odeyale, 2007).

The study on cassava value chain in Lake Zone by Land and Uliwa (2007) indicated that the supply chain of dry cassava chips can be profitable for all actors in the chain and that none of the actors is making excessive profits. However, the further downstream the better the returns can be. To a large extent this is caused by the information asymmetry and proximity to the urban buyers who have more money to spend.

2.5 Farmers' Preferential Choice Decisions of Alternative Value Chain Strands

A few studies have been done on risk perception (Amaza *et al.*, 2008; Odendo, 2007; Mutabazi, 2007; Senkondo, 2000). In these studies positive approach which starts from the farmers focusing on the question how farmers arrive at various decisions had been discussed. The approach entails close observation of farmers' behaviour and attitude, and understands what types of decision those farmers take and in which situation. The approach can also be used to explain how different households with different endowments differ in decision making. This approach is called the behavioural approach to the analysis of farmers' decision making. The method has an advantage of attaining a better descriptive theory of choice and solutions to choice problems faced by farmers in real world (Huijsman, 1986; Barlett, 1980 and Day, 1979) as cited by Senkondo (2000).

Decisions mean individual farmers choice in the selection of enterprises, crops and crop varieties as well as management practices, such as what to grow, where to grow, how and from where to purchase inputs etc. which occur at all levels in the hierarchy of agro-

ecosystems. In this behavioural framework farmer's beliefs and perceptions play a crucial role. Beliefs pertain to the degree to which an object (example, future contracts) may have particular consequences, and perceptions reflect the interpretation of these consequences (Gómez and Gutiérrez, 2008). Farmers' perceptions and attitudes regarding future contracts are driving their choices. Moreover, farmers do not merely care about crops but about crop decision attributes such as expected profits, risk, likely management problems.

Expected profits measure only the financial expected returns of devoting one hectare to produce the crop given other. For this reason other than monetized opportunity costs are not taken into account. These non financial crop costs include some that are private (as the cost of family labour) and others that are social or public (such as environmental costs and scarcity costs). Private non financial costs (such as family labour) as we will mention later might be of some relevance when farmers aim to avoid decisions that are highly complex to carry on (Gómez and Gutiérrez, 2008; Miller *et al.*, 2004).

Farmers take decisions without perfect knowledge of the yields they will obtain or of the selling prices they will get from the market, apart from other uncertainties related with input prices, labour, water availability (rainfall) in the right time of the season, *inter alia*. Farmers' preferential choice decisions of alternative cassava value chain strands will then depend on farmers' attitudes toward risk. Risk averse farmers will only accept risky strands if the expected profits from these kinds of strands are high enough to compensate them for voluntarily accepting such risk. Risk neutral farmers will always maximize expected profits, and risk prone farmers will not need to ask for higher expected profits in exchange for taking a risky option (Gómez and Gutiérrez, 2008; Langrock and Hurley, 2006). Thus

risk attitudes are determined not only by the farmers' decisions but also farmers' behaviour to adapt to institutional changes that adjust the balance of expected returns and risk.

According to Gómez and Gutiérrez (2008) apart from preferring strands with high and secure profits farmers might also like decisions that are easy to implement. Faced with two or three alternatives with the same expected profit and a similar risk, the farmer might also prefer the decision which is easier to carry out. Planting, waiting and harvesting may be perceived as better options than alternatives requiring, for example, the occasional hiring of skilled workers, permanent monitoring, a lot of household work and many other actions which, apart from being a nuisance, introduce additional uncertainty concerns.

The varietal preferences of cassava varied with the varietal characteristics, as evidenced from the varieties ranking matrix. The farmers preferred *Ullichuvala* owing to its yield, duration, tuber shape, market preference, cooking quality and suitability to low land cultivation (Ramanathan and Anantharaman, 2001). The present demand for cassava is mainly in the form of fresh roots for domestic consumption. The supply of fresh roots is seasonal in most areas with the peak harvest season. Harvesting and planting of cassava are done almost simultaneously during this period as the cassava is usually cultivated in dry areas as an annual crop. Therefore wholesale and the retail prices are low during this peak production period and high during the lean production period in a given year (De Silva, 2004).

So the study intended to analyze the farmers' preferential choice decisions under different or alternative cassava value chain strands which are producing for high quality cassava flour and chips for human consumption and animal feed industry.

2.5.1 Approaches to risk attitude analysis

There are several approaches used by researchers to analyze risk attitudes of decision-makers in agriculture and other sectors. Among the mostly widely used approaches are the utility functions (Gómez and Gutiérrez, 2008; Zapata *et al.*, 2007; Bekele, 2004; Chilonda and Van Huylenbroeck 2001; Senkondo, 2000; Goodwin *et al.*, 1997).

The expected utility model has been used extensively to investigate subject's behavior under risk. Von Neumann and Morgenstern (1944) are the major contributors to a large body of work that provides the justification for the use of the expected utility model by a rational decision maker. The expected utility model views decision making under risk as a choice between alternatives. Decision makers are assumed to have a preference ordering defined over the probability distributions for which a number of axioms hold. Risky alternatives can be evaluated under these assumptions using the expected utility preference function, $u(x)$.

Expected Utility Theory (EUT) has been under severe debate in recent years. The source of this debate has been the observation of apparently robust behavioural anomalies in decisions that individual experimental subjects make in controlled environments. The popular implication of these observations is that EUT is systematically misleading as a descriptive model of human behaviour under uncertainty. Many alternative models of individual choice behaviour have been proposed that can account for some or all of the alleged anomalies (Harrison, 1994). Moreover, the model fails to take into consideration some psychological principles of judgment and choice as well as recognition of other items which can be referred to as expressing risk attitude by farmers. This study utilized the

latent variable approach so as to measure farmers' risk attitude towards participation in alternative cassava value chain strands.

In the psychometric approach, risk attitude is a latent construct (that is, a not directly observable variable) that is measured by a set of observable variables (so-called indicators, i.e., questions or items). Likert (1932) proposed different multi-item scaling procedures termed as Likert - type scale. The Likert procedure has performed well with respect to reliability and validity and is most commonly used. The latent variables reveal underlying indicators not directly observed, that determine relationships among several variables concerning a research study. It also reduces a large number of variables to a few manageable factors that are uncorrelated to each other thus preventing multicollinearity problems. More strength of the approach is documented in detail by Defrancesco *et al.* (2006) and Senkondo (2000). However, the technique has shortcomings as generally being less reliable and dependable when analysis is run once, and "The factors are nothing but blurred averages, difficult to be identified" (Kothari, 2004).

2.5.2 Determinants of farmers' preference

In the context of domestic food preference, Good and Huddleston (1995) showed that age was usually negatively related to the attitude towards foreign and imported products, while the opposite was true for education and income.

More sophisticated behavioural approaches paid attention to a number of farmers' personal characteristics, such as motivations, values and attitudes. Reference has been made to microeconomic models based on the theory of reasoned action which assumes that the behavioural intentions of an individual are directly related to his/her attitudes (Defrancesco

et al., 2007). Recent studies have tried to incorporate farmers' behaviour into policy analysis models (Defra, 2006) or to explain technology transfer mechanisms (Rehman *et al.*, 2006). Wynn *et al.* (2001) propose the following classification: (i) physical farm factors; (ii) farmer characteristics; (iii) business factors and (iv) situational factors.

Among the farm structural (physical) factors such as size, type, labour, stocking rates – many authors consider farm size to be one of the most important determinants, but the research results are not consistent. Ueckermann *et al.* (2007); Wales and Mazzorra (2001) established that the larger the farm size, the higher the participation rate.

A farmer characteristic such as age has been assumed as a significant variable in most studies, to the extent that young farmers are more willing to take risks. This hypothesis is confirmed by Wynn *et al.* (2001). However, education, an indicator for quality of human capital, generally encourages participation (Dupraz *et al.*, 2002). Moreover, Irungu *et al.* (2006) found farmers' age and education level to be inversely but significantly related to the choice probability.

Business factors such as tenure (including the influence of landlords on the entry decision for leased land) and the share of off-farm income do not seem important in explaining entry in Wynn *et al.* (2001).

Situational factors include determinants linked to the interface between farmers and the policy: the amount of information received, neighbours' participation and advisors' negotiating skills supporting the entry decision (Drake *et al.*, 1999; Damianos and Giannakopoulos, 2002).

Furthermore, descriptive statistics and multivariate regression model (Tucker and Napier, 2000; Napier and Napier, 1991) indicated that farmers' preferences are influenced by the characteristics of the farm and the farmer and, the personal costs and benefits that farmers expect. In Tanzania, we have limited knowledge concerning the determinants of the farmers' preferential choice decisions of the alternative cassava value chain strands. It is not clearly explained what can drive the farmer to choose a certain strand of the chain in case of promotional interventions.

CHAPTER THREE

METHODOLOGY

3.1 Overview

This chapter describes the methodological aspects of this study. The chapter is divided into five main sections. The first section describes the study area and its characteristics. This is followed by description of the sampling procedures, data collection instruments, methods for data analysis in section two, three and four respectively. Section five describes in detail the expected relationships between profitability and the explanatory variables.

3.2 Study Area and its Characteristics

3.2.1 The study area

The study was carried at Morogoro rural district. The area was chosen because cassava is widely cultivated by virtually all the farmers in the district. Moreover the largest area planted with cassava in the region (5 564 hectare, 31%) is located in the area of study while the largest area planted with cassava per household is Mvomero district (0.91 hectare). With exception of Morogoro rural and Kilosa, the variations in the area planted with cassava household for the rest of the districts are small ranging from 0.24 hectare, 0.28 hectare and 0.31 hectare in Ulanga, Kilombero and Morogoro urban, respectively (URT, 2007). The area of study is located at North East of Morogoro Region between $8^{\circ}00'$ and $10^{\circ}00'$ Latitudes South of Equator and between Longitudes $37^{\circ}00'$ and $38^{\circ}22'$ East (Fig. 1). It borders Kisarawe and Bagamoyo (Coastal region) to the East, Liwale (Lindi region) and Kilombero districts to the South and Mvomero district to the North and West.

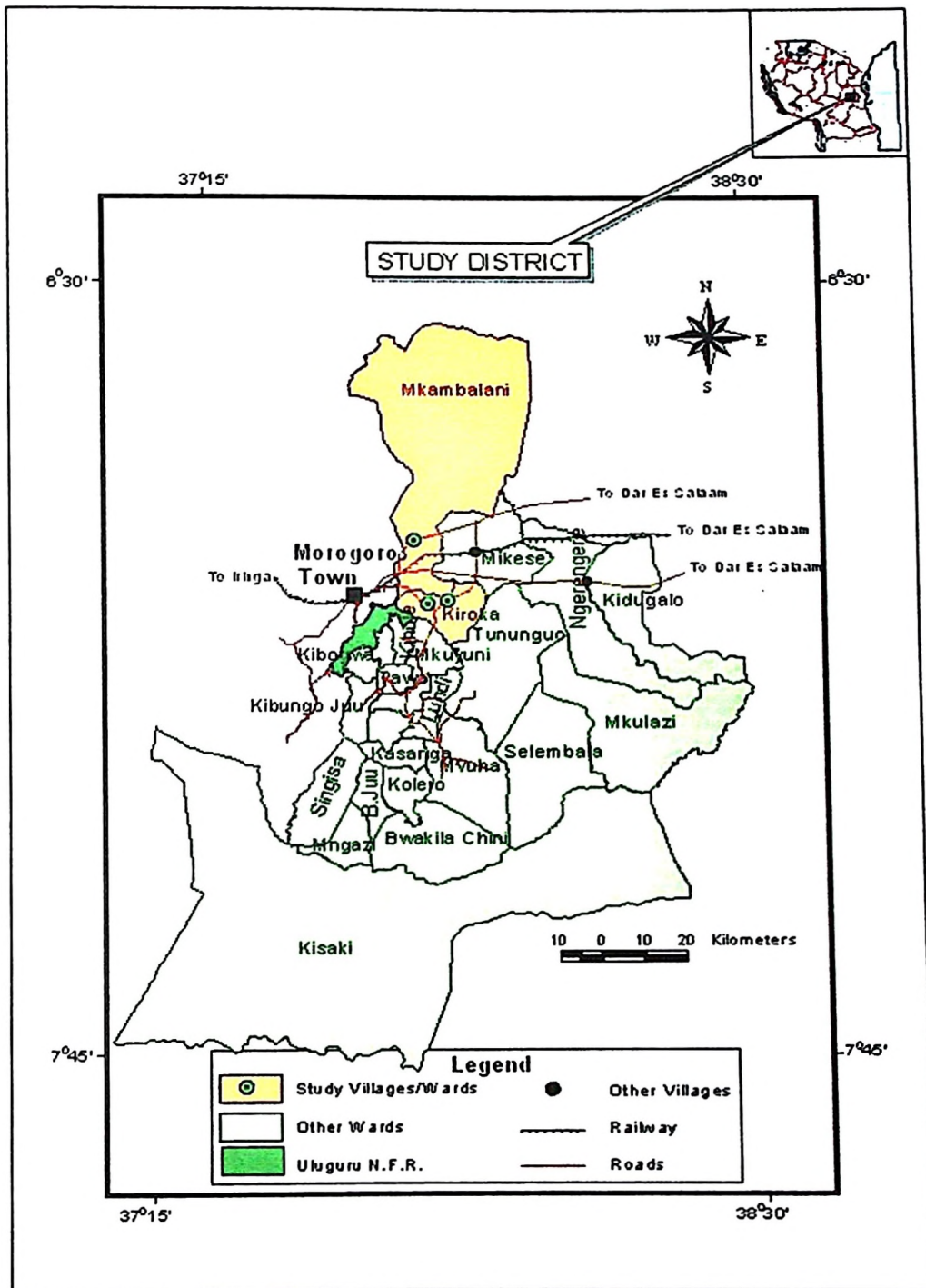


Figure 1: Morogoro Rural District's map.

3.2.2 District land area and administrative units

Morogoro rural district has an area of 11 925 square kilometres equivalent to 16.34% of the total area of Morogoro region. The potential arable land is 8805 square kilometres, game reserves occupy 2000 square kilometres and wetland and water bodies 1120 sq km. The district has six divisions, 25 wards, 132 villages, 657 hamlets and 56 723 households (MDC, 2008).

3.2.3 Population size and growth

According to the population and housing census conducted in 2002, Morogoro rural district had a population of 263 920 inhabitants (129 285 men and 134 635 women) with an average growth rate of 2.6 percent per annum. The average family size was 4.6 persons per household. However, the economical working group consists of 136 533 people.

3.2.4 Climate and soils

The temperature regime for Morogoro normally ranges from 18^o to 30^o of centigrade. The rainfall ranges from 600 mm in flat areas to 2000 mm in mountainous areas. It rains (long rains) from March to May (*Masika*) and short season rains in November and December (*Vuli*). January and February is a dry season while August to November is a hot season. There are different types of soils in the district, namely sandy soil at Ngerengere and Kisiaki, clay soil in Ngerengere and Kidugalo and loamy soil in Matuli and Ngerengere.

3.2.5 Cassava in the district's economy

Morogoro district's economy depends mainly on agriculture (crop production) where more than 80% of the population depends on the sector. The major crops cultivated in the district are maize, paddy, cassava and sorghum as food crops and cotton and sisal as cash crops.

According to the Morogoro District Council (2008), only 211 000 ha (12%) of arable land which is 1 774 000 ha is cultivated, whereby 5 564 ha are under cassava production (MDC, 2008 and URT, 2007). Table 1 indicates the land utilization for agricultural crop production in 2006/07.

Table 1: Agricultural crop production 2006/07

Type of crop	Target area	Achievement		Target harvest	Achievement	
	ha	ha	%	Tons	Tons	%
1 Maize	39 429	21 833	55.3	70 973	43 666	61.5
2 Paddy	20 588	16 584	80.5	51 469	41 460	80.5
3 Cassava	14 603	8 812	60	43 828	26 436	60.3
4 Sorghum	832	491	59.8	470	393	83.6
5 Millet	19 041	2 930	15.4	28 562	4 395	15.4
6 Banana	3 900	2 825	72.4	97 500	28 250	28.9
7 Beans	19 072	7 562	39.6	11 443	5 671	49.6
8 Coffee	1 916	617	32.2	942	185	19.6
9 Cotton	1 269	137	10.7	3 738	68.5	1.8

Source: District Department of Agriculture, Morogoro Rural (2007)

The area planted with cassava in 2006/07 in the district was larger than any other root and tuber crop in the region. According to Table 1 area under cassava was 8812 ha and its production was 26 436 tons in 2006/07.

3.3 Sampling Procedure

The selection of wards was done systematically in collaboration with district agricultural officers whereby the 25 wards in the district were ranked on a 0 – 10 scores with respect to three criteria, namely; actual production, potential production from farm expansion and physical accessibility of roads. The wards with highest score were selected. From this exercise Mkambarani and Kiroka wards were selected. Thereafter, all villages in the selected wards were numbered and three of them were randomly drawn from the list. These were Mkambarani, Kungwe and Kiroka villages. A simple random sampling was employed

to obtain 50 cassava farmers from each village making a total of 150 farmers. The study also involved only 13 traders (5 small traders, 1 wholesaler, 2 retailers, and 5 fried/roasted cassava traders). The survey involved a small number of respondents due to underdeveloped commercialization of cassava subsector.

3.4 Data Collection

3.4.1 Primary data

Primary data were collected from farmers using structured questionnaires. The questionnaire contained both open and close-ended questions (Appendix 1). The farmers or producer's questionnaire included information on household member's information, land availability, labour availability and use, productive assets, crop production and inputs, cassava production, marketing and processing, producer associations and household livelihood issues. The study conducted semi-structured interviews using a checklist to obtain important information from 12 traders of cassava products from both rural and urban markets (Appendix 3). An additional questionnaire was used to collect information from a sub-sample on farmers' attitudes towards working in groups, potential cassava strands and their respective markets (Appendix 2).

The supplementary questionnaire was administered to 42 a sub-sample respondents who were categorized as nearby and remote to urban market. These respondents were picked randomly from the main sample of 150 respondents. The exercise did not involve all respondents of the main survey sample due to the fact the exercise is a social experiment, which takes time to be conducted, hence needs a lot of time; bearing in mind that it was done in succession with the main survey. The technique measured latent preferential choice decisions of potential cassava value chain strands which did not exist in the study area.

First and foremost the sub-sample respondents were familiarized on two scenarios, which included the farmers' attitude towards working in groups, two potential strands of alternative cassava products (HQCF and animal feed) and their related marketing issues. From these scenarios, statements were addressed to the respondents. The statements were adapted from previous related research work and researchers experience in the study area. For each of the attitudinal statements, respondents were required to state if they strongly agree, agree, disagree, strongly disagree or undecided. In order to recognize the statements jointly explaining the variation, the sample variation was determined for each item, whereby items which showed insignificant variance were eliminated. Presence of sufficient variance in the axiomatic statements is a precondition for a successful run of factor analysis.

3.4.2 Secondary data

Secondary data and information were collected by reviewing documents from the District Agricultural Department, Reports, Journals, Sokoine National Agricultural Library (SNAL) and internet.

3.5 Methods for Data Analysis

A combination of qualitative and quantitative methods of analysis was used to analyze the data as described in subsequent sections. There is a growing recognition in literature on field methods in development studies that a judicious combination of qualitative and quantitative methods can help to solve problems that are associated with each type of method taken separately (White, 2002; Kanbur, 2001).

3.5.1 Analysis of structure, coordination and profitability of cassava value chain

a) Analysis of the structure of value chain

Descriptive analysis and conventional mapping were used to describe the structure of the cassava value chain. Specifically, descriptive statistics were generated for product flows, volumes, prices, key actors and products marketed.

b) Analysis of coordination of the chain

Descriptive analysis (numbers, maximum, minimum, percentages and means) was carried out to assess coordination of the chain which involved the relationship between the actors of the chain, selling/procurement style, terms of payment and services provided by firms or institutions to the farmers. The Statistical Package for Social Sciences (SPSS) was employed for the descriptive statistics of both the structure and coordination of the chain.

c) Profitability of cassava production and marketing.

Data collected were entered in SPSS and descriptive statistics were carried out for analyzing the socio-economic characteristics of the respondents. Furthermore, Microsoft Excel was used for quantitative techniques analyses (partial budget) computing the profitability of the cassava smallholder enterprises. Net (profit) margin was determined by multiplying the physical output (kg/acre) and price (Tshs/kg) minus variable costs. The variable costs included the costs of land preparation, buying cuttings, planting, weeding and renting in land. The basic equation for profit margins computation is as follows:

$$PM_j = \frac{1}{n} \sum_{i=1}^n (P_j V_j - VC_j) \quad (1)$$

Where,

PM_{ij} = average profit (net) margin earned by farmers $i=1...n$ earned by ith farmer for jth cassava output in Tshs/acre

P_{ij} = unit producer price of ith farmer for jth cassava output, (in Tshs/kg)

V_{ij} = volume marketed by ith farmer for jth cassava output given kth (in kg)

VC_{ij} = total variable costs incurred by ith farmer for jth cassava output (in Tshs/kg)

n = number of farmers dealing with jth cassava output.

Profitability of the above equation was estimated from the income generated by 98 sampled cassava farmers from the three villages (Mkambarani, Kiroka and Kungwe) for the 2007/08 growing season. The rest of the sampled farmers (52) were not included in the computation because they did not respond on cassava outputs for the same growing season. Furthermore, the villages' net margins were compared using Analysis of Variance (ANoVA). The partial budget was based on the production costs and yield per acre for the 2007/08 growing season. Non-marketed outputs and inputs such as fresh and processed cassava consumed at family level and family labour respectively were evaluated at the local market prices. The estimation of average costs for variable inputs such as planting materials (cuttings), land preparation, planting, weeding, harvesting and post harvesting charges, hired labour and land rent was based on prices and wages as reported by farmers in the field. The analysis also included cassava traders (small traders, large traders, food vendors and retailers).

In order to get returns to labour, the net profit margin which was computed in equation 1 was divided by total person-days of family workforce employed in different value chain operations. Person-day refers to the adult Equivalents (AE) multiplied by effective days multiplied by effective hours. Adult Equivalent is a multiplier used in converting man-hours into the number of full-time workers needed to complete a job within a given time-frame. In this study the Adult Equivalent for households was calculated as follows: adult male and female of 15 and above years of age were assigned 1, while a child of 10-14 years of age was equated to 0.5 of an adult equivalent and children below 10 years were considered as contributing insignificantly to family labour. The farm operations included land preparation, planting, weeding, harvesting, and marketing of cassava. The basic equation for returns to labour computation is as follows:

$$RL_{ij} = PM_{ij} / PD_{ij} \quad (2)$$

Where,

- RL_{ij} = average returns to labour earned by farmers $i=1...n$ earned by ith farmer for jth cassava output in Tshs/acre,
- PM_{ij} = average profit margins earned by farmers $i=1...n$ earned by ith farmer for jth cassava output (Tshs/acre),
- PD_{ij} = total person-days of family labour allocated by ith farmer in jth cassava output in person-day/acre.

3.5.2 Analysis of farmers' preferential choice decisions of alternative cassava value chain strands

The data collected were entered in Ms Excel and then were imported to SPSS version 12.0 and LIMDEP for various analyses. From SPSS factor analysis was used to identify the factors (variables) for further analysis. The factors with highest Eigen-values were applied to develop factor scores (calculated as the sum of products of the factor loadings with the original variables) for measuring the attitudinal variables. As a general rule, the information provided by factors having an Eigen-value less than 1 was considered to be of minor importance in the explanation of the variance.

3.4.3 Determinants of profitability and farmers' preferential choice decisions

3.4.3.1 Description of explanatory variables

The description of explanatory variables (X_1, \dots, X_{17}) of the linear and Poisson models is streamlined to five livelihood capitals namely human, financial, physical, natural and social capitals from the Sustainable Livelihood Framework (SLF). Details on the framework are found in a number of literature including Butler and Mazur (2007); Fouracre (2001); Murray and Ferguson (2001) and DFID (1999).

3.4.3.2 Determinants of cassava profitability

A linear regression model was used to identify the determinants of farmers' profitability where farmers' profit margin was taken as a function of other 15 variables entailing age of the household head, gender of the household head, education level of the household head, household size, experience in business, farm size under cassava cultivation, physical accessibility to urban market, amount of labour force available for work, status of food insecurity, group participation, perception on contribution of cassava to household income,

income from non crop livelihood sources, working status of farm implements and total person-days of family labour.

The model for profitability was specified as follows:

$$Y = \beta_0 + \beta_1 AGEHH + \beta_2 GEHH + \beta_3 EDUHH + \beta_4 EXPHH + \beta_5 AHSIZE + \beta_6 PERD + \beta_7 FULTLAB + \beta_8 INCLISO + \beta_9 CACONT + \beta_{10} WOSTHO + \beta_{11} ACEUMA + \beta_{12} MAINFO + \beta_{13} FARMSIZE + \beta_{14} GROPART + \beta_{15} FOODINSE + \mu \quad (3)$$

Where;

- Y = Profit margin (Tshs/acre)
- β_0 = the intercept of the regression equation
- $\beta_1 \dots \beta_{15}$ = the parameters to be estimated,
- $AGEHH$ = Age of the household head in years,
- $GEHH$ = Gender of the household head expressed as dummy, 1=female headed household, 0=otherwise),
- $EDUHH$ = Education level of the household head measured in years spent schooling,
- $EXPHH$ = Experience of household in cassava business expressed in years,
- $AHSIZE$ = Aggregate household size expressed in total number of family members,
- $PERD$ = Person-days spent in cassava cultivation in 2007/08.
- $FULTLAB$ = Labour force available was expressed in terms of total number of household adult working full time in cassava farm

- INCLISO* = Income from non crop livelihood sources measured in gross income of other activities excluding crop production,
- CAICONT* = Cassava contribution to household income was expressed as dummy variable where insignificant contribution to household income was coded '1' and '0' otherwise,
- WOSTHO* = Working status of farm implements was expressed as dummy variable whereby hand-hoes that were working properly were coded as '1' and '0' otherwise,
- ACEUMA* = Physical access to urban markets was expressed as dummy variable whereby all household heads/respondent who reside in remote area from urban market was coded '1' and '0' otherwise,
- MAINFO* = Access to market information was expressed as dummy variable whereby all respondents who have no access to market information were coded as '1' and '0' otherwise,
- FARMSIZE* = Farm size was expressed as the total amount of land in acres under cassava cultivation for 2007/08 growing season,
- GROPART* = Group participation was expressed as as dummy variable whereby all household who were members into different social groups were coded '1 and '0' otherwise,
- FOODINSE* = Food insecurity was expressed as dummy variable whereby all households who face food insecurity were coded as '1' and '0' otherwise,
- μ = Error term.

3.4.3.3 Determinants of farmers' preferential choice decisions

The determinants for farmer's preferential choice decisions were identified using a count data model known as Poisson model embedded in LIMDEP version 8.0 software.

Data for the count models may be censored or truncated. The data are said censored if a range of values of the dependent variable is collapsed where by responses might be 0, 1, 2, and 3 or more (Zeileis *et al.*, 2008; Greene, 2002). Such situation is common in clinical work whereby one often encounters situations where the outcome variable is numeric, but in the form of counts. However, in economics such cases happen too, when response variable is the number of occurrences in a given time frame (outcomes equal to 0,1,2,3,.....) for example number of customers shopping at a store on a given day or number of start-up companies by ex-employees. The aim of regression analysis in such instances is to model the dependent variable Y as the estimate of outcome using some or all of the explanatory variables (in mathematical terminology estimating the outcome as a function of some explanatory variables).

When the response variable had a normal distribution we found that its mean could be linked to a set of explanatory variables using a linear function like

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 \dots \dots + \beta_k X_k.$$

In the case of binary regression the fact that probability lies between 0-1 imposes a constraint. The normality assumption of multiple linear regression is lost, and so also is the assumption of constant variance. Without these assumptions the F and t tests have no basis. The solution is to use the logistic transformation of the probability p or logit p , such that: $\log_e(p/1-p) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 \dots \dots \beta_n X_n$. The β coefficients could now be interpreted as

increasing or decreasing the log odds of an event, and $\exp \beta$ (the odds multiplier) could be used as the odds ratio for a unit increase or decrease in the explanatory variable. In survival analysis we use the natural logarithm of the hazard ratio, that is $\log_e h(t)/h_0(t) = \beta_0 + \beta_1 X_1 + \dots + \beta_n X_n$.

The Poisson regression is usually estimated with the log link function, and is sometimes called the "exponential Poisson regression." The Poisson distribution for the dependent variable is limited to positive values, and has a variance equal to its mean. That is, in populations where events are very rare, the distribution is highly right skewed; as the mean of events rises, the distribution increasingly resembles the normal one.

When the response variable is in the form of a count we face a yet different constraint. Counts are all positive integers and for rare events the Poisson distribution (rather than the Normal) is more appropriate since the Poisson mean is greater than zero. So the logarithm of the response variable is linked to a linear function of explanatory variables such that:

$\log_e(Y) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 \dots$ etc. and so $Y = (e^{\beta_0}) (e^{\beta_1 X_1}) (e^{\beta_2 X_2}) \dots$ etc. In other words, the typical Poisson regression model expresses the log outcome rate as a linear function of a set of predictors.

Therefore the econometric model states as follows:

$$\text{Log}_e(Y) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \dots + \beta_n X_n + \mu \quad (4)$$

Where,

- Y = Dependent variable,
 β_0 = Intercept of the regression equation,
 $\beta_1 \dots \beta_n$ = Parameters to be estimated ranging from $i^{th} = 1$ to n^{th} ,
 $X_1 \dots X_n$ = independent variables ranging from $i^{th} = 1$ to n^{th} ,
 μ = Error term.

The empirical model was specified as:

$$\begin{aligned} \text{Log}_e(Y) = & \beta_0 + \beta_1 \text{AGERE} + \beta_2 \text{GERE} + \beta_3 \text{EDURE} + \beta_4 \text{EXPRE} + \beta_5 \text{AHSIZE} + \beta_6 \text{FULTLAB} \\ & + \beta_7 \text{MAOCHH} + \beta_8 \text{CAICONT} + \beta_9 \text{ACEUMA} + \beta_{10} \text{MAINFO} + \beta_{11} \text{FARMSIZE} + \\ & \beta_{12} \text{GROPART} + \mu \end{aligned} \quad (5)$$

Where:

- Y = Farmers' attitude (counts, scores),
 $AGERE$ = Age of the respondent in years,
 $GERE$ = Gender of the respondent expressed as dummy, 1=female,
 0=otherwise,
 $EDURE$ = Education level of the respondent measured in years spent
 schooling,
 $EXPRE$ = Experience of household in cassava production expressed in
 years,
 $AHSIZE$ = Aggregate household size expressed in total number of
 family members
 $FULTLAB$ = Labour force available was expressed in terms of total

number of household adults working full time in cassava farm,

- MAOCHH* = Crop production (farm) participation was expressed as a dummy variable whereby all household heads who engaged themselves in farm activities were coded '1' and '0' otherwise,
- CAICONT* = Cassava contribution to household income was expressed as dummy variable where insignificant contribution to household income was coded '1' and '0' otherwise,
- ACEUMA* = Physical access to urban markets was expressed as dummy variable whereby all household heads/respondents who reside in remote areas from urban market was coded '1' and '0' otherwise,
- MAINFO* = Access to market information was expressed as dummy variable whereby all respondents who have no access to market information were coded as '1' and '0' otherwise,
- FARMSIZE* = Farm size was expressed as the total amount of land in acres under cassava cultivation for 2007/08 growing season,
- GROPART* = Group participation was expressed as as dummy variable whereby all household heads who were members into different social groups were coded '1 and '0' otherwise,
- μ = Error term.

Hence we had to run three Poisson models, whose dependent variable for each model was the response (scores) of the interviewed farmers about their risk preferences on

participation in farmers groups, engaging in potential alternative strands and attitude towards marketing of the potential cassava products. The scores in the three items were regressed against the predictors presented in subsection 3.5.3.3 in equation 5.

3.6 Theoretical Description of Predictor Variables

i) **Access to urban market (ACEUMA)**. This is location of the farmers' household from the nearest urban market. The closer the urban market to farmers' household, the lesser would be the transportation charges, loss due to spoilage and better access to market information. This improves return to labour and capital mainly through increased farm gate price and the incentives to participate in economic transaction. A study conducted by Holloway and Ehui (2002) on expanding market participation among smallholder livestock producers in the Ethiopian highlands revealed that distance to milk market was negatively related to milk market participation decision of dairy households. So it was assumed that the smallholder cassava farmers with improved physical access to market for their produce were expected to exploit the benefit of market to sell the product and accrue more returns than those who were remote from the urban market which is a consumption demand hotspot. Such farmers were assumed to have positive attitude towards risks and also positively correlated with profitability of cassava.

ii) Age of the household head (AGEHH/AGERE)

It is a continuous variable and measured in years. Age of the farmer can generate or erode confidence; in other words, with age, a farmer can become more or less risk-averse to adopt new technology or venture in new opportunities. Moreover, age is a proxy measure of farming experience of household. Aged household heads are believed to have established practical know how in resource use and it is expected to have a positive effect

on marketable surplus. Tshiunza *et al.* (2001) identified age as the major farms' characteristics that significantly affected the proportion of cooking banana planted for market.

iii) Gender (GEHH/GERE)

Usually female farmers are socio economically less fortunate compared to male farmers; hence females were hypothesized as risk averse and negatively related to attitude towards risk as well as to profitability of cassava enterprise.

iv) Farm size (FARMSIZE)

Cassava farm size in acres under cultivation for 2007/08 growing season is an indicator of wealth and perhaps a proxy for social status and influence within the community. It is expected to be positively associated with the decision to take risk.

v) Education (EDUHH/EDURE)

Education of the household head plays an important role in the adoption of innovations/new technologies. Through education, the quality of labour and the propensity to adopt new technologies are improved. Further, education is believed to improve the readiness of the household to accept new ideas and innovations, and get updated demand and supply price information which in turn enhances producers' willingness to produce and market of more cassava market. A study conducted by Holloway *et al.* (1999) indicated positive relationship between education and dairy household market entry decision and marketed milk volume. Similarly, a study conducted by Gizachew (2005) and Rehima (2006) showed that formal education was positively related to household market

participation and marketed volume. Therefore, in this specific study, formal education is hypothesized to affect cassava profitability and risk attitude positively.

vi) Aggregate household size (AHSIZE)

Large household size was assumed as a motivation to produce more and even take risk. A study conducted by Jha (2009) affirms that large household size may be a source of motivation for livelihoods. Thus large household size would be expected to increase the profitability and thus increase the probability of risk preference.

vii) Labour force (FULTLAB)

It was hypothesized that farmers with more labour force available to work full time on the cassava farm would increase the confidence of taking risk and manage large cassava land holding and other farm operations. Therefore, labour force was hypothesized to be positively related with gross margin as well as with attitude towards risks.

viii) Person-days (PERD)

The study hypothesized that an increase in number of person-days for cassava production leads to an increase in profitability of cassava. A positive sign was expected for the parameter attached to this variable in the profitability model.

ix) Experience in cassava production (EXPHH/EXPRE)

Experience is knowledge or skills obtained from doing or practicing a certain task. Experience in cassava production should have a direct relationship with profit. As one gets proficient in the methods of production, optimal allocation of resources at his/her disposal is likely to be achieved. Thus the more experienced one is, the higher the profit. The same

is also applicable for risk preference. A farmer with more experience in farming is expected to be less risk averse. Hence a positive sign is assumed.

x) Food insecurity status (FOODINS)

Food security is a very important aspect livelihood of agrarian communities. Hence it was expected that household facing by food insecurity would be less productive mainly due to poor labour quality and therefore contributing less to profit margin.

xi) Group participation (GROPART)

Since the groups were not involved in marketing farmers were however, involved in joint learning and inter farmer knowledge exchange was assumed to pool together the little resources they own, and make decisions on how they can utilize them effectively. Therefore it was assumed that farmers who did not share learning and exchange knowledge with others can negatively contribute to cassava profitability. For the risk behaviour models, group networking was taken as a push factor for risk taking behaviour and has less risk preference to alternative cassava value chains.

xii) Significance of cassava contribution to household income (CAICONT)

Ideally cassava is a strategic famine crop, so its income contribution to most of the farmers in rural areas is thought to be low because it is grown basically for food in case of famine, but if it was high it would imply increased level of commercialization and farmers will be motivated to reallocate more resources to cassava production. Moreover farmers would be ready to take risk to produce cassava for commercialization. Therefore it was postulated that if the income from cassava contribute significantly to the household income, then it will have a positive influence to profitability of cassava and risk taking behaviour.

xiii) Working status of farm implements-hand hoes (WOSTHO)

Hand hoes were the mainly used farm implements in cassava production. The working status of the implement was measured as a dummy variable that takes value 1 if the hoes are working properly and 0 otherwise. The variable is expected to have a positive relation with profitability of cassava.

xiv) Income from non-crop livelihood sources (INCLISO)

Income from non-crop livelihood sources is positively or negatively related to profitability of cassava. Hence as households diversify their activities they could be in a good position to invest on cassava production as one of such diversifications. However, the household can reduce the size of the farm for cassava and grow other crops, or invest his capital in other activities, which will finally reduce profit margin of cassava.

xv) Market information (MAINFO)

This is a dummy variable which assumed that households lacking access to market information is negatively related to the cassava profit margin and risk attitude.

xvi) Main occupation of the household head (MAIICHH)

This is a dummy variable, household heads who participated in crop production as their main occupation were expected to have negative attitude towards risks. Therefore a negative sign was expected on the coefficient attached to the variable.

xvii) Land holding (LAHOLD)

The variable as it is used in the Poisson models encompasses the land that the household had access to whether it is owned or outsourced through other use arrangements. The

household with access to a large land may be in good position to manage farm risks compared to one with access to small land. Therefore attitude towards risk was expected to increase with increasing size in land holding.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Overview

This chapter presents and discusses the results of the study. The chapter is divided into five sections. The first section describes the socio-economic characteristics of the sampled households. The second section describes the results of the cassava production, processing and marketing in the study area. The third section describes the structure and coordination of the value chain and key actors along the chain. The fourth section discusses results on the profitability of alternative cassava value chain and determinants of profitability while the fifth section describes the results of the farmers' preferential choice decisions (attitude to risks) and factors that influence farmers' preferential choice decisions.

4.2 Socio-Economic Characteristics of the Respondents

Table 2 summarizes the socio-economic characteristics of the sampled households such as age, gender, education level and occupation of the household head. The results show that most of the household heads (60%) were below 50 years of age. It is also shown that more than 55% of the sampled households were males.

The results in Table 2 indicate that more than 80% of the sampled households attained formal education. The results generally concurred with the findings of agricultural marketing information needs study (URT, 2004), which found that there is a large number of farmers with primary education and below this level of education.

Table 2: Socio economic characteristics of the respondents

Variable	Category	Frequency	Percentage
Age	17-27	12	8.0
	28-38	48	32.0
	39-49	33	22.0
	50-60	34	22.7
	> 60	23	15.3
	Total	150	100
Gender of household head respondent	Male	99	66.0
	Female	51	34.0
	Total	150	100.0
Formal schooling	Illiterate	24	16.0
	Primary	109	72.7
	Secondary	17	11.3
	Total	150	100.0
Main occupation	Housewife/IH chores	1	0.7
	Crop production	136	91.3
	Government employee	4	2.7
	Casual labourer	3	2.0
	Business	5	3.4
	Total	149	100.0

Apart from education, the results in Table 2 indicate that most of the respondents interviewed were involved in crop production (91%), where the rest of the respondents (9%) were involved in government services, casual labour and business activities.

Table 3 shows the number of household members by age group. The total number of members in the household has an important implication in household ability to participate

in productive activities. A large family size implies large labour power for agricultural activities, in this case cassava production. The results in Table 3 indicate that maximum household size of the sampled households were 13 with an average of 6 members per household. There is small difference between the average household size of the sampled villages and the regional (Morogoro) average household size of 4.6 persons according to the 2002 population and housing census (URT, 2001). The deviation of the household size from the mean is 2.71.

Table 3: Descriptive statistics of the household size (N=150)

Item	Min	Max	Mean	Std. deviation
Household members below 18 years	0	9	1	1.76
Household members between 18-50 years	0	8	2	1.38
Household members above 50 years	0	3	1	0.79
Household size	1	13	6	2.71

4.3 Farm Resource Availability and Use

4.3.1 Land availability and use

Land as an important resource was available and accessible to households. Analysis of total land in acres per household regardless of type of land tenure revealed that households possess on average about 4.3 acres each (Table 4). Large land holdings per household signify the availability of one of the main factors of agricultural production. It offers a chance for farmers having more land to be in a good position to grow cassava among other crops compared to those with less land.

Table 4: Land holding (in acres) per household and tenure system and use type

Land tenure under different land uses	n	Min.	Max.	Mean	Std. deviation
Private titled land under customary tenure size (acres)	135	0.5	22.5	4.3	3.5
Annual crops	126	0.5	22.5	3.5	2.7
Perennial crops	30	0.25	4	1.5	0.9
Annual/perennial crops	23	0.5	7	2.3	1.7
Grazing	2	0.5	0.5	0.5	0.0
Fallow	16	0.5	7	3.0	2.0
Rented in land size (acres)	40	0.5	6	1.9	1.1
Borrowed land size (acres)	4	1	4	1.8	1.5
Gifted land size (acres)	6	0.5	4	2.3	1.6

The available land under the predominant customary tenure was utilized for growing annual crops (an average of 3.5 acres), annual and perennial crops (2.3 acres) and an average of 3 acres per household were fallows. This suggests that there is a possibility of increasing cassava production because land is not a limiting factor in the study area.

4.3.2 Family labour allocation

Family labour is one of the most important production resources in small scale agricultural production. The availability of labour determines the size of economic activity the farmer can engage in and the scope of improvement. Table 5 shows that most of the family labour available was allocated in land preparation and weeding activities for cassava production with an average of 50.4 and 60.1 person-days, respectively.

Table 5: Allocation of family labour to various cassava production activities

Activities	Mean	Std Deviation	Minimum	Maximum
Land preparation	50.4	56.1	6	300
Planting	25.7	19.7	2	90
Weeding	60.1	54.5	8	300
Harvesting	32.5	31.7	2	180
Post harvesting	25.2	72.2	4	70

4.3.3 Manure/fertilizer and pesticides application

About 60% of the sampled households experienced attacks of diseases and insect pests. The serious diseases were those leading to cassava rotting and leaves necrosis, while the animal pests were white flies, grasshoppers, and animals such as rats. Farmers did not apply any chemicals to control the diseases and animal pests but applied crop rotation to control the same, whereby cassava was rotated with maize and beans. The sampled households neither applied fertilizers nor manure for enhancing soil fertility in cassava farms. This implied that either their farms were still fertile or they did not have such inputs. Cassava can be grown in poor soils and still producing reasonable yields. Although it is assumed to be a 'poor man's' crop, usually grown without any inputs, this crop needs more nutrients and responds readily to the use of fertilizers. Gross margin analysis done by FAO and EU (2007) showed that cassava generates marginal income when using low inputs but income (returns) can be more than double with the use of fertilizers.

4.4 Cassava Production, Processing and Marketing

4.4.1 Cassava production

In the 2007/08 cassava growing season only 65% of the sampled households grew cassava. These were small scale farmers, whose farm size range from 0.25 to 4.5 acres. However,

there was an increase in acreage in 2008/09 growing season (Table 6). Basically cassava is grown for subsistence crop though some surplus is produced for commercial purposes.

Table 6: Descriptive statistics on cassava farm size in 2007/08 and 2008/09

Years	n	Minimum	Maximum	Mean	Std. Dev
2007/08	98	0.25	4.5	0.7	0.65
2008/09	88	0.25	5.0	1.5	1.26

About 57% of the households in the study area grew cassava as a sole crop while 43% grew it as an intercrop. In both cases cassava production requires routine activities from land preparation to harvesting and occasionally, post-harvest processing at household level. There are a number of cassava varieties grown in the area of study. Table 7 indicates that *Msenene* was the main cassava variety grown by 59 farmers out of 98 sampled farmers in the area of study during the 2007/08 growing season.

Table 7: Distribution of sampled farmers against cassava variety grown by villages

Cassava varieties	Village names			Total
	Mkambarani	Kiroka	Kungwe	
Kiroba	1 (1.0)	3 (3.1)	0 (0.0)	4 (4.1)
Msenene	14 (14.3)	25 (25.5)	20 (20.4)	59 (60.2)
Mwarusha	3 (3.1)	1 (1.0)	0 (0.0)	4 (4.1)
Mrefu	5 (5.1)	0 (0.0)	0 (0.0)	5 (5.1)
Kibangameno	2 (2.0)	0 (0.0)	4 (4.1)	6 (6.1)
Kigoma	0 (0.0)	6 (6.1)	4 (4.1)	10 (10.2)
Kiliusungu	1 (1.0)	0 (0.0)	3 (3.1)	4 (4.1)
Magereza	3 (3.1)	2 (2.0)	1 (1.0)	6 (6.1)
Total	29 (29.6)	37 (37.7)	32 (32.7)	98 (100.0)

Note: Values in brackets are %

The quality attributes of the variety are sweetness, early maturing taking 6 months to attain early and high yield up to 4 tons per acre and preferred in the market but prone to diseases. Other varieties grown in the area of study are *Kigoma*, *Magereza*, *Kibangameno*, *Mrefu*, *Kiroba* and *Mwarusha* (sweet varieties), *Dihanga* and *Kiliusungu* (Bitter varieties).

Most of farmers till the land before planting using mainly hand hoes (76%), whereby both men and women participate in the activity. Planting of cuttings is mainly carried out during short rainy season (October – November) and are mainly planted at an angle. It was reported that the most important sources of cassava planting materials were the neighbours and own farms. This is similar to findings by Ntawuruhunga *et al.* (2007) in their study in Southern Sudan, Equatorial Region, whose findings show that planting materials were sourced from neighbours and own farm.

Weeding is also one of the vital activities for cassava production. Weeding is usually carried out using hand hoes and is done twice between planting and harvesting time whereby both men and women participate in weeding.

Harvesting is another important farm operation. The operation is carried out through pulling the plants by hand after digging around stump. However, this process of pulling the plants by hand can leave some cassava roots in the soil and hence increase post harvest losses depending on the hardness of soil during harvest. In the study area, harvesting for commercial purposes is carried out by both men and women who constitute 41.8% of the sampled farmers who grew cassava in 2007/08 while for domestic consumption the activity is carried out mainly by women (44.4%) of the sampled households (Table 8).

Table 8: Distribution of sampled farmers involved in harvesting and transporting cassava

Who harvest and transport	Purposes	
	Commercial	Domestic consumption
Men only	32 (32.7)	22 (17.7)
Women only	11 (11.2)	55 (44.4)
Both men and women	41 (41.8)	36 (29.0)
All household members	4 (4.1)	11 (8.9)
Businessmen	10 (10.2)	-
Total	98 (100)	124 (100)

Values in parenthesis are %

Table 9 indicates that about 5% and 10% of the cassava was left underground during harvesting and rejected during marketing respectively. The sampled households dug the left underground cassava roots for home consumption while the rejected roots by the traders were also consumed at home (29% and 64%). A peak harvest season for the 2007/08 harvesting season for commercial purpose was reported to be between June and September (78%) when cassava is five to six months old and September during the Holy Month of *Ramadhan* when most Muslims use it for *jutari*.

Table 9: Cassava left underground during harvest and rejected by buyers

%	Cassava left underground (n=35)	Rejected cassava in sales (n=36)
1	5 (14.3)	5 (13.9)
2	5 (14.3)	8 (22.2)
3	3 (8.6)	3 (8.3)
5	5 (14.3)	9 (25)
10	11 (31.4)	8 (22.2)
>10	6 (17.1)	3 (8.4)

Values in parenthesis are %

Regarding transportation of cassava from the field it was noted that cassava is normally transported by buyers using bicycles and motor vehicles, especially if the cassava is sold. For home consumption, most of the farmers transport cassava on foot using their heads and shoulders.

4.4.2 Cassava processing and utilization

Traditional methods of cassava processing are manual and carried out at the household level. They lead to one end product which is dried chips that could be further milled into flour. Chips production involves peeling, washing, chipping and sun drying, thereafter milled to get flour for domestic human consumption. Table 10 shows that the rate of involvement in processing by farmers is very low (23%) and is of traditional type just for domestic consumption. Moreover the processing was mainly done by women. This implies that in the study area farmers do not process cassava for commercial purpose but for domestic consumption.

Table 10: Local cassava processing at household level

Response	Frequency	Percentage
Involved in processing	23	23.0
Not involved in processing	76	77.0
Total	99	100.0

In the study area, the cassava roots of sweet varieties are boiled or roasted for domestic consumption while bitter varieties are mainly used for alcohol brewing but some are processed into flour. The predominant method of processing cassava into flour is through fermentation in water for 3–5 days. Fermentation is mainly done in gunny bags.

4.4.3 Cassava marketing

The total harvest of cassava in the 2007/08 growing season was 94 612 kg. Farmers sell their cassava in fresh form whereby 78% of the sampled farmers who grew cassava in 2007/08 growing season, marketed the product. These farmers marketed only 69% of the cassava harvested in this season. Table 11 shows that most (53%) of cassava was sold on-farm. This result supports the findings by Mpanduji *et al.* (2006) that 54% of cassava is sold on-farm in Kibaha district. The marketing of cassava seem to be localized probably due to lack of technology to upgrade and (add value) cassava products.

Table 11: Cassava marketed to various marketplaces

Market place	Amount of cassava marketed (kg)	Proportion sold to the marketplaces (%)
On-farm	34 970	53.3
Neighbouring village	20 560	31.3
Village	6 805	10.4
Nearby town	2 275	3.5
Distant township	1 025	1.5
Total	65 635	100
Amount consumed at home	28 977	NA
Total harvest	94 612	NA

4.5 Structure of the Cassava Value Chain and Key Actors in the Chain

4.5.1 The cassava value chain in Morogoro rural

The cassava value chain in the study area is diagrammatically presented in Figure 3. The main value chain strands identified by the study were as follows:

a) Strand I: Farmers → Consumers

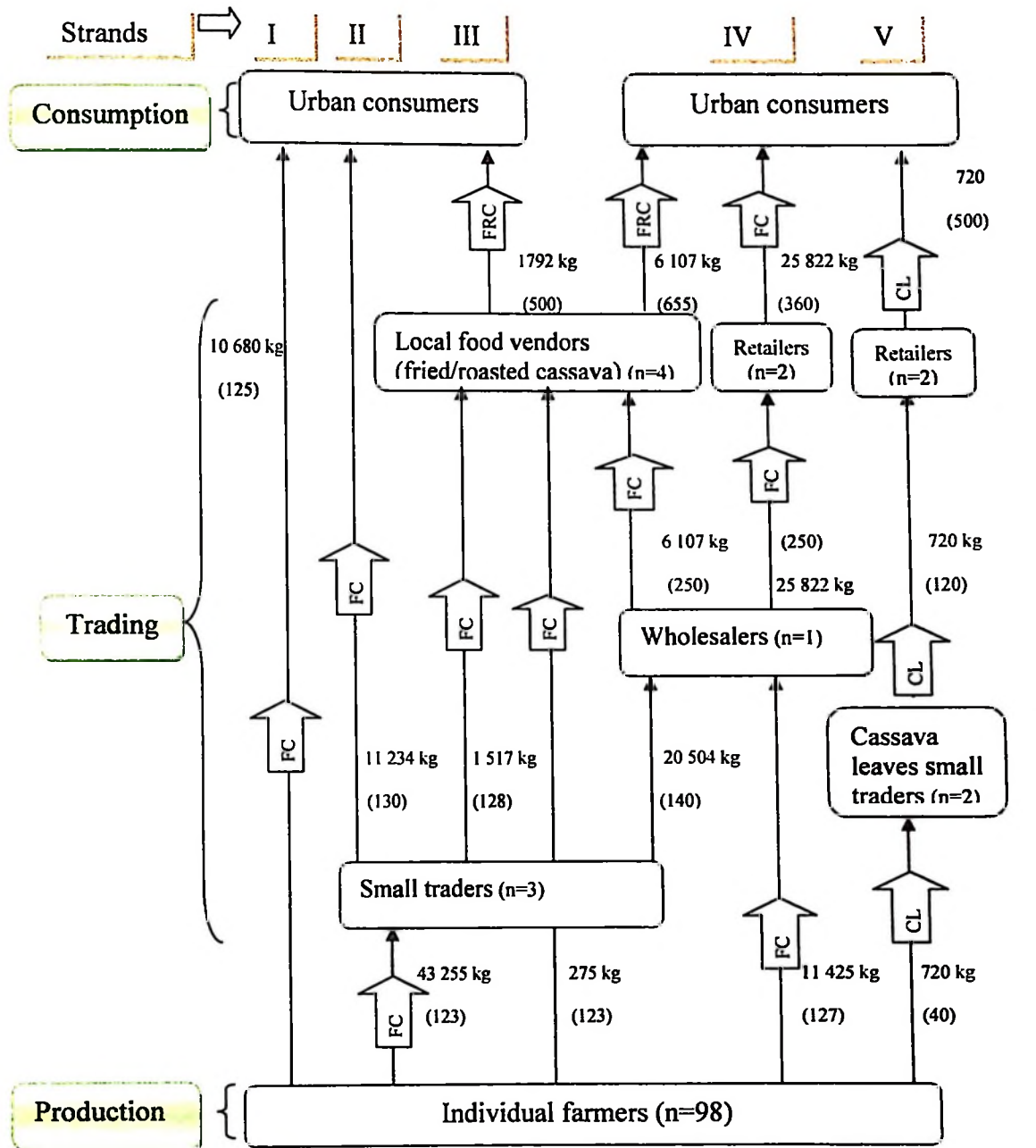
The strand was found to be the shortest of all cassava strands identified during the survey in the area of study. In this strand, farmers sell cassava roots to rural or household consumers. The volume of cassava sold through this strand is 10 680 kg at an average price of Tshs 125 per kg (Fig. 2).

b) Strand II: Farmers → Small traders → Retailers → Consumers

The strand is the most important alternative cassava sale outlet in the study area. It is through this strand that farmers sell their cassava roots to small traders, and the small traders sell to the wholesalers and food vendors (fried and roasted cassava) who sell to the final consumers. The small traders also sell the roots to rural consumers in village markets. Figure 2 shows that the sampled cassava farmers sold 43 580 kg to small traders at an average price of Tshs 123 per kg. Diagrammatically the main four strands in the study area are mapped as follows.

c) Strand III: Farmers → Local food vendors → Consumers.

Farmers sell their cassava roots to local food vendors who fry and roast cassava and sell to the final consumers. This strand is not very common as compared to others. About 275 kg were sold by the sampled farmers through the strand at an average price of Tshs 128 per kg (Fig. 2).



NOTE: Values in brackets are prices (Tshs) per kg

Products traded: Fresh Cassava, Fried/Roasted Cassava, Cassava Leaves

Figure 2: Cassava value chain in the study area.

d) Strand IV: Farmers → Wholesalers → Retailers → Consumers

In this strand, farmers sell the cassava roots to wholesalers who transport the roots to urban markets and sell to various retailers (Mawenzi, Mji Mpya and Msamvu markets) who finally sell to consumers. Individual farmers sold 11 425 kg of cassava roots to wholesalers at an average price of Tshs 127 per kg.

e) Strand V: Farmers (CL) → Small traders (CL) → Retailers (CL) → Consumers

This is a strand for cassava leaves product. The strand is common in Mkambarani village. It was observed that farmers sell the leaves to small traders (most of them being women) who transport the leaves to urban markets (Msamvu market). The small traders sell on credit to retailers who pay the credit after selling the product. The sampled households sold 720 kg at an average of Tshs 40 per kg.

4.5.2 The key actors in the cassava value chain

The value chain for cassava in the study area had only forward linkage; with the main nodes being the production, trading and consumption. The forward linkage after farm production involves middlemen involved in buying and retailing of raw cassava to ultimate consumers. This structure is contrary to the findings by Mpagalile *et al.* (2008) who found that cassava value chain is divided into backward and forward linkages; the backward link starting with farmers towards the input suppliers. Therefore, in the study area, there is no supporting market along the value chain, which means no financial services and sector specific services such as processing equipments which are important in upgrading the firms in the chain.

To understand how cassava products move along the chain from production point to consumption, it was necessary to identify the role played by each actor in the chain. The value chain comprised the following key actors: smallholder farmers, small traders, wholesalers, food vendors and retailers.

i) Farmers (producers)

The producers of cassava sell part of their cassava to traders or neighbouring farmers who face food shortages. The amount sold varies by the size of cassava fields, amount harvested and food requirement of households. Most of the cassava roots were sold at farm gate and at the village markets (Mkuyuni and Kiroka) and along the Dar es Salaam – Morogoro road at Mikese. Table 12 shows that large quantity of cassava roots (43 255 kg) was marketed to small traders which was about 66% of the marketed output.

Table 12: Main cassava products' market outlets

Market outlet	Frequency	cassava marketed (kg)	%
Small Traders/brokers	15	43 255	65.9
Local/household consumer	54	10 680	16.3
Large traders (wholesalers)	5	11 425	17.4
food vendors	2	275	0.4
Total	76	65 635	100.0

ii) Small traders

Rural small traders play an important role in collecting cassava and delivering it to either wholesale, retail outlets or ultimate consumers at Mkuyuni, Kiroka and Mikese village/rural markets. They buy cassava in small quantities ranging from 250 kg to 500 kg per week from farmers and sell the roots to retailers and wholesalers. The traders use

bicycles to transport cassava roots to the road (Matombo - Morogoro) and then hire vehicles to ferry the roots to the respective village markets. Sources of capital are mainly from their own saving or friends. Moreover, they have limited information on production and marketing of cassava.

iii) Wholesalers

The wholesalers supply the majority of cassava tubers to urban markets such as Mawenzi and Mji Mpya in Morogoro urban. They revolve their capital rapidly by minimizing the length of time between purchase and sale. They limit the risk that prices will move against them and avoid significant overhead costs and damage of the tubers. Such traders usually buy from several small traders and sometimes from the farmers and hire vehicles to transport the roots to the urban centres. Wholesalers tend to specialize in dealing with cassava roots.

iv) Rural and urban food vendors

These operate on individual basis like farmers. Rural food vendors are also cassava growers. They buy fresh cassava direct from farmers or take from their own farms while urban vendors usually buy from wholesalers. They usually procure small quantities of cassava roots ranging from 50 kg to 100 kg for 2 to 5 days. They generally sell fried and roasted cassava (*chips dume*) to consumers. They are also involved in others activities during cassava off-season including roasting green maize, potatoes and meat commonly known as *mishikaki*.

v) Retailers

In the study area, there are both urban and rural retailers who buy fresh roots and other cassava products such as cassava leaves (*Kisamvu*) and sell them to ultimate consumers in small quantities of a convenient form. The major retail outlets of cassava and cassava products are village market centres, town markets and along road sides.

vi) Consumers

These are the final users of cassava products. These include household consumers who mainly buy fresh roots and leaves (*Kisamvu*) from farmers, small traders and retailers for their domestic consumption. Household consumers always buy intermediate products which are further processed and consumed at home such as fresh roots and leaves which are transformed through cooking into boiled cassava or vegetables respectively. Another group of consumers are those who consume cassava and cassava products away from their homes. These normally consume various cassava products including fried/roasted cassava chips and raw fresh cassava.

4.5.3 The products marketed

Figure 2 shows that there are two products passing through the main strands. These are cassava roots and boiled/fried/roasted cassava (*chips dume*). However, the potential strands in the area can be cassava chips for High Quality Cassava Flour (HQCF) for human consumption and chips for animal feeds. These products are potential due to the high potential domestic demand of cassava flour in case it substitutes wheat and maize flour by 10% or 20% while about 40 000 tons of dried cassava chips are needed for animal feed sector (Gwera, 2009; Mutabazi *et al.*, 2008).

4.5.4 Coordination of the value chain

4.5.4.1 Vertical coordination

Figure 3 shows that 94% of the sampled farmers had no contractual agreements (both formal and informal) with their customers. The figure also indicates that more than 90% of the farmers neither sell to specific customers nor knowing the customer of the produce before harvest. This indicates that there is poor vertical coordination between the farmers and their customers (buyers). This may enhance exchange failures and reduce motivation of engaging in trade.

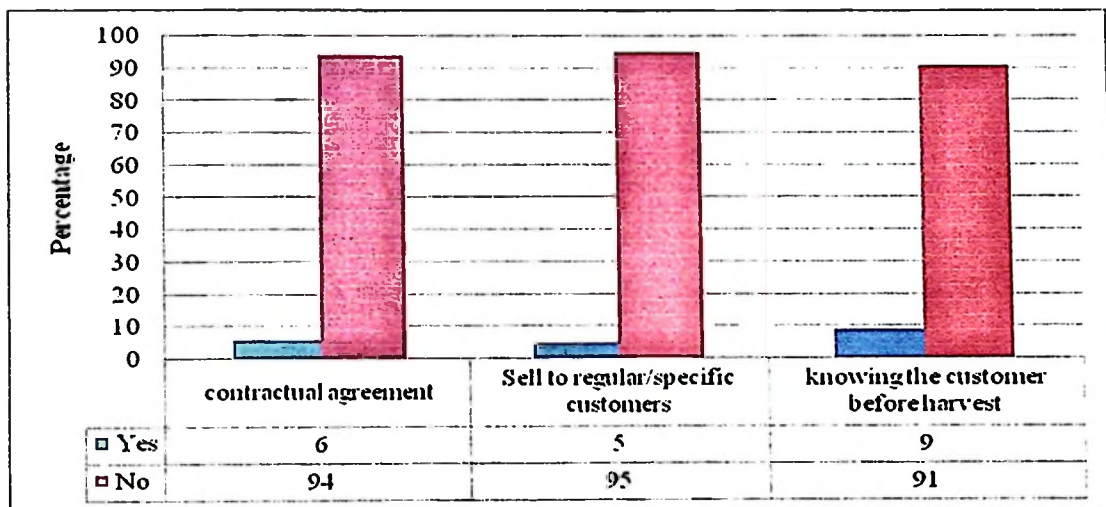


Figure 3: Farmers' response on vertical coordination.

4.5.4.2 Horizontal coordination

Table 13 indicates that 66% of the sampled households belonged to farmers' associations. However, most of the associations were those of cassava production encouraged by the cassava project based at SUA. Participation in farmers' association seems to be higher due to large number of project farmers being in the sample. The project farmers have recently benefited in terms of accessing new improved cassava varieties and extension services.

Table 13: Households participation in farmers' association

Response	Frequency	Percentage
Yes	92	66.2
No	47	33.8
Total	139	100.0

4.5.4.3 Sources of cassava market information

Farmers' sources of information is limited to farmers' efforts only visiting marketplaces whereby about 68% of the sampled farmers obtained market information (market, market requirements and prices) by physical visit to markets where they pretended as if they need the produce (Fig. 4). The rest of the farmers obtained information from traders who buy the roots and from other farmers.

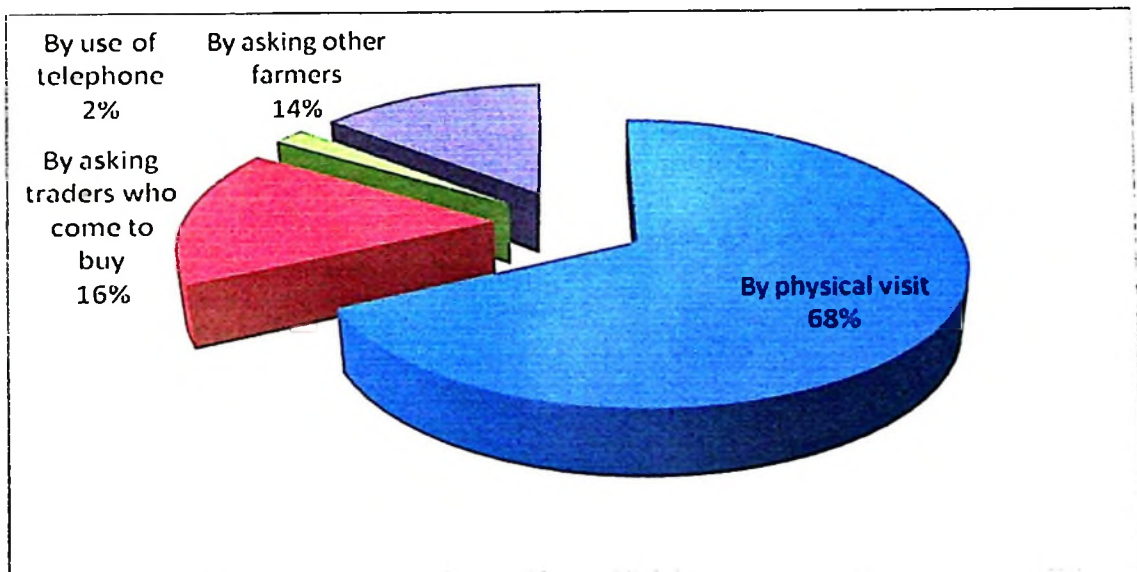


Figure 4: Source of market information.

4.6 Analysis of Profitability of Cassava Products

4.6.1 Profit margin at farm level

Table 14 compares the profit margins obtained by the sampled cassava farmers in the three villages. The profit margin per 1 acre was estimated to be Tshs 109 253, Tshs 58 744 and Tshs 118 652 for Mkambarani, Kiroka and Kungwe respectively. The overall gross margin is 94 573 Tshs. Furthermore, results from the table reveal that the returns per every shilling invested in the enterprise (Cost-Benefit Ratio) are 3.9, 0.8 and 4.5 for the respective villages. This suggests that cassava production in Kiroka is not viable.

Table 14: Profitability of raw cassava at farm level

Village/Item	Mkambarani (n=29)	Kiroka (n=37)	Kungwe (n=32)	Overall (n=98)
1.0 Receipts				
1.1 Yield per acre (kg)	980	1 109	1 297	1 102
1.2 Average farm gate price	140	116	112	122.50
Revenue	137 200	128 535	145 264	134 995
2.0 Variable total costs				
2.1 Land preparation	9 811	26 869	11 489	15 513
2.2 Plant materials (cuttings)	6 038	11 815	7 979	8 349
2.3 Planting	2 268	4 196	564	2 388
2.4 Weeding	7 675	22 135	5 851	11 608
2.5 Harvesting	832	4 049	532	1 736
2.6 Post-harvesting	1 323	727	197	828
Total Variable Cost	27 947	69 791	26 612	40 422
Profit Margin	109 253	58 744	118 652	94 573
3.0 Labour allocation (person-days)				
3.1 Land preparation	69	51	104	73
3.2 Planting	28	44	41	37
3.3 Weeding	76	75	115	86
3.4 Harvesting	35	46	62	46
3.5 Post-harvesting	22	18	78	36
Total Person/Day	29	29	50	35
Return To Labour	3 767	2 026	2 373	2 702
Cost-Benefit Ratio	3.9	0.8	4.5	2.3

This is due to high variable costs incurred in land preparation, weeding, planting materials (cuttings), planting and harvesting activities. The costs of production in Kiroka were probably accelerated by hired labour used while the other villages recorded more family labour (104 and 69 person-days for Kungwe and Mkambarani respectively) but Kiroka has the lowest person-days (51).

Analysis of variance (ANOVA) was employed to test the hypothesis which postulated that there is no significant variation in profitability between the three villages. Table 15 shows that there is no statistical significance difference between profit margins in the surveyed villages at ($p < 0.05$). We therefore fail to reject the null hypothesis.

Table 15: Descriptive statistics between profit margins by sample village

Description	Mkambarani (n=29)	Kiroka (n=37)	Kungwe (n=32)	Significance
Mean	108 741.67	57 364.19	118 306.25	0.16
Std dev	184 671.44	100 638.74	117 769.16	

Confidence interval 95%

4.6.2 Profit margin of raw cassava at small trade level

Small traders buy cassava roots from farmers. Apart from purchase cost other costs incurred are for harvesting, packaging cassava roots in bags, transport, levy, loading and unloading. Table 16 indicates that the profit margin for small trade level was Tshs 37 166.50, while the return to labour was Tshs 3 097 and the return per shilling invested was estimated to be Tshs 1.2. The profit obtained small traders in the study area was higher than that obtained in the Lake Zone of Tanzania which was Tshs 11 529.20 for 1 517 kg which is equivalent to Tshs 950 per bag of 125 kg (Land and Uliwa, 2007).

Table 16: Profit margin of cassava at small trader level

Parameter	Small traders (n=3)
1.1 Quantity of cassava bought in kg	1 517
1.2 Average purchasing price per kg	123
1.3 Purchases costs	186 591
1.4 Average selling price per kg	165
1.5 Gross revenue	250 305
2.0 Costs	
2.1 Transport costs	9 102
2.2 Market levy	758.50
2.3 Harvesting	10 619
2.4 Packaging	1 517
2.5 Loading/unloading	1 517
2.6 Bags	3 034
2.7 Total variable costs	26 547.50
3.0 Total person-days	12
5.0 Profit margin	37 166.50
6.0 Return to labour (Tshs/person-day)	3 097
7.0 Return per shilling invested	1.2
8.0 Return per kilogram of cassava	125

4.6.3 Profit margin of raw cassava at wholesale level

The profit margin at the wholesale level was estimated to be Tshs 268 600 for 3 500 kg sold in the last (2007/08) cassava trading season and his return to labour was Tshs 7 674 with Tshs 1.4 as a return per shilling invested in the business (Table 17). The profit obtained at the wholesale level is high as compared to that obtained in the Mkuranga district which was estimated by Mnenwa *et al.* (2008) to be Tshs 196 000 per 3 500 kg (Tshs 56 per kg).

Table 17: Profit margin of raw cassava at wholesale level

Parameter	Wholesalers (n=1)
1.1 Quantity of cassava bought in kg	3 500
1.2 Average purchasing price per kg	140
1.3 Purchases costs	490 000
1.4 Average selling price per kg	250
1.5 Gross revenue	875 000
2.0 Costs	
2.1 Transport costs	56 000
2.2 Market levy	7 000
2.3 Harvesting	24 000
2.3 Packaging	4 900
2.4 Loading/unloading	14 000
2.5 Bags	10 500
2.6 Total variable costs	116 400
3.0 Total person-days	35
5.0 Profit margin	268 600
6.0 Return to labour (Tshs/person-day)	7 674
7.0 Return per shilling invested	1.4

4.6.4 Profit margin of cassava at retail level

4.6.4.1 Profits obtained by retailers of raw cassava roots

Two retailers from urban markets (Mawenzi, Mji Mpya and Msamvu markets) were interviewed. Their respective profit margins were also associated with the amount of cassava roots (4 000 kg) they purchased throughout the season (Table 18). The results indicate that the overall profit margin of fresh cassava at retail level was Tshs 372 800 and return to labour of Tshs 7 767 per person-days. The returns per shilling invested during the whole season (5 month), was Tshs 1.3. However, the profit obtained by the retailers of cassava roots was also higher than that obtained in Mkuranga district which was Tshs 224 000 (Mnenwa *et al.*, 2008).

Table 18: Profitability of raw cassava at retailing level

Parameter	Retailers (n=2)
1.1 Quantity of cassava bought in kg	4 000
1.2 Average purchasing price per kg	250
1.3 Purchases costs	1 000 000
1.4 Average selling price	360
1.5 Gross revenue	1 440 000
2.0 Costs	
2.1 Transport cost	NA
2.2 Market levy	22 400
2.3 Harvesting	0
2.4 Packaging	0
2.5 Loading/unloading	44 800
2.6 Bags	0
2.7 Total variable costs	67 200
3.0 Total labour days/hrs	48
5.0 Profit margin	372 800
6.0 Return to labour (Tshs/person-day)	7 767
7.0 Return per shilling invested	1.3

4.6.4.2 Profit margin obtained by retailers of fried and roasted cassava

Another group of traders as shown in Figure 2 included those who fry and roast cassava. This involved five respondents (three from the villages and two from urban market (Morogoro Municipal). The profit margins of fried and roasted cassava at retail level were estimated to be Tshs 1 480 500 for an average of 6 300 kg of cassava bought in the same season. The return to labour was Tshs 29 610 per person-days while the return per shilling invested in the enterprise was estimated to be Tshs 2.4 (Table 19). A study conducted by Mnenwa *et al.* (2008) in Mkuranga district recorded a higher profit (Tshs 2 079 000) than that in Morogoro rural for 6 300 kg (Tshs 330 per kg).

Table 19: Profit margin of fried and roasted cassava traders

Parameter	Value of parameter (n=5)
1.1 Quantity of cassava bought in kg	6 300
1.2 Average purchasing price per kg	115
1.3 Purchases costs	1 052 100
1.4 Average selling price per kg	500
1.5 Gross revenue	3 150 000
2.0 Costs	
2.1 Cooking oil	315 000
2.2 Market levy	12 600
2.3 Firewood	126 000
2.4 "Kachumbari"	126 000
2.5 Salt	37 800
2.6 Total variable costs	617 400
3.0 Profit margin	1 480 500
4.0 Total labour days/hrs	50
6.0 Return to labour (Tshs/person-day)	29 610
7.0 Return per shilling invested	2.4

4.6.5 Profit margin for cassava leaves at small trade level

Table 20 indicates that profit margin for cassava leaves (*Kisamvu*) at small trade level was estimated to be Tshs 77 688 while the return to labour was Tshs 3 237 per person-days. The trade was common in Mkambarani and the leaves are from rubber trees locally known as *mipira*. Usually the small traders send the product to Msamvu market and sell to retailers. However, the traders are not paid promptly by the retailers. They normally wait for the retailers to sell the product and then are paid thereafter. In Kiroka and Kungwe, *Kisamvu* is not commercialized; it is mainly grown for domestic consumption.

Table 20: Profit margin of cassava leaves (*Kisamvu*) at small trade level

Parameter	Value of parameter (n=2)
1.1 Quantity of cassava bought in kg	720
1.2 Average purchasing price per kg	40
1.3 Purchases costs	28 800
1.4 Average selling price per kg	120
1.5 Gross revenue	86 400
2.0 Costs	
2.1 Transport costs	7 200
2.2 Market levy	1 440
2.3 Harvesting	NA
2.4 Filling	NA
2.5 Loading/unloading	NA
2.6 Bags	72
2.7 Total variable costs	8 712
3.0 Profit margin	77 688
4.0 Total labour days	24
6.0 Return to labour (Tshs/person-day)	3 237
7.0 Return per shilling invested	8.9

4.6.6 Comparative profitability analysis along the cassava value chain

Table 21 compares the profitability along the cassava value chain in the study area. Results from the table indicate that a farmer received Tshs 85.80 per kg. But for every Tshs 360 and Tshs 500 paid by a consumer of fresh and fried/roasted cassava per kg, a retailer and food vender obtained Tshs 83.30 and Tshs 292.00 as net margin per kg respectively. A small trader obtained Tshs 24.50 while a wholesaler obtains Tshs 89.80 as net margins. In general fried/roasted cassava and wholesaler obtained higher net margins than the rest actors in the cassava value chain.

Table 21: Cassava marketing costs and margins along the value chain per kg

Item	Farmers	Small traders	Wholesaler	Retailers	Food vendors
Average annual volume marketed in kg	1 102	43 255	11 425	4 000	6 300
Costs per kg:					
Production cost per kg	36.68	NA	NA	NA	NA
i) Harvesting	NA	7	6.80	NA	NA
ii) Bags	NA	2	3	NA	NA
iii) Packing	NA	1	1.40	NA	NA
iv) Transporting	NA	6	16	NA	NA
v) Loading/unloading	NA	1	4	11.20	NA
vi) Market levy	NA	0.50	2	5.50	2
vii) Cooking oil	NA	NA	NA	NA	50
viii) Firewood	NA	NA	NA	NA	20
ix) Others	NA	NA	NA	NA	21
Total costs <i>a</i>	36.68	17.50	33.20	16.70	93
Mean buying price <i>b</i>	-	123	127	250	115
Mean selling price <i>c</i>	122.50	165	250	360	500
Margin <i>d=c-b</i>	122.50	42	123	100	385
Net margin <i>e=d-a</i>	85.82	24.5	89.80	83.30	292

4.6.7 Determinants of cassava profitability at farm level

The results of linear regression analysis with respect to cassava profitability at farm level indicate that 68% of the variation in cassava profitability generated at farm level is due to the independent variables included in the regression model. That is to say the specified predictors explained the dependent variable (profit margin) by 68%. The remaining (32%) explains the error term. Table 22 indicates that farm size had a significant ($p < 0.01$) positive correlation with cassava profit margin.

Table 22: Linear regression model results of determinants of cassava profitability

Predictor	Coefficient	β /Std Error	Expected sign	Significance
(Constant)	-134446.528	66526.086		0.047
AGEHH	467.434	890.922		0.601
GENHH	13150.832	33775.803		0.698
EDUHH	5376.150	3548.550		0.134
AHSIZE	-4082.979	5392.046		0.451
FARMSIZE	138847.115	20366.522	+ve	0.000*
EXPHH	7244.068	2323.353	+ve	0.003*
FULTLAB	10149.112	8660.745		0.245
PERD	* 197.783	93.369	+ve	0.037**
ACEUMA	34725.096	28806.004		0.231
WOSTHO	-26372.720	32619.595		0.421
GROPART	-48984.340	-24391.534	+ve	0.048**
MAINFO	78739.005	49189.169		0.113
CAICONT	12943.689	22717.823		0.570
FOODINSE	-60056.295	24263.397	-ve	0.015**
INCLISO	.031	.018	+ve	0.093***

$R^2=68\%$, Adjusted $R =62\%$, $F=12^*$, *=significance at ($p<0.01$), **=significance at ($p<0.05$), ***=significance at ($p<0.1$)

This implies that farmers with large farms are liable to get larger gross margin than those with small farms. An increase in one unit of farm size leads to increase in profit margin of Tshs 138 847. This is similar to findings by Mafimisebi (2008) in his study on determinants and uses of farm income from the cassava enterprise in Ondo State, Nigeria whose findings show that farm size was significant at ($p<0.01$) with positive relation to profit margin. Moreover, experience of the household head in cassava production was also significant ($p<0.01$) and positively related with cassava profitability. The parameter estimates of each of these variables also carried a sign that conformed to *a priori* expectations.

Food insecurity of the household was significant at ($p < 0.05$) and negatively related to profit margin as it was hypothesized. This implies that as those households that face food insecurity were looking for means of survival (doing casual labour as a coping strategy) hence assign little time for cassava production, causing to decrease in profit margin.

Total person-days set for cassava production was significant ($p < 0.05$) and positively correlated with profitability of the crop as it was hypothesized. Group participation was statistically significant ($p < 0.05$) and negatively related to cassava profit margin. This relation is similar to what was expected. This proposes that for 2007/08 growing season, farmers' associations among cassava smallholder farmers were not common, despite the fact that few farmers were participating in field farm schools (*Shamba Darasa*) on rice, maize and sunflower. This signifies that farmers paid less attention on cassava.

Table 22 also shows that income from non-crop livelihood sources (INCLISO) predictor was significant ($p < 0.1$) and positively associated with profitability of cassava. This suggests that an increase of one unit among the livelihood sources (as livestock keeping, business, salaries/wage and remittances) leads to increase in profit margin by Tshs 0.03.

4.7 Farmers Preferential Choice Decisions

As pointed out in the methodology, farmers in the sub-sample were asked to indicate their agreement or disagreement on each item using five-point Likert-type scale ranging from strongly agree to strongly disagree. The construct validity of the selected scales was assessed using factor analysis. The robustness of the output from the factor analysis signified that 77.9% of the cumulative variance was explained by the statements included in the analysis (Table 23). A varimax rotation of the factor matrix yielded eight significant

factors with eigenvalues greater than one, with the highest value which was 6.9 vested in component 1 as the most critical factor. All the factors identified for the three risk themes had factor loadings (correlations) greater than 0.3 which is recommended according to Kim and Meuller (1978) as cited by Senkondo (2000).

Table 23: Total variance explained and factor analysis robustness test

Initial Eigenvalues			
Component with Eigenvalue >1	Total	% of Variance	Cumulative %
Component 1	6.900	26.538	26.538
Component 2	2.796	10.755	37.294
Component 3	2.588	9.954	47.248
Component 4	2.226	8.562	55.809
Component 5	1.861	7.158	62.967
Component 6	1.440	5.537	68.504
Component 7	1.370	5.270	73.775
Component 8	1.089	4.188	77.963

Extraction Method: Principal Component Analysis.

4.7.1 Farmers' attitude towards being in farmers associations (groups)

Attitude towards being in farmers' associations (groups) comprised attitudinal statements which classified risky decisions within the control of the respondents. Among the statements loaded on the attitude of farmers towards working in farmers' groups or associations, items G2 and G8 were different from the researcher's assumptions (Table 24). According to statement G2 the researcher hypothesized that farmers will disagree with the statement that they will join and work in farmers' association at any cost because of the past history of cooperatives. But the farmers agreed that they are ready to work in groups at any cost. The researcher postulated that farmers would not see the prospects of

participating in groups due to failure of cooperatives to reduce poverty (G8) therefore they will not agree to work in farmers' associations.

Table 24: Measurement of attitude towards participation in farmers' groups

Item	Researcher's hypothesis	Farmer's outcome	Factor loading
G1-I prefer working in groups	Agree	Agree	0.698
G2-I will join and work in groups at any cost	Disagree	Agree*	0.829
G3-Working in group helps to access various services to the group members	Agree	Agree	0.522
G4-Farmers group enable me to acquire new knowledge and technology for agricultural development	Agree	Agree	0.606
G5-Farmers group enable me to improve my agricultural produce.	Agree	Agree	0.736
G6-When I work in groups, it becomes easy to access market for our produce	Agree	Agree	0.469
G7-Farmers' group increases our bargaining power for our Products	Agree	Agree	0.776
G8-I do not see prospects of participating in groups when there is failure of cooperatives to reduce poverty	Agree	Disagree*	-0.568

** There is a difference between researcher's expectations and farmers' responses*

However, the respondents disagreed with this proposition, which means that despite the history of failure of cooperatives and some farmers associations, still the respondents were ready to participate in farmers' groups (production and marketing). The researcher's assumptions on attitude towards working in farmer's groups which matched with the farmers' response were G1, G3, G4, G5, G6 and G7.

Table 25 compares attitude towards the risk between farmers in remote village and villages near urban markets. Results indicates that only 5% of the respondents were risk averse

while 95% were risk takers as far as the risk of participation in farmers' association is concerned. The overall difference between the two locations (near and remote from the urban markets) was insignificant. Moreover, the preference of farmers towards participating in farmers groups was the smallest among the other items where the village near urban market (Mkambarani) prefer being more in group (90.5%) than the remote areas (Kiroka and Kungwe) which had 85.7%.

Table 25: Respondents indicating positive attitude towards group participation

Location/item	Near urban market (n=21)	Remote area (to urban market) (n=21)	Overall (n=42)
	% of respondents		
G1	90.5	85.7	88.1
G2	95.2	90.5	92.9
G3	95.2	100.0	97.6
G4	100.0	100.0	100.0
G5	95.2	100.0	97.6
G6	90.5	100.0	95.2
G7	100.0	95.2	97.6
G8	100.0	81.0	90.5
Overall	95.8	94.0	94.9

4.7.2 Farmers' attitude towards participation in alternative potential cassava strands

Items used to measure the farmers' attitude towards risk of involving themselves in alternative potential cassava strands and their hypothetical signs are as shown in Table 26.

Table 26: Measurements of attitude towards risk participation in alternative strands

Item	Researcher's hypothesis	Farmer's outcome	Factor loading
R1-I am ready to produce cassava so as to adhere the above stated customer of HQCF even if I lose money.	Disagree	Agree*	0.825
R2-Without taking the adding value of cassava for HQCF in the recent competition, cassava farming is not worthwhile.	Agree	Agree	0.616
R3-We need to look for means of processing cassava for HQCF at any cost.	Disagree	Agree*	0.799
R4-I am satisfied with producing and selling fresh cassava, therefore I do not prefer HQCF	Disagree	Disagree	0.701
R5-I can acquire more land for cassava cultivation in order to meet the HQCF customer needs.	Agree	Agree	0.745
R6-I am ready to produce cassava so as to adhere the above stated customer of animal feed even if I lose money.	Disagree	Agree*	0.805
R7-Without taking the adding value of cassava for animal feed in the recent competition, cassava farming is not worthwhile	Agree	Agree	0.706
R8-We need to look for means of processing cassava for animal feed at any cost	Disagree	Disagree	-0.645
R9-I am satisfied with producing and selling fresh cassava, therefore I do not prefer animal feed.	Disagree	Disagree	0.687
R10-I can acquire more land for cassava cultivation in order to meet the animal feed customer needs	Agree	Agree	0.768

* *There is a difference between researcher's expectations and farmers' responses*

The Table also indicates that three researcher's hypotheses (two on HQCF strand and one concerning HQCC) were contrary to the farmers' opinions. For R1 the researcher assumed that due to farmers' being sensitive to loss of their money (as far as adoption of new technology is concerned) they will not be ready to produce cassava for HQCF despite good price offered by the potential customer. Nevertheless farmers showed that they were ready to produce cassava for HQCF, implying that they were ready to take risk. The same was also applicable for the statement R6 on readiness of producing cassava chips for animal

feed. Farmers' response was also different from the researcher's hypothesis for hypothesis R3. Here the assumption relied on the cost for acquiring new cassava processing technology.

Moreover, some farmers would be ready to look for a technology once they concretize it; hence the researcher assumed that the farmers will not agree to search for such technology. The farmers nevertheless, agreed to look for means of processing cassava at any cost, implying that they need policy and guidelines to direct them to the right target. The rest of the items (R2, R4, R5, R6, R7 and R8) have the same signs as expected.

Table 27 compares the attitude towards risk in participating in alternative potential cassava strands between farmers in remote villages and village near urban market. The attitude towards risk of participating in alternative potential cassava strands was a bit low compared to other scenarios in this section with the overall average of 88% of the respondents showing a positive attitude towards the two strands (HQCF and chips for human consumption and animal feeds respectively).

However, when compared; farmers' positivity towards HQCF for human consumption was more (overall 89.9%) than that of chips for animal feeds (86.2%) of the respondents. This implies that farmers were highly motivated by the potential customers of the two cassava products. With regard to location, farmers from remote area were more risk takers than those near the urban market with 91.4% and 84.8%, respectively (Table 27). This suggests that the poor market outlets and road infrastructures worsen the cassava production hence farmers complain that they do not have a reliable market for the fresh cassava roots. However, farmers who were near the urban market had a good market outlets as well as

good road infrastructure therefore they were sure of selling their fresh cassava at an attractive price.

Table 27: Measurement of attitude towards risk participating in alternative strands

Location/item	Near urban market (n=21)	Remote from urban market (n=21)	Overall (n=42)
HQCF	% respondents		
R1	90.5	100.0	95.2
R2	85.7	100.0	92.9
R3	90.5	95.2	92.9
R4	71.4	81.0	76.2
R5	85.7	100.0	92.9
Overall Chips (for animals)	84.7	95.2	89.9
R6	85.7	95.2	90.5
R7	85.7	95.2	90.5
R8	85.7	81.0	83.3
R9	81.0	66.7	73.8
R10	85.7	100.0	92.9
Overall	84.8	87.6	86.2
Overall	84.8	91.4	88.1

4.7.3 Farmers' attitude towards marketing through potential cassava strands

Eight items were used in measuring the attitude towards marketing through potential cassava products. The results of the factor analysis in Table 28 indicate that only two statements of the researcher did not tally with the outcome from the farmers, that is M7 and M8 whereby the researcher postulated that with the present well known market of fresh and local processed cassava, farmers cannot prefer producing cassava for HQCF and animal feeds (chips) respectively, because farmers sometimes are lagging behind in adopting new

technologies, and most of the time find it difficult to abandon practices/customers they are familiar with.

Table 28: Measurement of attitude towards marketing through potential cassava strands

Item	Researcher's hypothesis	Farmer's outcome	Factor loading
M1-If there is an opportunity to make money by processing cassava for HQCF I will utilize it.	Agree	Agree	0.912
M2-If there is an opportunity to make money by processing cassava for animal feed I will utilize it.	Agree	Agree	0.850
M3-Growing more cassava for HQCF is the best way I can expand market opportunities.	Agree	Agree	0.819
M4-Growing more cassava for animal feed is the best way I can expand market opportunities.	Agree	Agree	0.852
M5-Correct information on price facilitates me to decide to invest for HQCF	Agree	Agree	0.507
M6-Correct information on price facilitates me to decide to invest for animal feeds	Agree	Agree	0.784
M7-With the present known market of fresh and local processed cassava, I cannot prefer producing cassava for HQCF	Agree	Disagree*	-0.928
M8-With the present known market of fresh and local processed cassava, I cannot prefer producing cassava for animal feeds	Agree	Disagree*	-0.928

* *There is a difference between researcher's expectations and farmers' responses*

They want to witness what is promoted works in practice otherwise they will not adopt or take risk to produce cassava for potential products (as HQCF, chips for animal feed, and for industrial uses). However, the outcome from the farmers disagreed with these hypotheses. This signifies their claim that they are discontented with the existing market of cassava, may be because of the tendency of selling fresh cassava to small traders who pay low prices for the products and use of unstandardized unit of measurement like *kiroba* (bags). Items/statements M1, M2, M3, M4, M5 and M6 signs were as hypothesized by the researcher in conformity to the farmer's response.

Table 29 compares farmers' attitude towards risk of marketing through potential cassava strands. The table reveals that for all items except M7 and M8 more than 95% of the respondents had positive attitudes toward risk. The statements M7 and M8 registered positive attitudes too, although farmers in remote areas from the urban market had a more positive attitude to risk with respect to all the eight axioms of market for the potential cassava strands which is more than 95% as compared to the area near urban market.

Table 29: Positive attitude towards market of the potential cassava strands

Location/items	Near urban market (n=21)	Remote from urban market (n=21)	Overall (n=42)
	% of respondents		
M1	95.2	100.0	97.6
M2	90.5	100.0	95.2
M3	90.5	100.0	95.2
M4	95.2	100.0	97.6
M5	100.0	100.0	100.0
M6	95.2	100.0	97.6
M7	47.6	95.2	71.4
M8	47.6	95.2	71.4
Overall	82.7	98.8	90.8

This entails the same problems of remote areas as was elaborated in the above section (attitude towards potential strands). The village (Mkambarani) near to urban area had 52.4% of the respondents in M7 and M8 items as risk averse.

4.7.4 Determinants of farmers' preferential choice decisions in risks

The Maximum Likelihood Method (MLE) was used to estimate the determinants of the three models (farmers' attitude towards group participation, risk attitude towards alternative potential cassava strands and attitude towards market of potential cassava strands). Poisson regression model was used to estimate the determinants of farmers' preferential choice decisions in risks.

4.7.4.1 Factors influencing farmers' attitude towards group participation

The attitude towards group participation scores (GROSCORE) was regressed against predictor variables of interest. The causal effect of variables on aggregate score for attitude towards risk was estimated using Poisson model. Statistics indicating the goodness of fit (GOF) for this model are sum of deviances (G^2), likelihood ratio test statistic (χ^2) and p^2 statistic. The closer G^2 is to zero, the better the model explains the real data. The G^2 value in this case is 42.889 which is a very high value. Meanwhile, the greater the likelihood ratio test statistic (χ^2), the more explanatory power the model has. In this case Chi-squared (likelihood ratio) is 18.1. While the closer the p^2 statistic to 1, the more variance the model can explain and thus the better the model fits the observed data. In this case R_p squared (p^2) is 0.1549 which is much less than the value of 1. These GOF measures indicate that the observed data is explained well by the predicted model.

The results indicate that only two of variables assumed to influence risk preference towards group participation were significant. Table 30 shows that the relationship between education in term of number of years the respondent spent in formal schooling (EDURE) and risk attitude towards farmers' group participation was significantly negative ($p < 0.1$) implying that the more educated or literate respondents have a propensity to worry less in involving themselves in farmers' association compared to less educated respondents.

Table 30: Poisson model results of risk towards farmers' group participation

Variables	Coefficient	Expected sign	β /std Error	Probability
Constant	2.894		10.663	0.000
ACEUMA	-0.080		-0.880	0.379
GENRE	0.021		0.237	0.813
AGERE	0.003		1.071	0.284
EDURE	-0.021	+ve	1.744	0.081*
MAOCHH	0.166		0.814	0.416
AHSIZE	-0.010		-0.551	0.413
EXPHH	-0.004		-0.700	0.484
FARMSIZE	-0.022	+ve	-1.666	0.096*
CAICONT	0.022		-0.278	0.781
LAHOLD	-0.030	+ve	-2.094	0.036**
FULTLAB	-0.019		0.610	0.542

Number of observations = 42
 Log likelihood function = -123.4810
 Ch-squared and associated p -value = 18.1, <0.03
 R_p -squared = 0.1549
 $G^2 = 42.889$

*Significant at ($p < 0.1$), **significant at ($p < 0.05$),

However, farm size (FARMSIZE) under cassava cultivation and total land holding (LAHOLD) were significant ($p < 0.1$ and $p < 0.05$) with negative correlation with risk preference towards farmers groups respectively (Table 30). This suggests that respondents with large farm size for both cassava and other crops are likely to worry less on group participation compared to those with small cassava and other crops farms respectively.

4.7.4.2 Determinants of risk attitude towards alternative potential cassava strands

The results from Table 31 indicate that the goodness of fit of the model is relatively high as measured by G^2 which is 107.78, likelihood ratio test statistic (χ^2) is 28.965 and p^2 statistic

is 0.163. These GOF measures indicate that the observed data is explained well by the predicted model.

The table shows that access to urban market, gender of the respondent farm size, main occupation of the household head and total land owned by the household were significant. Access to urban market (ACEUMA) appeared to have a strong significance ($p < 0.01$) and positively relationship with risk towards participating in potential cassava strands (POTESCOR). This suggests that smallholder farmers living far from urban market demonstrate higher risk preference than those who reside near urban market.

Table 31 indicates that the level of risk attitude towards potential cassava strands tended to decrease significantly ($p < 0.1$) amongst crop production respondents as their main occupation (MAOCHH). This confirms the expected sign. The level of attitude towards risk (potential cassava strands) tended to decrease significantly ($p < 0.01$) among female respondents (GENRE) as opposed to male counterparts. This conforms to the expected sign, that females expressed high risk aversion in the potential cassava strands compared to male respondents.

Farm size had a significant ($p < 0.1$) positive influence on risk attitude towards HQCF and HQCC as potential strands (Table 31). This means that risk preference increases among farmers with large size cassava farms compared to farmers with small farms. Nevertheless, the level of attitude towards risk on the potential cassava strands declines significantly ($p < 0.05$) with increasing amount of land holding owned by the household head. The direction of causality between the land holding of the household head for other crops (cassava excusive) and risk attitude was positive.

Table 31: Poisson model results of risk towards engaging in potential cassava strands

Variables	Coefficient	Expected sign	β /std Error	Probability
Constant	3.247		10.669	0.000
ACEUMA	0.274	+ve/-ve	2.635	0.008***
GENRE	-0.277	-ve	-2.748	0.006***
AGERE	-0.001		-0.409	0.683
EDURE	-0.006		-0.487	0.626
MAOCHH	-0.388	-ve	-1.836	0.066*
AHSIZE	-0.007		-0.465	0.642
EXPHH	0.007		1.141	0.254
FARMSIZE	0.024	+ve	1.793	0.073*
GROPART	-0.008		-0.093	0.926
CAICONT	0.120		1.378	0.168
LAHOLD	-0.032	+ve	-2.265	0.024**
FULTLAB	-0.050		-1.437	0.151

Number of observations = 42

Likelihood function = -153.649

Ch-squared and associated p -value = 28.965, <0.00065

R^2 - squared (p^2) = 0.163

G^2 = 107.7875

*significant at ($p < 0.1$), **significant at ($p < 0.05$), ***significant at ($p < 0.01$)

4.7.4.3 Determinants of risk attitude towards marketing through potential cassava strands

The results from Table 32 indicate that the goodness of fit of the model is moderately high as indicated by G^2 which is 59.787, likelihood ratio test statistic (χ^2) is 43.098 and p^2 statistic is 0.482. Therefore these measures of goodness of fit signify that the observed variables are explained well by the predicted model. Risk attitude towards marketing through potential cassava strands (MARSCORE) had a strong significant ($p < 0.01$) positive relationship for farmers in remote areas (Table 32). This means that risk towards marketing through potential strands increased among farmers in remote areas. Hence the farmers become less risk averse.

The level of risk altitude towards marketing through potential cassava strands declined significantly at ($p < 0.01$) with increasing experience in farming amongst cassava farmers. According to Nkonya and Featherstone (2001) as cited by Abele *et al.* (2007) if farming experience is viewed in terms of accumulation of knowledge, then it stimulates improved technology use. Older farmers may have had the opportunity to experiment with other improved varieties of cassava and observed their superiority over local ones. They may also know better methods of seed selection than the relatively young farmers. Consequently, they will be quicker to accept new cassava technologies than younger farmers.

Table 32: Poisson model results of risk towards participation in marketing through potential cassava strands

Variables	Coefficient	Expected sign	β /std Error	Probability
Constant	3.401		10.529	0.000
ACEUMA	0.495	+ve/-ve	4.962	0.000***
GENRE	0.127		1.293	0.196
AGERE	0.114		0.417	0.676
EDURE	-0.137		-0.105	0.916
MAOCHH	0.073		0.299	0.765
AHSIZE	-0.008		0.586	0.558
EXPHH	-0.029	+ve/-ve	-5.014	0.000***
FARMSIZE	0.014		1.112	0.266
GROPART	-0.049		-0.541	0.589
CAICONT	0.110		1.295	0.196
LAHOLD	-0.034	+ve	-2.577	0.01**
FULTLAB	-0.350		-0.963	0.335

Number of observations = 42
 Likelihood function = -129.4092
 Ch-squared and associated p -value = 43.098, < 0.00000
 R^2 squared = 0.4816
 G^2 = 59.787

significant at ($p < 0.05$), *significant at ($p < 0.01$)

Moreover, the risk attitude towards marketing through potential strands was found to decline significantly ($p < 0.05$) with an increase in size of the land for other crops – LAHOLD (Table 32). The negative correlation is different from the expected sign. It was expected that farmers who are largely diversifying into other crops are less risk takers than those who are less diversifying. In addition to what is explained above (section 4.7.4.3) the marketability of upgraded cassava products is still unknown to farmers in the study area. Farmers are not aware that their cassava roots can be transformed into various products which are highly demanded in the urban market. Such products have been reported by Silayo *et al.* (2006) as *Kababu*, ban (*maandazi*), chapatti, chips and bread/cakes.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

The general objective of this study was to examine the value chain for cassava in order to determine strategies needed to enhance profitable participation of smallholder farmers in the cassava value chain for reducing income poverty using Morogoro rural district as a case study. The specific objectives of the study were: (i) To analyse the structure of the cassava value chain and coordination among actors in the value chain, (ii) To analyse profitability of alternative cassava value chain strands and identify determinants of profitability and (iii) To analyse farmers' preferential choice decisions of alternative cassava value chain strands and identify factors that influence farmers' preferences of choice decisions.

Data for the study were collected from 150 farmers and 10 traders using structured questionnaires and checklists, respectively. A systematic sampling procedure was used as a technique for sample selection. Both descriptive statistics and econometric models were applied to analyze the data. Whilst a considerable part of the analysis was based on descriptive statistics, linear and Poisson regression models were used to determine the factors that influence profitability of cassava at farm level and preferences of choice decisions of alternative cassava value chain strands, respectively. This chapter presents conclusions and recommendations emerging from the major findings of the study.

5.1 Conclusions

5.1.1 Structure of cassava value chain

The analysis of structure of cassava value chain has shown that among the three cassava products (fresh cassava, cassava leaves and fried/roasted cassava) fresh cassava has been

traded in large quantity. The mapping is confined into four strands that trade in fresh/raw/leaves of cassava and one strand on fried/roasted cassava. This indicates that cassava processing is much limited in the study area.

The analysis of coordination of the key actors in the value chain indicated that farmers are generally poorly coordinated both vertically and horizontally which contributed to low profit margins as compared to other actors in the value chain. This suggests that the product was not added value partly due to lack of knowledge (awareness) of the potential alternative products among the smallholder farmers, poor access to cassava markets, poor coordination and lack of appropriate technologies for value addition especially processing technologies.

5.1.2 Profitability of alternative cassava value chain strands

Analysis of profitability of the alternative cassava value chain strands shows that food vendors who trade in fried and roasted cassava products obtained high profit compared to other actors who traded in fresh cassava roots in the value chain. This suggests that the profitability of cassava can be enhanced through value addition. Based on the results of the linear regression model, it can be concluded that profitability of cassava in the study area is enhanced by area under cassava cultivation in 2007/08 growing season, experience of the household head in cassava production, total labour days spent in cassava production for the crop and income of non-crop livelihood sources. On the other hand, lack of cassava farmers groups and food insecurity among smallholder farmers are significant factors that reduced cassava profitability.

5.1.3 Farmers preferential choice decisions

The analysis of farmers' preferential choice decisions of alternative cassava value chain strands has shown that smallholder farmers had positive risk attitude towards potential cassava value chain strands (HQCF and chips for animal feeding) despite the fact that they have little knowledge on how to process cassava roots into such products and the underlying demand requirements. This is due to farmers' dissatisfaction of the price of raw cassava as compared to production costs they incur in producing cassava.

Based on the results of the Poisson regression models it can be concluded that education of the household, farm area under cassava in 2007/08 growing season and the total land owned by the household are significant factors that negatively influenced probability of group participation in cassava production. Moreover, access to urban markets and farm size are important factors that increased the probability of preferring risk towards alternative cassava strands. On the other hand, female headed households and total land owned by the household are significant factors that affect negatively the probability of farmers to prefer alternative cassava strands in the study area. Furthermore, access to urban markets and experience of the household in cassava production are essential factors that can increase the probability of farmers to take risk to produce cassava for marketing through potential cassava strands, meanwhile total land owned by the farmer reduces the probability the household to produce cassava for this potential market (alternative cassava strands) in the study area.

5.2 Recommendations

In view of the major findings of the study and the above conclusions, the following are recommendations are drawn:

i) Strengthening coordination of the chain actors

The findings of the study show weak vertical and horizontal coordination along the cassava value chain. Furthermore linear model regression results indicate that profitability of cassava at farm level is negatively and significantly affected by lack of farmers group. This suggests that efforts to improve both horizontal and vertical coordination are required. In order to improve horizontal coordination, deliberate efforts should be made to establish more farmers' groups and strengthen existing ones by mobilizing, sensitizing and training farmers on the importance of farmers groups, group dynamics and management. Farmers' groups will not only increase their bargaining power but also reduce transaction costs in marketing cassava as well as economies of scale. In order to improve vertical coordination farmers have to be linked to profitable markets of cassava by facilitating and networking partnerships among farmers and other market players so as to enhance bargaining power, improve exchange relations and meet the contractual agreements in the profitable markets of cassava.

ii) Provision of improved (High yielding) cassava varieties

The findings of the study show that *Msenene* variety was a largely grown cassava variety in the study area. However, yields for this variety in the study area were found to be low averaging about 1.1 tons of cassava roots per acre. Though susceptible to diseases, the variety can yield up to 4 tons per acre. Therefore the low yield reported by farmers in the study area suggests improvement of husbandry practices to exploit the yield potential of this variety. Improvement of husbandry practices should go hand in hand with introduction of high yielding disease resistant varieties. Since the International Institute of Tropical Agriculture (IITA) is willing to join the Government and its partners in the design and implementation of a new strategy and programs for cassava to play its role as an engine for

economic growth, job creation, and food security, there is a need of working with the institute for the provision of new cassava varieties that have yield potentials as high as 35 tons of fresh roots per hectare such as *Kiroba*. Working together with development partners (NGOs, farmers' organizations and the private sector) would facilitate the spread of new varieties that are disease resistant. In addition to provision of improved cassava varieties there is a need of improving agronomic practices among cassava growers.

iii) Introduction of cassava processing technologies

The findings of the study indicate that cassava was sold in fresh form without adding value. At the same time there are markets of value added products like cassava flour and cassava chips for animal feed. Moreover, the results indicate that farmers have positive attitude towards the alternative cassava strands such as HQCF and chips for animal feeds. In order to exploit these markets there is a need to promote appropriate cassava processing technologies such as grating, chipping and crashing by educating farmers on these technologies and facilitate acquisition of processing equipment. As farmers become knowledgeable and realize the importance of these technologies in reducing income poverty, they can be motivated to organise themselves through their farmers associations to purchase simple cassava processing equipments.

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APPENDICES

Appendix 1: Farmers questionnaire for Urban Market – Linked Cassava Value Chain in Tanzania

1.0: INTERVIEW DETAILS

01 INTERVIEWER'S NAME	
02 NAME OF RESPONDENT	
03 NAME OF HOUSEHOLD HEAD	
04 ADDRESS OF HOUSEHOLD (for M&E)	
05 DISTRICT NAME	
06 WARD NAME	
07 VILLAGE NAME	
08 SUB-VILLAGE NAME	
09. DATE OF INTERVIEW	□□/□□/□□

010: Does this household or any member of this household belong to any of the groups established by the Project? 1= Yes, 2= No

1.1 HOUSEHOLD AND HOUSEHOLD MEMBERS INFORMATION

- All Members of HH currently resident (people who eat from the same pot)
- Record the information for each individual on the table

ID	Name	Age	Sex	Relationship to HH head	Education level	Main occupation
		Enter age in years (Infants record 00)	1 = Male 2 = Female	1 = Head 2 = Wife/husband 3 = Wife in Polygamous relation 4 = Child 5 = Grandchild 6 = Other relation	1 = Illiterate 2 = Primary 3 = Secondary 4 = Beyond secondary	1 = Child under school age 2 = School student 3 = Housewife / HH chores 4 = Crop production only 5 = Govt. employee 6 = Private sector employee 7 = Casual labourer 8 = Business 9 = Other (status)
1						
2						

- Members of family (temporarily) away

ID	Name	Age	Sex	Relationship to HH head	Education level	Main occupation	Remittance during the past 12 months
3							
4							

2.0: LAND AVAILABLE AND USED BY HOUSEHOLD

2.1. In the table below, please list all land operated by the household (under different tenure structures).

Land tenure structure	Size (Acres)	Size of land under (Acres) under different land uses				
		Annual crops	Perennial crops	Annual/perennial crops	Grazing	Fallow
Private (customary title)						
Rented in land						
Sharecropped land						
Borrowed land						
Gifted land						
Rented out						
Given out						

3.0: LABOUR AVAILABILITY AND USE

3.1 How many household members in the following age groups were available for farm work during the last cropping season?

Age group	Number of persons		Full-time or part-time	
	Male	Female	Full-time	Part-time
Below 18 years old				
18-50 years old				
Above 50 years old				

3.2 Did you use communal labour to supplement household labour during the last cropping season? Yes/No. If yes, indicate number of people used ... Women, Men For which crop(s) and activity (ies)

.....

4.0 PRODUCTIVE AND LIVESTOCK ASSETS

4.1. Please provide information on the following key productive assets

Asset	Number owned	Working status 1=It is or are most of them working properly; 2=Is it or are most of them working moderately; 3=Is it or are most of them working improperly; 4=Not working	Total value (Current value if liquidated/if it can be sold)
Hand hoe			
Panga Knife			
Axe			
Ox-plough, weeder, riper etc			
Ox-cart			
Wheel barrow			

Oxen			
Donkeys			
Horses			
Sprayer			
Watering can			
Irrigation pump/Treadle pump			
Tractor			
Pick-up, Lorry			
Other(s) Specify			

4.2. Please indicate the type and number of non-working livestock the household owns.

Type	Number		Value	
	Young animals	Adult animals	Average price per young animal	Average price per Adult animal
Cattle				
Goats				
Sheep				
Pigs				
Poultry (chicken, ducks)				
Rabbits				
Doves				
Donkeys				
Other (specify).....				

5.0 CROP PRODUCTION AND INPUTS

5.1. Land allocation, diseases/pests and inputs during the last season

Crop system ID	Crop enterprise	Area (Acres)	Extent of disease/pest infestation 1=Not infested 2=Mild 3=Severe	Inter-cropped with	Proportion on cassava area (%)	Planted variety name ¹	Organic fertilizer (FYM)			Inorganic fertilizer			Seeds/material (For all including inter-crops)			Pesticides (For all including inter-crops)	
							Qnty	Unit ²	Unit price	Qnty	Unit ²	Unit price	Qnty	Unit ²	Unit price	Qnty	Unit ²
01	Cassava, sole																
02	Cassava, intercropped																
03	Local maize																
04	Improved maize																
11	Sunflower																
12	Cassava																
19	Rice																
20	Others (specify)																

¹Variety : 1= Kiroba, 2= Kosmus, 3= Dihanga (bitter), 4= Mscenc, 5= Mwarusha, 6= Mrcfu, 7= Kibangameno, 8= Mbega, 9= Kigoma, 10= Kisabuni, 11= Kitusungu (bitter)
²Unit: 1= Kilogram, 2= Liter, 3= Others (specify in Kgs)

5.2. Production costs and labour inputs for the last season

Valid crop system ID (as in 5.1)	Seasonality in terms of rainfall/moisture in the farms 1=Good 2=Normal 3=Bad	How much did you harvest (IN KG PLEASE)			Direct costs and family labour input																		
		Crop 1	Crop 2	Crop 3	Land rent if rented in	Land preparation			Planting			Fertilizer/disease control			Weeding (all)			Harvesting			Post-harvesting (transporting, processing, marketing)		
					Cost	Family hired labour	Month	Cost	Family labour	Month	Cost	Family hired labour	Month	Cost	Family hired labour	Month	Cost	Family hired labour	Month	Cost	Family hired labour	Month	

FAMILY LABOUR: PEOPLE (A.E.) X EFFECTIVE DAYS X EFFECTIVE HOURS
A.E. = Adult Equivalents (1 Adult = A person of 15 and above years of age; A child of 10-14 years of age will be equated to 0.5 of an Adult equivalent)

5.3. Crop marketing aspects for the last season

Valid crop system ID (as in 5.2)	Crop product mix ³	Quantity in store/in the field based on measurement unit of sale	Quantity sold on unit of measurement of sale	Unit of measurement of sale ⁴	Perceived equivalent weight in KG	For cassava roots selling only		Month most of the product was sold (month/yr)	Average unit sale price during a peak month of sale	Marketplace where most of the produce was sold ⁵	Who bought most of the produce ⁶	Was there a middleman (broker) in the exchange/ 1= Yes, 2= No	For cassava roots only	
						% rejected?	% left under ground						What did you do with rejected roots ⁷	What did you do with roots left underground ⁸

³Crop product mix: 1= Raw cassava roots, 2= Processed cassava, unfermented makopa, 3= Processed cassava, fermented makopa, 4= Processed cassava, flour, 5= Processed cassava, boiled/fried/roasted, 6= Cassava leaves, 7= Cassava cuttings, 8= Maize, 9= Beans, 10= Sorghum, 11= Millet, 12= Soybean, 13= Groundnuts, 14= Cowpeas, 15= Sunflower, 16= Irish potatoes, 17= Sweet potatoes, 18= Vegetables, 19= Banana, 20= Tobacco, 21= Sugarcane, 22= Rice, others (specify)
⁴Unit of measurement: 1= Kilogram, 2= Dobe, 3= Bakuli, 4= Sadolim, 5= Fungu, 6= Kiroba, 7= 2 ton truck, 8= 1 ton truck/pick up, 9= Others (specify)
⁵Marketplace: 1= On-farm, 2= Village, 3= Neighbouring village/location/road/junction, 4= Nearby township, 5= Distant township, 6= Regional market, 7= Others (specify)
⁶Buyer: 1= Local/household consumer, 2= Small trader/broker (bicycle/on-foot), 3= Large trader (vehicle), 4= Institution (school, prisons etc), 5= others (specify)
⁷Fate of rejected and leftover roots: 1= Sold to the same buyer at a token price, 2= Left them to rot, 3= Consumed raw at home, 4= Sold to other local buyers/consumers, 5= Processed into Makopa for sale/home consumption, 6= Others (specify)

6.0 CASSAVA ENTERPRISE RELATED ISSUES

6.1. CASSAVA PRODUCTION

(a) General information

6.1.1. For how long have you been growing cassava? ----- years

6.1.2. What cassava cropping pattern do you practice?..... 1=Monocropping, 2=mixed cropping.

6.1.3. Is cassava grown mainly as1=Food crop, 2=Cash crop, 3=Both food and cash crop

6.1.4. How many acres of cassava have you cultivated in this year (2008/09)?

(b) Land preparation for cassava

6.1.5. How do you usually prepare land for cassava production? 1=Burning, 2=Slashing, 3=Slash-and-burn, 4=Scratching, 5=Tilling, 6=Others (specify)

6.1.6. What tool do you mainly use to prepare land for cassava? 1= Panga, 2=hand hoe, 3=Animal traction, 4= tractor, 5=Others (specify)

6.1.7. Who participate in land preparation? 1=Men only, 2=Women only, 3=Both men and women, 4=All household members

(c) Planting cassava

6.1.8. What method do you use for planting cassava cuttings? 1=Ridging, 2=Digging holes, 3=Others (specify)

6.1.9. How are the cuttings placed on the ridge, hole etc..... 1=Vertically, 2=Horizontally, 3=At an angle

6.1.10. In which season do you plant cassava?1=Short rains (*Vuli*), 2=Long rains (*Masika*) 3 = Both seasons

6.1.11. Where do you get cassava cuttings (source)? 1=from own farm, 2=Buy from other farmers, 3=Buy from seed farmers, 4 = Others (specify)

6.1.12. Do you practice raw planting or plant without a particular pattern? 1 = Row planting, 2 = No particular planting pattern

6.1.13. If you practice raw planting, what is the spacing between cuttings in a row ...and between rows...?

6.1.14. How many cuttings are planted in one acre?

6.1.15. Who participates in cassava planting? 1=Men only, 2=Women only, 3=Both men and women, 4 = All household members including children

(d) Weeding Cassava field

- 6.1.16. How do you weed your cassava field?1=Use hand hoe, 2=Slashing, 3=Use chemicals, 4=Others (specify)
- 6.1.17. How many times is field weeded per season? ...1=Once, 2=Twice, 3=Thrice, 4 = More than three times (specify)
- 6.1.18. Who participate in weeding?.....1=Men, 2=Women, 3=Both men and women. 4= All household members including children (specify)

(e) Cassava disease and pest control

- 6.1.19. Do rotate cassava with other crops?1= Yes, 2=No. If yes, with which crops?.....
- 6.1.20. Do you experience problems of cassava diseases and pests (also animal pests like rats, pigs etc)?1= Yes, 2= No, If yes, indicate the major cassava diseases and pests
- 6.1.21. What methods do use to control cassava diseases? (*multiple responses are possible*)?.....1=Use of pesticides, 2=planting disease resistant varieties, 3=burn residues after harvest, 4=Leave fallow, 5=Others (specify)
- 6.1.22. Who participate in cassava disease control?1=Men, 2=Women, 3=Both men and women. 4= All household members including children (specify)

(f) Cassava harvesting and transportation

- 6.2.23. How do you harvest cassava for commercial purpose?..... 1=Uprooting as needs arise, 2= Harvest all mature plants at once, 3=Harvest whole plot at once, 4=Others (specify), Who harvests cassava for commercial purpose? 1=Men, 2=Women, 3=Both men and women. 4=All household members, 5 = Others (specify)
- 6.1.24. How do you harvest cassava for home consumption?..... 1=Uprooting as needs arise, 2= Harvest all mature plants at once, 3=Harvest whole plot at once, 4=Others (specify), Who harvests cassava for home consumption?..... 1=Men, 2=Women, 3=Both men and women. 4=All household members, 5 = Others (specify)
- 6.1.25. How many bags of cassava roots did you harvest in the past season? What is the approximate weight of such a bag(kg)
- 6.1.26. Who transports harvested cassava roots and processed roots?.....1=Men, 2=Women, 3=Both men and women. 4=All household members, 5 = Others (specify)

6.2.11. Who sets cassava and cassava products prices? 1=seller (farmer), 2=buyer, 3=negotiation between seller and buyers, 4=Other (specify)

6.2.12. What are the criteria used in setting cassava and cassava products prices?..... 1= Cost incurred in producing cassava, 2=Supply and demand situation, 3=Others (specify)

6.2.13. How do you get information about cassava markets, market requirements and prices? 1=By physical visit, 2= By asking traders who come to buy, 4=By use of telephone, 5=Others (specify)

6.2.14. Do you know who will buy your produce before the crop is harvested/processed?1 = Yes, 2 = No

6.2.15. Do you usually sell cassava products to specific/regular buyer or customer? 1=Yes, 2=No, If Yes, what is the relationship between you and the buyer? 1=Neighbour, 2=Friend, 3=Relative, 4= Business partner, 5=Others (specify)

6.2.16. How did you come into contact with this buyer/customer?

6.2.17. Do you usually sell cassava products to specific/regular buyer or customer? 1=Yes, 2=No, If Yes, what is the relationship between you and the buyer? 1=Neighbour, 2=Friend, 3=Relative, 4= Business partner, 5=Others (specify)

6.2.18. Why do you usually sell to this specific buyer? 1=Credit advancement, 2=Trust full person, 3= pay constant price, 4= pay higher price, 5= pay promptly, 6=pay cash upon delivery, 7=Others (specify)

6.2.19. Do you have any formal contractual arrangements with the buyers/customers of your cassava products?..... 1=Yes, 2=No; If yes, please fill the following table on the terms and conditions of the last sale

Cassava product	Month	Unit price (Tshs)	Unit of measurement	Kgs equivalent	Terms of payment 1= on cash 2=on credit	Nature of contractual arrangements 1= Written, legal 2= Written, mutual trust 3= Verbal	Have you ever experienced any commitment failure with this buyer? If Yes, how this did happen?
Raw cassava roots							
Unfermented makopa							
Fermented makopa							

Cassava flour							
Boiled/fried/roasted							
Cassava leaves							
Cassava cuttings,							

6.2.20. What are the labour costs for processing 50 kg (standard Kiroba) of fresh roots into dried chips (fermented/unfermented)?

Cassava product	Labour (person days)	Opportunity cost of labour (at local wage rate)	Other costs
Peeling			
Washing			
Hand chipping			
Fermenting			
Drying			
Water bill			

6.3: INCOME FROM CASSAVA

6.3.1. Do you consider income from cassava to contribute significantly to household income? 1= Significant contribution, 2 = insignificant contribution

6.3.2. Who decides on the use of income from cassava?..... 1= Men (husband), 2=Women (Wife), 3 = Both men and women, 4 = All household members are involved

7.0: PRODUCER ASSOCIATIONS

7.1. Are you a member of any association/group? 1=Yes, 2=No, If yes, what kind of association?

7.2. Is membership to the group voluntary or involuntary? 1= Yes, 2= No

7.3. Is there membership fee? 1=Yes, 2=No, If yes, how much do you pay per year? TShs.

7.4. What are the activities of the group or association?
.....

7.5. What services and benefits do you get from the group/association?
.....

8.0 HOUSEHOLD LIVELIHOOD ISSUES

8.1. Please provide information on income sources, the family members involved, turnover and performance trend of income enterprises

Major occupations/livelihood enterprises	Name of the most MOST IMPORTANT ENTERPRISE under each of the livelihood OCCUPATION	Which household members are involved (use the SN from the ROSTER)	Amount/Turnover per year from this ENTERPRISE	Who decides on the use of income this ENTERPRISE? 1=Men (husband) 2=Women (Wife) 3=Both men and women 4 =All household members are involved	How is the situation/robustness of this ENTERPRISE now compared to the past 10 years? 1= Worsened 2= Improved 3= The same	If the ENTERPRISE situation has worsened what is the major drawback factor?
Crop production						
Livestock keeping						
Business						
Salaries/professional employment						
Wage work						
Technician						
Artisan/handcraft						
Natural resources (wood, charcoal, fish, minerals)						
Traditional medicine/healing						
Resource rent income						
Others (Specify)						

8.3. Is your household food insecure in most cases? _____ 1= Yes, 2= No, If Yes,

Food insecurity drivers	Rank (1=Most important, 2, ... n = Least important)	How do you cope/adapt against each of the food insecurity drivers

8.4. How do you generally rate your household regarding food security in terms the following dimensions of:

Food security dimensions	Rating	Codes
Food self-sufficiency (producing enough)		<i>By how much is your hhd food self-sufficient:</i> 1=Less than 25%, 2= 25 – 50%, 3=51-75% 4= 76-100%
Access from the market (food purchasing power)		<i>To what extent your hhd affords to buy food from the market:</i> 1=It cannot completely afford, 2= It can afford to some extent, 3= It certainly affords
Remittances from relatives		<i>How reliable are remittances from your relatives:</i> 1=Not reliable at all, 2= Somewhat reliable, 3= Highly reliable
Transfers from social safety nets		<i>How reliable are remittances other members in the community:</i> 1=Not reliable at all, 2= Somewhat reliable, 3= Highly reliable
Reliability of relief food		<i>How reliable is the relief food from government and other organizations:</i> 1=Not reliable at all, 2= Somewhat reliable, 3= Highly reliable

THANK YOU

Appendix 2: Questionnaires on farmers' perceptions on alternative cassava strands

Please indicate your attitude with regards to the following

S/N	Attitudinal statements	Responses: 1=strongly agree, 2=agree, 3=undecided, 4=disagree, 5=strongly disagree	
A	Attitude towards working in farmers' group		
	Farmers have witnessed cooperatives and village farms collapsing, and even some of recently associations/groups not performing well as their objectives describe. With this experience how do you perceive working in farmers groups		
1	I prefer working in groups		
2	I will join and work in groups at any cost.		
3	Working in group helps to access various services to the group members.		
4	Farmers group enable me to acquire new knowledge and technology for agricultural development.		
5	Farmers group enable me to improve my agricultural produce.		
6	When I work in groups, it becomes easy to access market for our produce.		
7	Farmers' group increases our bargaining power for our products.		
8	I do not see prospects of participating in groups when there is failure of cooperatives to reduce poverty.		
B	Attitude towards risk in involving in alternative strands	HQCF	HQCC
	Cassava farmers have been complaining that they do not have reliable and profitable market. Now there is a reliable and profitable market if farmers will process cassava into HQCF whereby 1kg of flour can be sold from 400 – 480 TAS, but the buyer prefer grating over chipping, High quality and supply of cassava throughout the year. With this situation;		
9	I am ready to produce cassava so as to adhere the above statement for HQCF even if I lose money.		
10	Without adding value of cassava for HQCF in the recent competition, cassava farming is not worthwhile.		
11	We need to look for means of processing cassava for HQCF at any cost.		
12	I am satisfied with producing and selling fresh cassava, therefore I do not prefer HQCF.		
13	I can acquire more land for cassava cultivation in order to meet the HQCF customer needs.		
	Apart from this market, there is a good market for cassava chips for animal feeds. The animal feed factory owner is ready to offer 350-400 TAS per 1kg of cassava chips. But he needs a supply of an average of one tonne per day, constant supply throughout the year, good quality chips and farmers to stick on agreement.		
14	I am ready to produce cassava so as to adhere the above statement for animal feed even if I lose money.		

15	Without adding value of cassava for animal feed in the recent competition, cassava farming is not worthwhile.		
16	We need to look for means of processing cassava for animal feed at any cost.		
17	I am satisfied with producing and selling fresh cassava, therefore I do not prefer animal feed.		
18	I can acquire more land for cassava cultivation in order to meet the animal feed customer needs.		
C	Attitude towards market of the alternative cassava products		
19	If there is an opportunity to make money by processing cassava for HQCF I will utilize it.		
20	If there is an opportunity to make money by processing cassava for animal feed I will utilize it.		
21	Growing more cassava for HQCF is the best way I can expand market opportunities.		
22	Growing more cassava for animal feed is the best way I can expand market opportunities.		
23	Correct information on price facilitates me to decide to invest for HQCF		
24	Correct information on price facilitates me to decide to invest for animal feeds		
25	With the present well known market of fresh and local processed cassava, I cannot prefer producing cassava for HQCF		
26	With the present well known market of fresh and local processed cassava, I cannot prefer producing cassava for animal feeds		

Appendix 3: Interview guide for traders

Issue	Primary information
Description of trading activities	<ul style="list-style-type: none"> • how long have you been in business as a trader? • is it a family business? • how long do you intend to remain in the business?
Specialization <i>(Remember that this question relates to economies of scale and risk strategies)</i>	<ul style="list-style-type: none"> • how many products do you trade in? • what are these products? • why do you trade in these particular products?
Description of trading and product flows	<ul style="list-style-type: none"> • describe where you buy "cassava product(s)". • describe where you sell the "cassava product(s)"
Price formation (among others, this indicates transaction costs)	<ul style="list-style-type: none"> • what factors do you consider when negotiating prices with people you buy "cassava product(s)" from? • what factors do you consider when negotiating prices with people you sell "cassava product(s)" to? • how long do price negotiations usually take?
Price risk	<ul style="list-style-type: none"> • how stable are "cassava product" buying prices? • how stable are "cassava product" selling prices?
Volumes traded	<ul style="list-style-type: none"> • in a typical week, how much "cassava product" do you sell? (ask to see records if they exist) • does the amount of "cassava product" that you trade in vary very much on a weekly basis? <ul style="list-style-type: none"> • if yes, why? • does the amount of "cassava product" vary much between the wet and dry seasons? <ul style="list-style-type: none"> • if yes, why?
Market risk	<ul style="list-style-type: none"> • do you experience problems in finding people who sell "cassava product" to you? • if yes, why? • do you experience problems in finding people who buy "cassava product" from you? • if yes, why?
Price risk	<ul style="list-style-type: none"> • how stable is the buying price of cassava products ie.chips, flour, starch, fresh cassava etc.? • how stable is the selling price of cassava products as in above?
Quality	<ul style="list-style-type: none"> • <i>Observation:</i> Feel, smell, appearance • what are the best methods and conditions for transporting "cassava product"? • how does the trader assess quality before buying the "cassava product"? • when selling, do you receive higher prices for "cassava products" of higher quality? • when buying, do you offer a higher price for higher quality "cassava product"? • what quality attributes receive the best prices?
Transport risk	<ul style="list-style-type: none"> • do you experience "cassava product" transport losses? • if yes, what are the major causes of "cassava product" transport losses (both in terms of quality and quantity)? • What is the cost per bag?
Profitability	<ul style="list-style-type: none"> • how profitable is "cassava product" trading" compared with other products. • what is the current difference between your buying and selling price of "cassava product"? • What is the usual difference in your buying and selling prices? <i>(NB if the difference varies greatly, the trader's answer will reveal information on price risk)</i>
Handling, sorting and packaging	<ul style="list-style-type: none"> • observation: Does the trader sell the product in different quality grades? • do you buy the "cassava product" in different grades? • do you sort the "cassava product" into different grades? • what sort of packaging do you use? • why do you use that type of packaging?
Liquidity:Sources of credit: • Bank • Association/Group/Union	<ul style="list-style-type: none"> • do you use credit or borrowed money? <i>(Refer to our list of different types of credit, covering both formal and informal sources)</i> • if yes, try to distinguish between money that is being borrowed for fixed capital

<ul style="list-style-type: none"> • <i>Micro-credit institution</i> • <i>Friends and relatives</i> • <i>Trading partner</i> • <i>Informal money lender</i> 	<p>(storage shed) and for working capital (stocks)</p> <ul style="list-style-type: none"> • <i>if the trader does not use credit, is credit or borrowed money available? (try to distinguish between credit for fixed capital and for working capital)</i> • <i>If yes, why don't you use credit or borrowed money?</i>
<p>Credit to buyers (this will inform us on the extent to which trust exists in the chain and also give insights to the existence of interlocking markets)</p>	<ul style="list-style-type: none"> • do you offer credit to the people who buy "cassava product" from you? • if yes, why do you let them have credit?
<p>Credit from sellers (this will inform us on the extent to which there is trust in the chain and also give us an insight to the existence of interlocking markets)</p>	<ul style="list-style-type: none"> • do you receive credit from the people who sell "cassava product" to you? • if yes, why do they let you have credit?
<p>Competition Remember that we will be able to judge Competitiveness through profit margins</p>	<ul style="list-style-type: none"> • <i>observation: Does the number of and activities among traders give the impression that competition is strong?</i> • are there any conditions that you have to fulfill before you enter wholesaling? (question relates to barriers to entry)
<p>Institutional constraints (remember that this includes cultural constraints)</p>	<ul style="list-style-type: none"> • how do the actions of the government/local authorities/trade associations affect your business? • how do you choose the people that you do business with?
<p>Spatial market integration</p>	<ul style="list-style-type: none"> • given any particular period, do prices in different towns usually move in the same direction? • describe what influences prices in different towns/villages. <p><i>Note: these questions might be more appropriate for inter-urban traveling traders</i></p>
<p>Skills</p>	<ul style="list-style-type: none"> • <i>observation: Does the trader keep business/trading records?</i> • how did you learn to become a traveling trader? • have you ever received any business training? • what is the highest level of education that you attained?
<p>Innovation</p>	<p><i>Discover whether the trader actively participates in:</i></p> <ul style="list-style-type: none"> • <i>trader associations (get description of associations)</i> • <i>seeking to supply new markets</i> • <i>responding to changes in market requirements</i> • <i>vertical integration</i> • <i>interlocking markets.</i>
<p>Information</p>	<ul style="list-style-type: none"> • how do you obtain information on: • prices in your own market • prices, supply and demand in other markets • others?