CASSAVA VALUE CHAIN: WILLINGNESS TO PAY FOR IMPROVED CASSAVA PLANTING MATERIAL IN COASTAL AND LAKE VICTORIA AREAS OF TANZANIA

ISSA MAJID MAGGIDI

A DISSERTATION SUBMITTED IN PARTIAL FULLFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTERS OF ARTS IN PROJECT MANAGEMENT AND EVALUATION OF THE SOKOINE UNIVERSITY OF AGRICULTURE. MOROGORO, TANZANIA.

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EXTENDED ABSTRACT

Lack of clean planting materials and use of Cassava Mosaic Disease (CMD) and Cassava Brown Streak Disease (CBSD) infected planting materials has been the major constraints to cassava production thus communities need to be empowered to have a self-sustaining clean seed production system. Therefore, agricultural policies of the countries in Sub-Saharan Africa should therefore emphasize seed system strategies which would result in good quality seed of the right varieties being available. There are many factors that hinder cassava production among them is the unavailability of clean quality improved planting material. To overcome the challenge of unavailability of clean quality improved planting materials, it is envisaged that its production in large quantity and dissemination in affordable manner is imminent. The production of such planting materials could be done on commercial basis. Therefore, objective of this study was to assess i) the cassava demand for industrial consumption; ii) the supply base of cassava planting materials; iii) the cost of planting materials incurred by smallholding farmers in the study areas and iv) to determine willingness of smallholding farmers to pay for clean quality improved planting material (improved cassava seeds) when produced and made available to them on commercial basis. The study found that 0 percent of the respondents obtain cassava planting materials from formal seed system, 89 percent do use seed-system approved and released planting materials and 99 percent obtain planting materials from their own source. Also, it was not easy to directly determine the cost of planting materials per hectare, though based on the survey conducted to determine willingness to pay for clean quality improved cassava planting materials it was estimated that smallholding farmers in the study areas would pay TZS 62 500 per hectare to obtain clean quality improved cassava planting materials. It was also found that factors influencing the willingness to pay were age, household monthly income, agronomic cost and residential location.

The study also revealed wide range of cassava varieties which are grown in the surveyed areas whereby some of them take long time to mature. The research implications of this study are that the demand for improved cassava seeds creates opportunity for further research into the area whilst the practical implications are that entrepreneurial opportunity is available for investment into commercial production. Socially the results of this study increase the knowledge that smallholding farmers are now willing to pay for improved cassava seeds. It was thus concluded that, although smallholding farmers showed willingness to pay for clean quality improved cassava planting materials when disseminated on commercial setting, the price they are willing to pay is much less compared to what is currently charged by commercial cassava planting materials producers under a pilot project are charging. Also, factors influencing willingness to pay were age, household monthly income, area under cassava cultivation, agronomic cost, CBSD disease attack, revenue from selling cassava, cassava selling price, industrial demand awareness, getting extension services, need for training and farming group membership. Smallholding farmers at Muheza district were more willing to pay compared to Kwimba and lastly Sengerema respectively. It was recommended that community based or commercial planting materials farms be established to ensure smallholding farmers obtain clean quality improved planting materials affordably and timely. It was recommended that a proper governance of the cassava value chain be put in place with measures such as establishing a cassava governing board and policy framework such as a Cassava Master Plan.

Key Words: Improved cassava planting materials; cassava commercialisation; willingness to pay.

DECLARATION

I, Issa Majid Maggidi, do hereby declare to the Senate of Sokoine University of Agriculture that, this dissertation is my own work done within the period of registration and that it has neither been submitted nor being concurrently submitted in any other institution.

…… ..…….. …….

Issa M. Maggidi **Date**

(MAPME Candidate)

The above declaration is confirmed

…….. …….

Dr. Jeremia R. Makindara **Date**

(Supervisor)

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DEDICATION

This work is dedicated to my Father, the Late Majid Jumaa Maggidi, may his soul rest in eternal peace and to my Mother Hajjat Mwanshamba Saad.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATE

LIST OF APPENDICES

LIST OF ABBREVIATIONS AND ACRONYMS

AfDB African Development Bank

B4FA	Bioscience for Farming in Africa
CBB	Cassava Bacterial Blight
CBSD	Cassava Brown Streak Disease
CMD	Cassava Mosaic Disease
CQI-CPM	Clean Quality Improved Cassava Planting Materials
FAO	Food and Agriculture Organization
FCI	Farm Concern International
FRN	Federal Republic of Nigeria
GA	Grow Africa
GDP	Gross Domestic Product
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
IITA	International Institute of Tropical Agriculture
IJST	International Journal of Science and Technology
M	Million
MA	Masters of Arts
MEDA	Mennonite Economic Development Associates
MOAC	Ministry of Agriculture and Cooperatives
PANTIL	Programme for Agricultural and Natural Resources Transformation for Improved Livelihoods
PIND	Partnership Initiatives in the Niger Delta
PTILP	PT Intera Lestari Polimer
SDG	Sustainable Development Goals
SWOT	Strength Weakness Opportunity Threats
UNDP	United Nations Development Programme
URT	United Republic of Tanzania

USA	United States of America
USAID	United States Aid Agency
WB	World Bank
WTP	Willingness to Pay

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

This dissertation presents the findings of a study to determine smallholding farmers' willingness to pay (WTP) for clean quality improved cassava planting materials (CQI-CPM) in the Coastal and Lake Victoria areas of Tanzania. Also, it comprises assessment on awareness for commercialization of cassava, cassava demand for industrial processing and production as well as source of cassava planting materials among smallholding farmers.

The study was motivated by commitment by the Government of the United Republic of Tanzania (URT) to pursue industrialization policy in line with Vision 2025 whose main objective is to attain high quality livelihood to all Tanzanians through strategies which ensure the realization of a number of goals, among them being food self-sufficiency and food security and absence of abject poverty (URT, 1999), This objective is in line with Sustainable Development Goals (SDGs), particularly the first and second, No Poverty and No Hunger respectively. Also, transforming the country to become a middle-income with a well-educated society running a competitive economy capable of producing sustainable growth and shared benefits. That is, transforming the economy from a predominantly agricultural one to a diversified and semi-industrialized economy with a substantial industrial sector comparable to typical middle-income countries (URT, 2011a).

Moreover, local industrialization through promotion of agribusiness and agro-processing activities would contribute directly to poverty reduction by providing jobs to low-income workforce in the rural economy as well as by adding value to agricultural products (URT,

2011b). Private investment in agro-processing has the potential to generate employment, raise productivity, transfer skills and technology, increase competitiveness, substitute imports, enhance exports and contribute to the long-term national economic development. As well, rapid urbanization and rising incomes have been contributing to increased demand for value-added products in the agriculture sector (URT, 2016).

In order to achieve the first SDG of absence of abject poverty and transform the economy stimulating and sustaining double digit rates of economic growth remains the only route for achievement of this core objective. Also, delivering double digit broad-based growth depends on transformation of agriculture to raise productivity to global levels and kick-start a dynamic process of agriculture-led and resource-based industrialization whereas the commercialization initiative is expected to produce fundamental changes in the structure and functions of Tanzania's agricultural sector including among others, increased supply of raw materials to the industrial sector (URT, 2011b). Thus, industrialization to consume agricultural produce for processing and production is imminent. Hence, inclusion of non-traditional cash crops such as cassava into the raw materials base for industrial processing and production is pertinent.

Cassava or manioc (*Manihot Esculenta Crantz*) is a perennial shrub which is cultivated as food and food security crop. It is consumed as food by more than 500 million people in tropical and sub-tropical Africa, Asia and Latin America (El-Sharkawy, 2004). Cassava was brought to Africa as potentially useful food crop by European traders after their discovery of Americas. It was later taken to Asia to be cultivated as food security crop and for the extraction of starch (Akinpelu *et al.,* 2011). In addition, cassava could contribute to industrialization as a raw material for processing and production based on its known industrial uses such as production of starch, alcohol, beer, bio-degradable paper bags,

conversion to biomass, carbohydrates, acids, textiles, paper, boards, processed food such as noodles, confectionaries and animal feeds (Tan *et al.*, 1984; Msabaha, Kepakepa and Laswai, 1986; Nduele *et al.*, 1993; Ajiwe, 1994; White *et al.*, 1998; Rajeshwarisivaraj *et al.*, 2001; Nwokoro, Orheruata and Ordiah, 2002; Roble *et al.*, 2003; Popoola *et al.*, 2007; Akpa and Dagde, 2012; Bennet, *et al.*, 2012; Attah, *et al.*, 2013; Ubwa *et al.*, 2015; Li *et al.* 2017; Manano, *et al.*, 2018).

Although, cassava is no longer a food security crop, there is a high demand for cassava-based products as raw materials for processing and manufacturing factories (FAO and IFAD, 2005). However, despite its potential for increased household incomes in low-income agrarian economies through commercialisation, its cultivation has centered over food security concerns (Radchenko and Corral 2017). Therefore, cassava need to be considered as one of the crops that can contribute to the rapid industrialization of the rural areas which besides being a food crop, is attracting more attention as a commercial commodity for industrial uses (Silayo *et al.*, 2008). However, despite its rising commercial attraction cassava value chain development has faced many challenges, among them being diseases, pests, insufficient planting materials and lack of market (Kapinga *et al.*, 2015).

For example, Mtunda (2009), argues that smallholder cassava farmers are faced with the shortage of quality and disease-free planting materials. This led to cassava farmers to re-use their own planting materials or obtain from relatives, friends and other farmers which are susceptible to pest and diseases spread. Mwang'ombe (2013), argued further that lack of clean planting materials and use of cassava seed infected with Cassava Mosaic Disease (CMD) and Cassava Brown Streak Disease (CBSD) has been a major constraint to cassava production and yield in Coastal areas of Kenya and suggested that communities need to be empowered to have a self-sustaining clean seed production system.

Furthermore, Kapinga *et al.* (2015) cited by Msabaha (1988) claimed that lack of adequate planting materials is another constraint hampering expanding cassava land area. MEDA (2016), ascertained that clean quality improved cassava planting materials could be disseminated through donor funded intervention program, unfortunately such programs are not sustainable. McGuire *et al.* (2016), argued that agricultural policies of the countries in Sub-Saharan Africa (SSA) should therefore emphasize on seed system strategies which would result in availability of good quality seeds. McQuaid *et al.* (2016) emphasized further that facilitating and enabling seed entrepreneurs to produce and disseminated clean quality improved cassava planting materials on commercial setting can be one of those good strategies. Hence, MEDA (2016), established a pilot project in Southern Tanzania for entrepreneurial cassava planting materials production and dissemination to smallholding farmers by paying the producing entrepreneurs, as one way of ensuring availability of good planting materials to cassava farmers.

This study therefore, was undertaken with the main objective of determining smallholding cassava farmers' willingness to pay (WTP) for clean quality improved cassava planting materials when disseminated under commercial environment. The study also, assessed the cassava value chain, the smallholding farmers' awareness on cassava commercialization and its use as industrial raw material for processing and production; estimated demand for cassava as raw materials for industrial processing and production; and assessed the cassava planting materials supply base in the study areas.

1.2 Problem Statement

According to IITA (2016), cassava crop loss in Tanzania is about 2.5million tons every year. This is due to poor access to improved planting materials, pest and diseases attacks, and low investment in research and development (RD). This study was focusing

specifically on planting materials aspect and as argued by Chiona *et al.* (2016) that cassava is propagated by stem cuttings, the main sources of which are farmers' own field, neighbours and rural markets. However, availability of high-quality cassava cuttings are often in short supply due to low multiplication ratio although. Thus, farmers cannot access and plant healthy stem cuttings as planting materials in order to improve the production. MEDA (2016), claimed that there are problems in cassava planting materials from the practice of re-use from own source and obtaining from informal sources which leads to reduced production and spread of diseases. Moreover, even when clean planting materials are availed, they are from short lived donor sponsored dissemination programs with fixed budget and national sponsored programs which are budget constrained and not sustainable.

Furthermore, Mwang'ombe (2013), claimed that the use disease infected planting materials and lack of clean ones, has been a major constraint to cassava production. In addition, Abbas *et al.* (2013) claimed that smallholding farmers in Africa faces serious challenges among them being poor supply of planting materials, unorganized production systems, poor post-harvest handling and poor processing capabilities and capacities. In addition, Chikwado (2012) argued that cassava value chain lacks an efficient seed system and quantities of planting material are insufficient while Mtunda (2009) argued further that unavailability of clean, disease free planting material, is a factor among others which hinders smallholding farmers from realizing expectable yield which could be above 35 tons/ha as opposed to about 10 tons/ha currently realized. Also, Gwarazimba (2009) claimed that cassava production is constrained by lack of quality planting material and similarly Iglesias and Hershey (1994), argued that cassava stem-cuttings are constrained by short post-harvest life, build-up of viruses and low multiplication rate. All these challenges influence production of high yield crops.

Based on these situations, this study assessed smallholder farmers' willingness to pay (WTP) for quality improved cassava planting materials a sustainable way of solving cassava seed unavailability challenge.

1.3 Justification of the Study

It is argued that addressing the challenge of non-availability of clean quality improved cassava planting materials (CQI-CPM), smallholding farmers could be supplied from entrepreneurial planting materials producers regularly and when the need arises. However, traditionally cassava planting materials is not traded commodity. Hence, this study seeks to determine smallholding farmers' willingness to pay for clean quality improve cassava planting materials when disseminated on commercial setting.

This study endeavored to contribute to the body of knowledge on the readiness of smallholding farmers to participate in the commercialization of cassava crop in general and its seed systems in particular. That is, on the input side of the production system thereby anticipating increased production and yield, lifting up the cassava value chain and contribute to poverty alleviation in line with SDGs and Tanzania Vision 2025. This is because commercialization of agriculture can contribute to transformation of smallholder farmers from subsistence to commercial oriented production thereby reduce poverty level (URT, 2016). In addition, the Global Cassava Development Strategy is based on the belief that growing demand for cassava can lead to rural industrial development and contribute to economic development in cassava producing countries around the world (Sokak, 2010). This is also in line with FAO (2005) which argued that commercialization of cassava has the potential to increase its demand as a cash crop thereby making it no longer a food or food security crop only.

Moreover, Almekinders *et al.* (2017) argued that seed systems of crops such roots, tubers and banana which are propagated through vegetative, are not well studied. Likewise, Farm Concern International (2015) claimed that in Kenya and Tanzania there has been a demand for readily available cassava seeds and the prices has been increasing. Kyamanywa *et al.* (2011) also argued that multiplication and deployment of improved varieties necessitates development of high throughput seed delivery systems which could be achieved through a participatory approach involving key stakeholders in a public-private partnership. Silayo *et al.* (2008), argued further that, an intervention to increase production and yield was required so that the weaknesses at production node of cassava value chain are minimized by introducing and disseminating diseases-resistant varieties. Howeler *et al.* (2018), also claim that, the shortage of cassava planting is large when large-scale cassava is under consideration since it will be difficulty to obtain the required number of stem cuttings at once.

Furthermore, cassava has an advantage that it can be grown as a cash crop in the arid and non-irrigated areas and on virgin soils where other crops cannot be grown economically. In addition, it can be cultivated within the whole year round making it more profitable to smallholding farmers (Treesilvattanakul, 2016). Cassava is also emerging as one of the most important raw material in textile and paper industries due to its properties and the ability to be modified (Akpa and Dagde, 2012; Piyachomkwan and Tanticharoen, 2011). Thus, cassava can be traded internationally whereby dry cassava trade worldwide was estimated at 8.4million tons with Thailand and Indonesia leading the export for chips, pellets, starch, and flour hence providing opportunity to smallholding farmers to earn from export proceeds (Federal Republic of Nigeria, 2006).

Moreover, in Thailand, farm price increased due to ethanol boom as an alternative fuel, making cassava an important raw material in the industry as its ethanol yield is higher compared to other starch base crops such as maize and rice (Poramacom *et al.*, 2013). In addition, China need ethanol demand was estimated at 5 million metric tonnes since it has planned to substitute 10percent in gasoline and cassava could be the raw material (Wang, 2002). Hence cassava is now multi-faceted crop since it is food, food security and cash crop, as far as smallholding farmers are concerned. Also, its importance in the cropping systems of developing countries particularly Sub Saharan Africa (SSA) cannot be overemphasized. Therefore, it is important that the crop is thoroughly studied from different viewpoints, scientifically, socio-scientifically and socio-economically.

Hence, it was envisaged that the knowledge generated by this study is expected to benefit policy makers and Development Partners on identification of kind of interventions which could be implemented to improve cassava production and production. Therefore, the best course of action and would be on cassava production entrepreneurs who would be ready to invest in commercial production of cassava planting materials.

1.4 Research Objectives

1.4.1 Overall objective

The overall objective of this study is to determine the willingness to pay (WTP) for clean quality improved cassava planting materials by smallholding farmers when produced under commercial environment in order to improve productivity and sustainability of cassava value chain in Tanzania.

1.4.2 Specific objectives

The study was guided by the following specific objectives:

i) To assess the smallholding farmers' cassava commercialisation awareness and demand for industrial consumption in Coastal and Lake Victoria areas of Tanzania;

ii) To assess the supply base of cassava planting materials in the study areas;

iii) To assess the cost of planting materials incurred by smallholding farmers; and

iv) To determine smallholder farmers' WTP for clean quality improved cassava planting materials produced under entrepreneurial seed producing venture.

1.5 Research Questions / Hypothesis

1.5.1 Research questions

The specific objectives i) to iii) were guided by research questions whilst specific objective iv) was guided by hypothesis.

a) What is the demand for cassava as raw materials for industrial consumption and processing?

b) How and when do farmers get planting materials within the study area?

c) How much per hectare do cassava farmers pay for planting materials?

d) Are the farmers ready to pay for good quality cassava planting materials if available to them under commercial setting?

1.5.2 Hypothesis

This research hypothesised that smallholding farmers are not willing to pay for commercially supplied clean quality improved cassava planting materials.

1.6 Study Area

The study area is indicated on Figure 1.1 below, was purposefully selected based on the main cassava cropping zones in Tanzania. That is according to Masumba (2012), these are

the Lakes Zone covering Geita, Kagera, Kigoma, Mwanza, Shinyanga and Simiyu regions; Coastal Zone covering Tanga, Dar Es Salaam and Coast regions and Southern Zone covering Lindi, Mtwara and Ruvuma regions. The regions were randomly selected from the two zones. Thus, this study was conducted in Mwanza and Tanga Regions for Lakes and Coastal zones respectively. The districts were also randomly selected, whereby Muheza was selected in Tanga region and Sengerema in Mwanza region. Moreover, Kwimba district was purposefully selected base on its proximity to Tanzania Agricultural Research Institute at Ukiriguru.

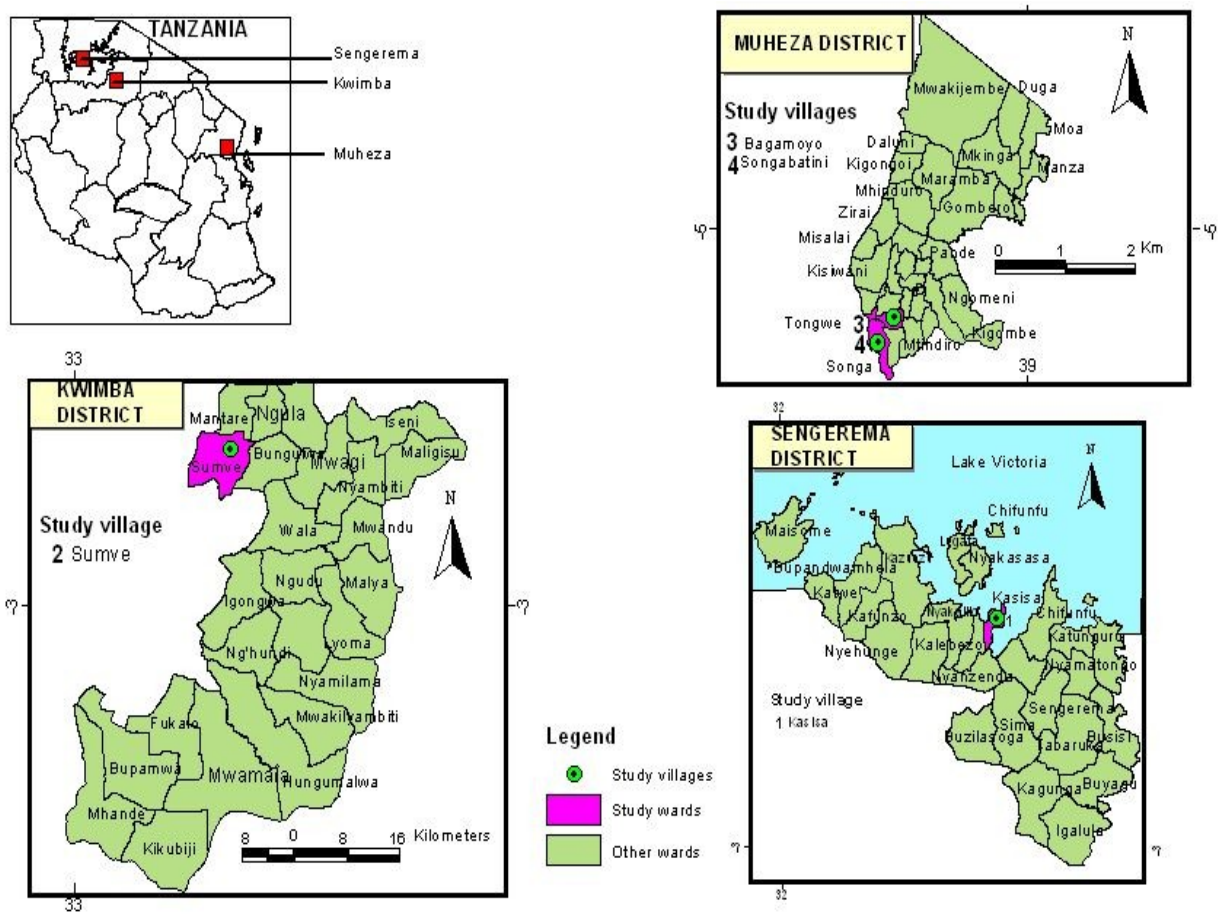

Figure 1.1: Map of the study area

The wards where the research was conducted were randomly selected whereby at Muheza district, Tongwe and Songa wards were selected. Tongwe is located at upland on the

foothills of Eastern Usambara Mountains while Songa is located at low land of the mountains. Sumve and Kasisa wards were randomly selected at Kwimba and Sengerema districts respectively.

Sengerema district lies at Latitude 32.64° South and Longitude 2.65° East, Kwimba lies at Latitude 33.36° South and Longitude 3.06° East and Muheza district, which lies at Latitude 38.9° South and Longitude 4.92°.

1.7 Sample Size

The sample size was determined using Cochrane formulae (Cochrane, 1963) as presented in equation 1.

$$n_o = \frac{Z^2*p*(1-p)*N}{[(N-1)*E^2 + Z*p*(1-p)]} \quad \text{……………………………………………………..………… (1)}$$

Where: n_o is Sample size

Z is Confidence level at 95percent = 1.96

E is Margin of Error = 5percent = 0.05

P is the Probability = 0.5

N is the Population

Using Cochran's Correction Formulae: $n_{oc} = 384/[1+(384/\ n_{os}\ )]$……………………...… (2)

Therefore, Sample Population = 384/[1+(384/1466)] = 302 ...………………..…...…(3)

Therefore, targeted sample was 109 for Kasisa, 107 Sumve, 37 Songa and 48 Tongwe. However due to actual situation on site and repetitive responses during interviews only 35 respondents were interviewed at Tongwe ward, 41 at Songa, 70 at Kasisa and 90 at Sumve (Table 3). Also, the 35 satisfied the minimum criterion of 30 in accordance with Bailey (1994). Thus, the sample population was 241 as smallholder cassava farmers.

Table 1.1: Sample size

Region	District	Ward	Population (Persons)	Stratified Sample (Persons)	Village	Actual Sample (Persons)
Mwanza	Kwimba	Sumve	16 436	107	Sumve	90
	Sengerema	Kasisa	16 839	109	Kasisa	70
Tanga	Muheza	Songa	5 769	37	Kwamianga	41
		Tongwe	7 478	48	Bagamoyo	35

Source: URT (2012)

The sampling procedures involved purposive selection of four villages based on criteria that the villages are involved in cassava cultivation. Key informant's information was used to refine selection of the study sites and sample size.

1.8 Methodology, Data Collection and Analysis

Determining smallholding cassava farmers' WTP for clean quality improved cassava planting materials when disseminated on commercials basis was carried out using economic analysis approach of willingness to pay (WTP) based on Contingent Valuation Theory which is also referred to as Contingent Valuation Method. The method was used in other agricultural related studies, to mention few, as by Whitehead *et al.* (2001), Ghazanfar *et al.* (2015), Tolera, Temesgen and Rajan (2014) and Chancharoenchai and Saraithong (2017).

The sampling procedures involved random selection of four wards in the three districts however; villages were purposefully selected based on criteria that they are intensely involved in cassava cultivation. Key informant's information was used to refine selection of the study sites.

Data was collected from smallholder farmers first through Focus Group Discussion (FGD) and then through individual interviews. The demand for cassava as industrial raw materials was estimated using secondary data. Secondary data was collected from Sokoine National Agricultural Library (SNAL) and MEDA Tanzania.

This study used both descriptive in line with research conducted by Ahmed (2015). The quantitative data were analysed by using Statistical Package for Social Sciences (SPSS) by computing descriptive statistics to obtain frequencies and percentage distribution of the responses.

1.9 Organization of the Dissertation

This dissertation is presented in the publishable manuscript format, and it is organized in six chapters. Chapter one covers the introduction which includes the problem statement and justification, objectives and research questions, theoretical and conceptual frameworks, study areas and sample size. Chapter two covers literature review carried out for the study. Chapter three is the first manuscript which is based on the first specific objective of the research, assessment of smallholding farmers' cassava commercialization awareness and estimate of cassava demand for industrial consumption. Chapter four is the second manuscript which is based on research objectives number two and three and presents the assessment of the supply base of cassava planting materials in the study areas and the cost of planting materials incurred by smallholding farmers. Chapter five is the third manuscript which is based on main research objective, to determine smallholding farmers' willingness to pay for clean quality improved cassava planting materials when made available to them under commercial setting. Chapter six is the overall conclusion and recommendations.

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CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Definition of Concepts

2.1.1 Cassava planting materials

Cassava planting materials, in the context of this research refers to propagation materials, namely stem cutting and true seeds.

2.1.2 Industrialization

Effiom and Udah (2014) conceptualized industrialization as the process of transforming raw materials, with the aid of human resources and capital goods, into consumer goods, new capital goods and social capital, which together with human resources provides new services.

2.1.3 Value chain

Value Chain is defined value chain as a set of activities that are performed in an industry in order to deliver a valuable product or service for the market (Porter, 1985), it describes the full range of activities which are required to bring a product or service from conception, through the different phases of production. (Kaplinsky *et al.*, 2000).

2.1.4 Seed system

Seed System is a framework of institutions linked together through a combination of components and processes of production, multiplication, storage and marketing of improved varieties of specific quality along with the interactions and support to make seed available to a particular end user (Loch and Boyce, 2003)

2.1.5 Contingent valuation

Contingent Valuation is a survey-based method frequently used for placing monetary values on environmental goods and services not bought and sold in the marketplace (Carson, 2000). CV was proposed by Ciriary-Wantrup in 1952 and first published in an empirical study in 1963 by Davis (Chilton, 2007).

2.1.6 Willingness to pay

Willingness to pay (WTP) is defined as the maximum price a given consumer accepts to pay for a product or service, is of particular interest as it is richer in individual information. The concept first appeared in economic literature in 1902 by Davenport (Le Gall-Elly 2009).

2.1.7 Commercialization

Commercialisation may be defined as the proven level of commercial capabilities of a market actor to undertake activities and manage processes that ultimately exposes products or services to the voluntary actions of other market actors, who's actions significantly impact the knowledge regarding the degree of commercial success of the product or service in question (Sloek-Madsen *et al.*, 2015).

2.2 Theoretical Framework

This study sought to assess study areas smallholding farmers' cassava commercialization awareness, supply base and cost of cassava planting materials and willingness to pay for clean quality improved cassava planting materials when made available on commercial setting. Therefore, it implored theories underpinning each part which are, commercialization theory, seed system theory and the theory governing willingness to pay studies which is contingent valuation theory or contingent valuation method.

2.2.1 Commercialization theory

When an organization commits its limited resources to innovative endeavors it expects new revenue streams or increased profitability. The return on new product investment can only be achieved by bringing the new product to customers and this is generally referred to as commercialization. Thus, commercialisation may be defined as the proven level of commercial capabilities of a market actor to undertake activities and manage processes that ultimately exposes products or services to the voluntary actions of other market actors, whose actions significantly impact the knowledge regarding the degree of commercial success of the product or service in question (Sloek-Madsen *et al.,* 2015).

Agricultural commercialization was defined as the ratio of the value of crop sales in household over the value of the total crop production (Pender and Alemu, 2007). Pingal and Rosegrant (1995) argued that commercialization of agriculture is accompanied by economic growth, urbanization and withdrawal of labour from the agricultural sector, increase food security and improve household nutrition through increased revenue providing the necessary cash to buy marketed food.

The transition from subsistence to commercial agriculture represents a key ingredient for the economic development of low-income countries, that is agricultural commercialization enhances trade and efficiency, leading to economic growth and welfare improvement at the national level which is further expected to initiate a virtuous cycle which raises household income, thus improving consumption, food security and nutritional outcomes inside rural households (Carletto *et al.,* 2017).

In addition, factors affecting commercialization process in agriculture are such as rapid growth of economies in the both developing and developed countries, introduction of new

technologies, market expansion, market liberalization, urbanization, rapid increase of demand for food, decrease of farming population, liberalized and open economic policies, bilateral and multilateral economic agreements, developed infrastructure facilities in farming areas and government agricultural policies (Mahaliyanaarachchi and Bandara, 2006). Hence, in order for smallholder farmers to thrive in competitive global economy, it is necessary to create an entrepreneurial culture in rural communities where farmers produce for markets rather than trying to market what they produce. One of the suggested ways to achieve commercialization is to support farmer organizations to allow smallholders to realize economies of scale in service access and delivery (Ochieng, *et al.*, 2015).

Furthermore, cassava commercialization may be seen as all those processes and activities which are carried out on cassava value chain with intention of obtaining income from land acquisition for cassava cultivation, soil investigations, field preparation, procurement and utilization of planting materials, good agricultural practice implementation, post-harvest activities, marketing, industrial processing and production using cassava as raw material, cassava residue utilization and waste management (Li *et al.,* 2017). Therefore, the commercialization theory is applicable to this study since it sought to establish the willingness to pay by smallholder farmers for quality improved cassava planting materials when produced and distributed on commercial setting. This is where commercialization theory meets the study.

2.2.2 Seed System Theory

In the context of this research, cassava planting materials refers to propagation materials, namely stem cutting and true seeds. A seed system, is a framework of institutions linked together through a combination of components and processes of production,

multiplication, storage and marketing of improved varieties of specific quality along with the interactions and support to make seed available to a particular end user (Loch and Boyce, 2003). It is a legal and regulatory systems that enable the development, access, and availability of high quality agricultural inputs which are essential to building a vibrant agricultural sector and commercially successful agribusinesses that will benefit small-scale farmers (USAID, 2007).

Seed systems are of two categories, formal and informal, with the informal seed sector is usually defined as the total of seed production activities of farmers, mostly small-scale farmers. In contrast, the formal sector refers to seed production activities by the public and commercial sector (Loch and Boyce, 2003). Synonyms used for informal seed sector are local or farmers seed system., whereas a clear-cut distinction between the informal and formal seed system does not exist in the situations where public or private institutions are engaged in the production of uncertified, unlabeled or registered seed lots (Almekinders, 2000). The formal seed sector is the primary source of new crop varieties, and is home to most of the capacity in scientific plant breeding, extension services, credit and the like whilst the informal sector is the primary link to farmers' and traditional knowledge, especially requirements for new varieties, inputs and services (FAO, 2010).

Moreover, Almekinders *et al.*, (2017) claimed that roots tubers and banana (RTB) seed systems are not well studied. Also, farmers should have access to seed (planting material) of adequate quality such that the immediate needs for access to planting material are met and contribution to long-term restoration, rehabilitation, or improvement of agricultural systems is done (Sperling and Cooper, 2003).

In addition, seed production and distribution are important amongst the factors which determine the pace of agricultural development (Venkatesan, 1994). Therefore a well-developed enabling environment for agro-inputs is necessary to create robust food systems, strengthen food security, reduce rural poverty, and ensure environmental sustainability (USAID, 2007). Thus, cassava farmers would benefit from a reliable availability of good quality seeds and a continuous supply of varieties with different traits, adapted to continuously changing agro-ecological conditions and market demands if a well-functioning seed system is available. To achieve this, a functioning market with seed entrepreneurs seeking to make a profit out of seed production and marketing is needed (ISSD, 2017).

Thus, agricultural policies in SSA should emphasize on seed system strategies which would result in good quality seed of the right varieties being available to farmers at the right time and at affordable prices (Venkatesan, 1994). In addition, development partners should closely review policies aimed at fostering the privatization of seed systems in developing countries which will ensure establishment of sustainable seed system to the benefit of farmers. This should focus on the farmers' seed sourcing behaviour and the state of public sector breeding-related activities and evolve a strategy of long-term support of national and international public agricultural research (Rangnekar, 2001).

Therefore, the applicability of the seed system theory this study is due to its aim of finding out whether or not smallholder farmers are willing to pay for quality improved cassava planting materials (cassava seeds). Thus, an understanding of cassava seed system is important.

2.2.3 Contingent Valuation Theory and Willingness to Pay

Contingent Valuation Theory also referred to as Contingent Valuation Method is a theory used to value non-marketed goods (Alberini, 1995). Bowen (1943) and Ciriacy-Wantrup (1947) were the first to propose the use of a public opinion survey as a valid instrument to value public goods, based on the idea that voting could be the closest substitute for consumer choice. In what is often considered the first book on environmental and resource economics, Resource Conservation: Economics and Policy, Ciriacy-Wantrup (1952) defends the use of direct interview methods in valuing public goods (Hoyos and Mariel, 2010).

Moreover, Carson and Hanemann (2005), argued that CV is deeply rooted in welfare economics, its surveys are capable of directly obtaining a monetary measure of welfare associated with a discrete change in the provision of an environmental good by substituting one good for another or the marginal substitution of different attributes of an existing good. Mitchell and Carson (1989) played a central role in defining the practice of contingent valuation through their book, '*Using Surveys to Value Public Goods: The Contingent Valuation Method'*. Also, Kling *et al.* (2012) claimed that the Exxon-Valdez accident of 1989 resulted into cementing the CV as a reliable method for valuing environmental goods and passive values

Furthermore, CV is a survey approach designed to create the missing market for public goods by determining what people would be willing to pay (WTP) for specified changes in the quantity or quality of such goods or, more rarely, what they would be willing to accept (WTA) in compensation for well-specified degradations in the provision of these goods. It circumvents the absence of markets for natural resource services by presenting consumers with a choice situation in which they have the opportunity to buy or sell the

services in question. The popular name for this form of non-market valuation arose because the elicited values are contingent upon the particular scenario described to survey respondents (Carson *et. al.*, 2003).

Willingness to Pay (WTP) was defined as the maximum price a given consumer accepts to pay for a product or service and as a concept, was first presented in economic literature by Davenport in 1902, was designed to determine prices for pure public goods and services and has been used in econometrics of varied subjects such as the value of human life, threatening human life risks minimization, the arts, social programs, marketing and corporate investments (Le Gall-Elly 2009). Although, currently it has gained wide acceptance and use in area of agricultural economics such that it has been used to estimate farmers' WTP to pay for services such extension service (Whitehead *et al.*, 2001), cow insurance (Xiu *et al.*, 2012) and cabbage produced under good agricultural practice in Thailand (Chancharoenchai and Saraithong, 2017). WTP is estimation as a probability or maximum likelihood of the studied population to accept the proposed intervention (Peng, *et al.*, 2002).

Traditionally, cassava planting materials are not marketed goods in Tanzania. Thus, cassava planting materials have been treated like environmental goods which could just be obtained within a community, from neighbours and friends whenever required and are available. However, the challenges caused by cassava diseases, low yield and lengthy maturity periods for traditional cassava varieties have made advent of quality improved cassava planting materials inevitable.

Therefore, this research was conducted to determine WTP by smallholding farmers, for quality improved cassava planting material when marketed and disseminated on commercial basis, thus applicability of CV theory.

2.3 Analytical Framework

This study used both descriptive and inferential statistics to analyse the data collected from the field. Descriptive statistics was used to analyse data associated with objective (i) to (iii) and the main objective of determining willingness to pay used inferential statistics. The statistics which are used to summarize data in an organized manner enable decision makers to assess specific population in a more manageable form is known as descriptive statistics (Kaur *et al*., 2018). This method helps researcher to detect sample characteristics that may influence conclusion and to compare sample from one study with another (Thompson, 2006). On the other hand, inferential statistics draws inference from finding of a study (Adeyemi, 2009). Inferential statistics is based on the probability theory, such that determining WTP is estimating the probability or maximum likelihood of the studied population to pay for commonly non-marketed goods or services (Carson *et al.*, 2003).

Moreover, determination of maximum likelihood may be modelled based on dichotomous or binary outcomes using regression models such as Multiple Linear (ML), Ordinal Least Square (OLS), Multinomial Logit (MNL), Probit or Logit methods as in a binary response, a number of predictor variables results into either one of the two outcomes, such as either Yes or No thereby a respondent only makes one choice between two available options (Campbell and Campbell, 2001). Horowitz and Savin (2001) noted that estimating the conditional probability of an econometric problem could be achieved using either probit or logit model which assume that the dependence functional form of explanatory variable is known and the estimation based on either probit or logit a more alike.

Le Gall-Elly (2009) argued further that, determining WTP has the advantage that both sales volume and margins could be optimized when prices can be customized as well as raised when factors which influence WTP are known. Thus, enables calculation of demand curve according to price and setting the price where it offers the best possible margin. Breidert *et al.* (2015) claimed that though there has been advancement in both academic and applied pricing research, many companies make pricing decisions without understanding of buyers' and competitors' response to their decisions, as such missing sufficient knowledge on buyers' WTP for the priced products.

Moreover, it is important to review and decide on methods of measuring WTP, since outcome of a WTP study allows pursuing a pricing strategy that is suitably customized to marketing environment (Breidert, Hahsler and Reutterer, 2015) and thereafter it is important to choose an appropriate statistical model for analysis (Hanley *et al.*, 2001). In this regard, logistic regression is well suited for describing and testing hypotheses about relationships between a categorical outcome variable and one or more categorical or continuous predictor variable (Peng *et al.*, 2002).

Logistic regression model was invented in 19^{th} century by Verhulst while describing population growth as: $P(t) = \beta P(t) \{1 - P(t)\}$……………………………………………..(4)
Where P(t) is the proportion of population at any time t to the maximum (saturated) population and β is the constant rate of growth.

Accordingly, the logarithmic solution to equation (4) is:

$$P(t) = \frac{\exp(\alpha + \beta t)}{\{1 + \exp(\alpha + \beta t)\}} \quad \text{…(5)}$$

Where α is the error term.

This function tends to approach 1 as time passes infinitely and known as Logistic Regression, that is, a population will tend to regress towards a certain figure as time passes infinitely (Cramer, 2002). Peng *et al.* (2002), had put it that the probability of WTP is P(Y=1) and the logarithmic ratio of the probabilities of likelihood as:

$Log_e[P(Y=)] / [1-P(Y=)]$ …….(6)

Which according to Park (2013) can be equated to a linear function $\alpha + \beta X$ ……..(7)

where P(Y) is the probability, β is the gradient of the linear equation, X is the variable and α is the error term.

Thus, the logistic model of estimation can be written as:

$Log_e [P (Y = 1) |X_1, X_2...X_n] / [(1-P) (Y = 1) |X_1, X_2...X_n] = \alpha + \beta_0 + \beta_1X_1 + \beta_2X_2 +...\beta_nX_n$ .....(8)

Which can be generalized as: $Log_e[P] / [1-P] = \alpha + \beta_nX_n$ .....(9)

Solving: $P / (1-P) = e^{(\alpha + \beta nXn)}$ or $P = e^{(\alpha + \beta nXn)} - P*e^{(\alpha + \beta nXn)}$ .....(10)

Or: $P (1 + e^{(\alpha + \beta nXn)}) = e^{(\alpha + \beta nXn)}$ .....(11)

Therefore: $P = [e^{(\alpha + \beta nXn)}] / [1+ e^{(\alpha + \beta nXn)}]$……(12)

The probability of WTP is thus, $1 \geq P > 0$; if $P(Y=1) > 0.5$.

β_0 is the Y intercept when X = 0 $\beta_1, \beta_2,$ ..... β_n are the slopes of regressions where X_n are the independent variables (regressors) which were used in the analysis.

Furthermore, the application of logistic regression in relation to contingent valuation method result into WTP distributions which are asymmetric with mean larger than median, since income distribution is asymmetric and here is often a sizable part of the population that is fairly indifferent to the environmental good and a group that care about its provision. Mean WTP is the traditional measure used in benefit-cost analysis. In these cases, median WTP, which corresponds to the flat amount that would receive majority approval, is a standard public choice criterion (Carson, 2000).

In addition, the logistic regression equation found its use in biology and chemistry in explaining growth of insect colonies and chemical reaction (Cramer, 2002). Also, in marketing (Akinci, *et al.,* 2007); medical research (Sathian 2011); employees performance appraisal (Francis, 2017); and in agriculture (Ahmed, 2015; Chancharoenchai *et al.*, 2017; Afroz *et al.,* 2017 and Diaz-Perez *et al.,* 2019).

Therefore, this study used logistic model in determining factors which influence smallholding farmers' WTP for clean quality improved cassava planting materials when disseminated on commercial setting.

2.4 Empirical Review

2.4.1 Cassava commercialization

A strategic action plan for the development of Nigerian cassava industry was released in 2006, in which among others a SWOT analysis of cassava industry was conducted and a roadmap was drawn to take the Nigerian cassava industry to higher levels in term of research and development, production, processing and export (Federal Government of Nigeria, 2006). The Presidential Cassava Initiatives program had the effect of improved cassava output, promoted food supply, enhanced national food security and further commercialized the crop (Donkor *et al.,* 2017).

Moreover, the Cassava Commercialization and Processing Program supported by Alliance for a Green Revolution in Africa (AGRA) which was implemented by Farm Concern International in Kenya, Tanzania and Uganda has experienced an improvement in demand for clean and improved cassava varieties and the prices of cassava cuttings increase tremendously, commercializing the input side of cassava value chain production node (FCI, 2015). Also, the Bill and Malinda Gates Foundation (BMGF) 'Cassava: Adding Value for Africa' (C:AVA) project have demonstrated that rural poverty can be addressed

by upgrading value chains for new cassava products such as high quality cassava flour (HQCF) as well as commercialization of cassava planting materials through entrepreneurs (MEDA, 2016).

Furthermore, Haggblade *et al.* (2012) argued that strategic investment in areas of research and development, breeding and food science and technology should be increased in the Southeast African countries of Malawi, Mozambique and Zambia since cassava commercialization in those countries had concentrated in post-harvest processing of fresh roots into low quality cassava flour and starch extraction. Alene *et al.* (2018) claimed that a number of programs since 1970s on cassava researches have been implemented with a view of fighting pest and diseases, notably cassava mosaic disease (CMD) and cassava brown streak disease (CBSD). Institutes such International Institute of Tropical Agriculture (IITA) and International Centre for Tropical Agriculture (CIAT) as well as CGIAR research programs played key role in the cassava commercialization efforts.

2.4.2 Institutional framework of seed systems in Tanzania

In Tanzania, the seed industry is governed by an act of parliament, the Seed Act 2003 which provides regulations for seed matters, such that Article 13 (1) provides that, any person, who intends to deal with importation, exportation, production, processing, distribution, sale or advertisement for sale of seeds shall obtain a permit from the Director or any other person authorized by the Director in that behalf; the Director is the Chief Seed Quality Controller. In addition, the seed sector comprises of a wide variety of stakeholders from the public and private sector, as well as civil society actors. The public sector is strongly involved in all steps of the seed chain, from plant genetic resource management to seed production and marketing. Since 1989 private seed companies have been producing and marketing certified seed and some basic seed, with a main focus on

modern varieties of maize. However, only 5.3 per cent of the seed used in Tanzania is certified, which doesn't come close to meeting farmers' needs (ASARECA, 2014).

The role of the Seed Act 2003, among others is to ensure registration of seeds dealers, issuance and cancellation of certificate of registration, hearing of appeals, promulgation of prohibition, keeping records pertaining to seeds, approval and listing of varieties. TOSCI on the other hand is responsible for certification and promotion of quality agricultural seeds produced o imported into the country for sale to safeguarding farming community from poor (fake) seeds from vendors of farm inputs (URT, 2003).

Moreover, in SADC countries, seed supply of food crops has significantly improved as governments liberalized seed sectors and put together suitable regulatory framework that ensure timely supply of quality seed to farmers but most regulatory frameworks are limited to cereal food crops. That is, there are no regulations, controls or support for tuber crops including cassava which is one of the most important food crops. It is little recognized and often viewed as a poor man's crop (Gwarazimba, 2009).

In overall, the root and tubers seed system are not well established as argued by Almekinders (2017). In addition, the cassava seed system in Tanzania, is in its infancy and there is deficit of quality improved cassava planting materials (MEDA, 2016). Therefore, this study sits with the situation and that it studied the cassava seed system in Tanzania.

2.4.3 Factors affecting Willingness to Pay

Several studies to determine WTP have been done in various areas of economics. Giannoccaro *et al*. (2016), in a study to determine factors influencing farmers' willingness

to participate in water allocation trading in Southern Spain found a positive relationship between the WTP and the level of information about available water, suggesting that uncertainty hinders decision making. Ahmed *et al.* (2015) explored factors influencing farmers' WTP for a planned adaptation programme to address climatic issues in agricultural sectors in which the statistical result showed that education, income and the right of environment to be protected irrespective of the costs were the factors influencing WTP.

In a study of farmers' WTP for crop insurance in Pakistan, Ghazanfar *et al.* (2015) found that credit access, expected yield, farm income, land holdings, loss experience and land tenure system had significant impact on WTP for crop insurance. Kassa and Teshome (2015) found that age, household size, education, income, total livestock unit, land slope, perception and initial bids, were the factors influencing soil and water conservation activities. Also, in econometric analysis of WTP for agricultural extension services, Tolera, Temesgen and Rajan (2014) found that age had a negative and significant relationship with WTP, young farmers were more willing to pay whilst household income and farm size had positive influence on farmers WTP for extension services.

Moreover, off-farm income, credit access and satisfaction with the management of irrigation water supply system were found to positively influence the farmers' WTP for irrigation water (Omondi *et al.,* 2014). Also, it was found that when farmers know about insurance and realize its advantages, they would like to participate and pay for it, while access to information influenced WTP (Xiu *et al.*, 2012). The magnitudes of households' WTP for agricultural technologies, as well as the type of payment, vary with the nature of the technology (Ulimwengu and Sanyal, 2011). In determinants of farmers' willingness to

pay for soil conservation practices in the Southeastern Highlands of Ethiopia study, Asrat *et al.*, (2004) found that farmers were less WTP cash but willing to spend labour and time as well as age influenced WTP.

In addition, Sirutyte (2017) found that intervention session successfully enhanced farmers' knowledge, however there were no significant changes in farmers' WTP based on the knowledge. That is, there was no evidence of causality between knowledge and WTP. Therefore, information and knowledge were found not to lead to increased adoption of certified seed but budget constraint was the key barriers in the farmers' WTP. Also, in Tanzania, Kazuzuru (2018) established that tourists' trip-related characteristics such as group size, purpose of visit and travel arrangement were more influential factors in spending by tourists than the destination attributes as well as the demographic characteristics.

Furthermore, Gingrich *et al.* (2017) in a study for demand and willingness to pay for bed nets argued that, nets manufacturers and retailers should advertise and promote consumers' preferred net attributes as well as policy makers should consider making credit available for interested buyers. Swai (2016), in a study for WTP for watershed services by downstream water users in Babati, education, farm size, gender and occupation were factors found to affect WTP. Also, the basis preferred for charging and collection of fees an agency office and the amount willing to pay could be the fee. Ndetewio *et al*. (2013), found that among factors affecting WTP were level of education, household income, household size, farm size and main economic activities of the area.

Bruner *et al.* (2015), used WTP study to suggest to Tanzania National Parks Authority on fee structures for various national parks based on whether the tourists were foreigners or citizens.

In addition, Mussa (2015) found that Dodoma residents were WTP for garbage collection and the factors influencing it were age, education level, marital status, household income, occupation, charge per month, collection frequency, transport mode, disposal method, quantities of solid waste generated and dump site location. Ndetewio, *et al.* (2013) argued that, for effective WTP, the observed weaknesses which environmental education, participatory basin management approach and good governance of basin resources should be taken care of. Also, Kuwawenaruwa *et al.* (2011), in WTP study for voluntary health insurance found location, whether rural or urban had varying influence toward WTP. Bonu *et al.* (2003), found that implementation of uniform user charges in the public facilities might adversely affected utilization among the poor, women and the elderly, suggesting that household income, gender and age were factors influencing WTP for health services. Walraven (1996) observed that there was large WTP for health services through insurance but respondents preferred local insurance system over user fees.

Traditionally, cassava planting materials were non-marketed. Therefore, its commercialization necessitate determination through a study, on whether or not the planting materials could be produced and distributed on commercial setting. Hence, the above revisited literature affirmed the use of WTP studies in determining the readiness of respondents to pay for goods or services which were commonly non-marketed as this study determined farmers' WTP for clean quality improved cassava planting materials, which traditionally are not commonly marketed.

2.5 Research Gap

Since commonly, cassava planting materials are largely non-marketed goods in Tanzania, their dissemination on commercial basis would fall into the category non-marketed goods. Cassava planting materials have been obtained by farmers from their own sources, relatives, friends, neighbours (Mtunda, 2009) and from intervention programs such as by MEDA (2016). Therefore, is pertinent to determine whether or not smallholding farmers are WTP for cassava planting materials when disseminated on commercial setting. The outcome information from this study will contributed to the body of knowledge as whether the smallholding farmers are willing to purchase clean quality improved cassava planting materials if availed to them.

Therefore, this study was undertaken to determine smallholding farmers' WTP for clean quality improved cassava planting materials (CQI-CPM) assessing the potential for commercialisation cassava seed system as an intervention for boosting cassava production in Tanzania for commercial purpose. This is due to the fact that cassava has traditionally been cultivated as food and food security crop.

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CHAPTER THREE

3.0 CASSAVA COMMERCIALIZATION AWARENESS AMONG SMALLHOLDING FARMERS AND DEMAND ESTIMATES FOR INDUSTRIAL CONSUMPTION IN TANZANIA

Issa Majid Maggidi[1] and Jeremia Makindara[2]

[1]MA Student, College of Social Sciences and Humanities, Sokoine University of Agriculture, P. O. Box 3024 Morogoro, Tanzania. immaggidi@gmail.com

[2]Senior Lecturer, School of Agricultural Economics and Business Studies (SAEBS), Sokoine University of Agriculture, P. O. Box 3140 Morogoro, Tanzania. makj@sua.ac.tz

Abstract

Cassava in Tanzania is a food crop with high potential for commercialisation. Tanzania is 12th world's cassava producers and 6th in Africa with average of 5.23M tonnes. Cassava is a source of carbohydrates, protein from leaves and raw materials for industrial processing and production. Smallholder farmers in Coastal and Lake Victoria areas are aware of commercialization of cassava and do participate in the commercial processes of the crop. In Coastal area cassava farmers prefer to sell bulk fresh cassava whilst in Lake Victoria area, to sell dried cassava. In both areas, smallholder farmers are aware of cassava as raw material for industrial use and export crop. Farmers group plays an important role in uniting and organizing smallholder farmers and offer joint market outlet, opportunity for easy to access both credit and other assistance. The study concluded that there is a potential for cassava demand increase due to industrial consumption leading to increased production and research. The study recommends that farmers are assisted to form groups to easy markets access

Key words: Commercialization, Smallholder Farmers, Processing, Industrial Demand.

3.1 Introduction

Cassava (*Manihot Esculenta Crantz*) originated from Latin America where it has been cultivated for about 4000 years now and was brought to Africa by European traders carrying it as a food crop and taken to Asia for cultivation as a food security crop and potentially for starch extraction (Akinpelu *et al.,* 2011). It is Africa's second most important food staple for roughly two out of every five Africans because of its climate resilience (Lamboll *et al.,* 2015). Cassava is currently the sixth world food crop for more than 500 million people in tropical and sub-tropical Africa, Asia and Latin America (El-Sharkawy, 2004).

However, cassava is no longer a food or food security crop only owing to its uses as commercial crop and raw materials for industrial processing and production (FAO and IFAD, 2005). Cassava is an important raw material, a valuable food source in developing countries and currently employed for producing starch, bioethanol and other bio-based products such as feed, medicine, cosmetics, and biopolymers as well as its industrial residues are rich in organic matter and suspended solids which can be turned into by-products due to their potential for value addition through bioconversion and bio-refinery (Li *et al.,* 2017). Tonukari *et al.* (2015) enumerated industrial uses of cassava as production of animal feed, confectionaries, starch in pharmaceutical, detergent, textile, bio-degradable plastic, bio-fuel, adhesive, plywood, paperboard and other value-added products from cassava residues from industrial uses.

Nevertheless, Manano *et al.* (2018), claimed that some cassava varieties in Uganda contained high levels of cyanogenic glucosides than recommended by Ugandan and East African standards thus are not safe for direct consumption and utilization for industrial food production although their starch content levels made them valuable raw materials for

starch production and starch related processes, thus suitable for commercial exploitation in non-food uses.

Commercialization may be looked at as the process in which an actor in a value chain undertake activities and manage processes that exposes a product of service to the voluntary actions of other market actors whose actions significantly impact the knowledge, utilization and other aspects of the product or service (Sloek-Madsen *et al.*, 2015). Commercialization also applies to agriculture, as when agricultural production employs paid labour, mechanized farming and post-harvest processing (Von Braun, 1995). Agriculture commercialization increases household income and food security (Radchenko and Corral, 2017). Therefore, cassava commercialization includes all those activities carried out for the purpose of cassava production beyond household consumption (Li *et al.*, 2017). Also, cassava commercialization involves gender dynamics (Andersson *et al.*, 2016).

Furthermore, cassava commercialization led to international trade in dry cassava of about 8.4M tons with Thailand and Indonesia leading the export for chips, pellets, starch, and flour whilst Nigeria remained the largest cassava producer worldwide (FRN, 2006). In Thailand, cassava farm gate price increased from USD 16.00 (TZS 35 840) per ton in 2001 to USD 53.64 (TZS 120 176) per ton in 2010 due to ethanol boom as an alternative fuel since cassava was used in ethanol production (Poramacom *et al.*, 2013). Netherlands and Spain maintained the lead in cassava imports, as it was used for animal feed production (Okidim and Ellah, 2014). In Thailand, cassava chip factories are small-scale enterprises which belong to farmers or small businessmen and are located in close proximity to the growing area (Piyachomkwan and Tanticharoen, 2011).

Therefore, this paper discusses cassava commercialization awareness of smallholding farmers in Coastal and Lake Victoria areas of Tanzania and cassava demand for industrial consumption in Tanzania as part of a study to determine WTP for clean quality improved cassava planting materials when disseminated on commercial setting.

3.2 Problem Statement

The demand for cassava has a potential to increase when cassava is used as raw materials for industrial processing and production as the introduction of new cassava varieties which are diseases tolerant will lead to improvement of production, processing and utilization, thereby, increase earning from sell of fresh and processed cassava products, change the crop status and contributing to livelihood improvement since trading in cassava and cassava products had three times earning potential compared to minimum wage earning (Silayo *et al.*, 2008). For example, Bennet *et al.* (2012) estimated that an addition demand of 672 000 tons of fresh cassava will be required every year if Presidential Cassava Initiative (PCI) was implemented, which stipulated that it is mandatory to all wheat flour producers to include 10percent of high quality cassava flour in their products.

Moreover, A cassava starch factory was established in Rufiji to produce about 17 000 tons of starch using 70 000 tons of fresh cassava whereby 80percent of produced starch is exported (FJS, 2010). Theodory *et al.* (2014) argued that Kibaha and Muheza Districts had future potential of increase in cassava production from 80 000 to 128 571 tons per year if cassava is commercialized and smallholding farmers get access to appropriate markets. Kapinga *et al.* (2015) claimed that, in 1984 at Sengerema District, a starch factory had to close down due to shortage of raw cassava as raw materials despite cassava being widely cultivated in the District albeit, for consumption as staple food and food security crop. TanzaniaInvest.Com (2019) reported that a cassava flour factory was opened in Lindi

Region with annual capacity of 6 000 tons, which in turn will create a further demand of 18 000 tons of raw cassava per year.

Furthermore, recent developments in Uganda have tried to produce beer and extract starch from locally grown cassava which resulting in reduced foreign currency demand to finance imports, industrialize the economy, increase employment and provide opportunities for research and development (Manano *et al.*, 2018). In Kenya, 30percent cassava inclusion in animal feed will raise the demand for industrial consumption which will in turn result in commercialization opportunity, but feeds manufacturing companies were reluctant to adopt cassava for inclusion in feeds due to unstable cassava supply in large quantities from smallholding farmers (Farm Concern International, 2016).

In addition, Wang (2002) estimated that in China if 10percent ethanol is substituted in gasoline, 5 million tons worth 2.5 billion US$ per annum will be required cassava could be the raw material due to its superior processing properties against maize. Piyachomkwan and Tanticharoen (2011) found that in Thailand, smallholding farmers engage in cassava trading due to easy of markets access for fresh crop because cassava chip factories are small-scale enterprises which belong to smallholding farmers or small businessmen and are located in close proximity to the growing areas.

However, despite the existing and potential demand for cassava commercialization awareness has not been established as well as the demand assessed. This study therefore, fills the gap.

3.3 Objective of the Study

Objective of this study was to assess cassava commercialisation awareness among smallholding farmers in the study area and estimate overall demand for industrial consumption in Tanzania.

3.4 Significance of the Study

This study was a part of a research to determine smallholding farmers' willingness to pay for clean quality improved cassava planting material when disseminated on commercial setting. Therefore, it was significant to assess smallholding farmers' awareness for commercialization of cassava as well as estimate cassava demand for industrial consumption for processing and manufacturing. The knowledge generated by this study will be used by entrepreneurs and commercial entities to seize the opportunity that farmers are ready for commercialization of the crop, by police makers to further entrench the industrialization policy and by research and development community to further research areas for cassava processing and utilization either locally or for export.

3.5 Literature Review

3.5.1 Theoretical Review

This study approached commercialization theory both in general and agricultural specific terms. Sloek-Madsen *et al.* (2015), defined commercialisation as the proven level of commercial capabilities of a market actor to undertake activities and manage processes that ultimately exposes products or services to the voluntary actions of other market actors, whose actions also significantly impact the knowledge regarding the degree of commercial success of the product or service in question. In agricultural specific terms: Pender and Alemu (2007), defined agriculture commercialization as the ratio of the value of crop sales in household over the value of the total crop production.

Pingal and Rosegrant (1995), also explained that commercialization of agriculture is accompanied by economic growth, urbanization and withdrawal of labour from the agricultural sector and as extending beyond the marketing of agricultural output to include the product choice and input use decisions that are based on the principles of profit maximization. Therefore, when limited resources are committed to innovative endeavors it expected that new revenue streams will emerge or profitability will increase. The return on the investment can only be achieved by bringing the new product to customers and this is generally referred to as commercialization (Sloek-Madsen *et al.,* 2015).

Likewise, agricultural commercialisation is deemed to increase food security and improve household nutrition through increased revenue providing the necessary cash to buy farming inputs and marketed food (Radchenko and Corral, 2017). Also, the transition from subsistence (or semi-subsistence) to commercial agriculture represents a key ingredient for the economic development of low-income smallholding farmers since household welfare can be improved at national scale leading to efficiency, economic growth and enhancement of trade (Carletto *et al.*, 2017).

Moreover, commercialization of agriculture is more than presence of cash crops in an agricultural production system as it can take different forms, both in the output and input sides of a production system in on the output side, it can take the form of sold surplus and on the input side it may be the increase of purchased farm inputs, that is, once production system is beyond subsistence then agriculture is commercialized (Von Braun, 1995). Therefore, agricultural commercialization is associated to food security with self-sufficiency and marketing of surplus production and consumption of what is not produced by a farmer (Radchenko and Corral, 2017). Commercialisation in smallholding agriculture

can be measured by Household Commercialization Index (HCI) which is the ratio of sold produce to the total produce expressed in percentage (Dube and Guveya, 2016).

However, the drive towards a higher level of commercialization in consistency with broad-based growth depends on several factors, including effective institutions such as markets, farmers' organizations, financial institutions – bank and insurance, overseeing and regulatory authorities, research and extension services; improved infrastructure such as road, rail, power and information technology networks; knowledge management such as its generation, dissemination and storage (Goletti *et al.*, 2003). In addition, there are a number of factors affecting commercialization of agriculture particularly to smallholding farmers. These include impediments to market access caused by non-performing infrastructures including information, economic growth of both developing and developed countries, rapid technological changes, economic liberalization policies and governments' agricultural policies (Mahaliyanaarachchi and Bandara, 2006).

Therefore, for smallholder farmers to thrive in competitive global economy it is necessary to create an entrepreneurial culture in rural communities where farmers produce for markets rather than trying to market what they produce such as to support farmer organizations to allow smallholders to realize economies of scale in service access and delivery (Ochieng, *et al.*, 2015). In this case, commercialization will be enhanced.

In addition, commercialization of agriculture, particularly in Sub-Saharan African (SSA) countries brings forth the debate of smallholding versus large scale farms as argued by Binswanger-Mkhize *et al.* (2011), that large scale farms commercialization is economical to crops which require on farm processing such as sugar and tea. Otherwise proper

policies, starting from land policies to marketing as contrasted between Brazil and Indonesia, is a pre-requisite for successful smallholding agriculture commercialization.

Therefore, cassava commercialization may be seen as all those processes and activities which are carried out on cassava value chain with intention of obtaining income from land acquisition for cassava cultivation, soil investigations, field preparation, planting materials and farm inputs procurement and utilization, good agricultural practice implementation, post-harvest activities, marketing, industrial processing and production, cassava residue utilization and waste management (Li *et al.*, 2017).

3.5.2 Empirical Review

Smallholding farmers commercialization of agriculture has direct link with productivity since commercialization tend to expose farmers to market forces which invariably necessitate farmers to improve performance of agricultural production particularly where credit constraints prevail. It also increases farmers' market participation thereby increasing awareness level (Tirkaso, 2013). Amaza *et al.* (2016) argued that there was a positive correlation between awareness of cassava mechanized processing technologies and their rate of adoption which was also influenced by vicinity road, that in turn translate to easy of markets access. Thus, the level of commercialization was influenced by awareness.

Commercialization of agriculture is also affected by government policies as well as changes in administration regimes thus making smallholding farmers' awareness to be functional to government policies and the government (Alemu and Berhanu, 2018).

Likewise, In Tanzania, Agricultural Sector Development Program (ASDP) II identified and propagated that agriculture mechanization and value-addition processing as components of agriculture commercialization. Mechanization results into increased production and yield such that the surplus have to be marketed whereas value-addition result into more valuable agricultural goods and both have a net effect of increased household income and improved nutritional status (URT, 2015). Also, Wasseja *et al.* (2015), claimed that there is a significant relationship between commercialization and household welfare with market access and internal farming activities contributing to household income and farm output improvement respectively and suggested that, smallholding farmers should form saving group in order to raise their commercialization level through purchase of farm implement.

Furthermore, Opondo *et al.* (2017a), claimed that majority of smallholder farmers in Kenya operate within the low and medium levels of cassava commercialization thus suggested that policies which raise awareness, such as enhancing formal education be developed in order for farmers to reach to optimal land usage. Also argued that transport costs be minimized through infrastructural development for commercialization to grow sustainably. Opondo *et al.* (2017b), argued further that there was a difference in income between smallholding farmers' household which engaged commercialization and those who are not and claimed that enhancement of interventions which could support cassava commercialization including strategies which would increase cassava output such as use of high yield and fast maturing cassava varieties cuttings conduct trainings and that government should ensure that planting materials are disseminated at the right time and at affordable price.

However, despite commercialization to be assumed to lead to improved household income, Adong *et al.* (2014), claimed that among smallholder farmers, food self-sufficiency goals are more important than self-reliance and are depending on the season. It is therefore important for commercialization policies in order to be successful, food sufficiency goals should be addressed first by improving crop productivity, storage and interventions should target those crops which perform well even in adverse weather conditions such as cassava. In SSA Africa, cassava commercialization is centered on poverty alleviation concerns through sell of fresh roots, cassava leaves and value addition such as production of high quality cassava flour, animal feeds and starch (Tonukari *et al.*, 2017)

3.5.3 World cassava production trends

In 2011 the world cassava production surpassed 250 million tons, due to industrial application in Southeast Asia (Irish Aid and DANIDA, 2012). Global cassava output growth was of 4 percent per annum, outpacing other crops and exceeding world population growth (FAO, 2015). In 2016, Nigeria lead world cassava production with 57.13M tons and Tanzania was 12th largest world producer and 7th in Africa, produced 5.4M tons (FAO, 2018). In addition, international trade in dry cassava was estimated at 8.4M tons with Thailand and Indonesia leading the export for chips, pellets, starch, and flour (FGN, 2006). In Thailand, farm price increased in 2010 due to ethanol boom as an alternative fuel (Poramacom *et al.*, 2013).

Moreover, Netherlands and Spain maintained the lead in import for feeds (Okidim and Ellah, 2014). In South East Asia, Malaysia, China and Republic of Korea lead in importing cassava from Indonesia. On export, Thailand lead exporting 23 percent of produced cassava followed by Vietnam exporting 9 percent. Indonesia only exported 0.6

percent of produced cassava. The exported cassava is mainly in the form of flour and chips (Hubarat *et al.*, 2017). In Thailand, cassava chip factories are small-scale enterprises belonging to farmers or individuals and located in close proximity to the growing areas, making fresh roots processed as soon as harvested reducing post-harvest losses (Piyachomkwan and Tanticharoen, 2011).

However, in Africa, cassava has not been an export crop, despite of its high production per capita, particularly in Nigeria, DR Congo, Angola, Ghana, Mozambique, Uganda, Malawi, and Tanzania due to emphasis on its production as food and food security crop (Spencer and Ezedinma, 2017).

3.5.4 General agricultural and cassava production trends in Tanzania

Agriculture has remained the largest single contributor to the GDP, in 2014 (TI.com, 2016) with a general decline between 1990 – 2016 (WB, 2018). The export performance of Tanzania's agriculture has been weak and the share of cash crops in GDP fell from 6.7 percent in 1996 to 2.8 percent percent in 2010 (UNDP, 2015). Agriculture contribution to GDP falls due to low incentives provided by the Government of United Republic of Tanzania caused by shifting resources to other sectors of economy (Chongela, 2015). Also, there has been a steady decline of population employed in agriculture between 2007 and 2016 with women falling from 76.6 percent (2007) to 70.3 percent (2016) whilst men fell from 70.2 percent to 63.8 percent within the same period (WB, 2018).

Table 3.1: Tanzania cassava crop, yield, agriculture employment, GDP (2007-2016)

Year	Cassava Area (million ha)	Annual Production (million ton)	Annual Yield (ton/ha)	Women Employed in Agriculture (percent)	Men Employed in Agriculture (percent)	Agriculture Contribution to GDP (percent)
2007	0.779	5.2	6.7	76.7	70.2	28.8
2008	0.837	5.4	6.4	76.7	69.6	30.8
2009	1.081	5.9	5.5	76.2	69.1	32.4
2010	0.873	4.5	5.2	75.4	68.3	32.0
2011	0.739	4.6	6.3	74.2	67.7	31.3
2012	0.954	5.5	5.7	73.5	66.9	33.2
2013	0.863	4.7	5.5	72.5	65.4	33.3
2014	0.800	5.0	6.2	70.9	64.9	31.4
2015	1.094	5.9	5.4	70.6	64.3	31.5
2016	1.061	5.6	5.3	70.3	63.8	31.5

Source: FAOSTAT (2018)

Moreover, Table 3.1 above depicts that, the area under cassava cultivation has been fluctuating from 0.78M ha in 2007 to 1.09M ha in 2015. Maximum yield of 6.7ton/ha was obtained in 2007 and minimum of 5.2ton/ha in 2010. However, as a trend, there has been a general decline in cassava yield since acreage has been on increase whilst production has stagnated (FAOSTAT, 2018).

3.5.5 Cassava consumption trends

Cassava is used as industrial raw material in manufacturing of animal and poultry feeds (Msabaha, Kepakepa and Laswai, 1986; Nduele *et al.*, 1993; Nwokoro, Orheruata and Ordiah, 2002; Roble *et al.*, 2003); Starch, alcohol, acids, carbon, fuel and beer (Tan *et al.*, 1984; Rajeshwarisivaraj *et al.*, 2001; Akpa and Dagde, 2012; Bennet *et al.*, 2012; Manano *et al.*, 2018); Cassava seed oil, pharmaceuticals and medicine (Ajiwe, 1994, Popoola *et al.*, 2007; White, 1998; Ubwa *et al.*, 2015); Environmentally friendly biodegradable bags (PTILP, 2011); and in cyanide production through various methods as noted by Attah, *et al.*, (2013). Fresh roots are used in production of fried wafers and dried cassava in production of high quality cassava flour for industrial processing in confectionaries and production of noodles (Treesilvattanakul, 2016; Li *et al.*, 2017; Tonukari *et al.*, 2017).

Moreover, cassava as a raw material for industrial processing and production has a positive contribution in overall development of a nation since has the potential to increase farm incomes, reduce rural and urban poverty (FAO and IFAD, 2005). Dada (2016), claimed that cassava could be used as an industrial base for diversification of economy particularly when post-harvest processing is brought to rural areas where unemployment is growing at a high rate.

3.5.6 Cassava commercialization efforts

There have been several efforts towards commercialization of cassava through government policies and donor agencies. In 2006 Federal Government of Nigeria directed that wheat flour millers should include 5–10 percent cassava flour in all wheat flour produced in order to stimulate demand for cassava and induce commercialization to smallholding farmers in turn save foreign currency on wheat imports (PIND, 2011). A strategic action plan for the development of Nigerian cassava industry was released in 2006, in which among others a SWOT analysis for cassava industry was conducted and a roadmap was drawn to take the Nigerian cassava industry to higher levels in term of research and development, production, processing and export (Federal Government of Nigeria, 2006). The Presidential Cassava Initiatives program had the effect of improved cassava output, promoted food supply, enhanced national food security and further commercialized the crop (Donkor *et al.*, 2017).

Moreover, the Cassava Commercialization and Processing Program supported by Alliance for a Green Revolution in Africa (AGRA) which was implemented by Farm Concern International in Kenya, Tanzania and Uganda has experienced an improvement in demand for clean and improved cassava varieties and the prices of cassava cuttings increase tremendously, commercializing the input side of cassava value chain production node (FCI, 2015). Also, the Bill and Malinda Gates Foundation (BMGF) ‘Cassava: Adding

Value for Africa' (C:AVA) project have demonstrated that rural poverty can be addressed by upgrading value chains for new cassava products such as high quality cassava flour (HQCF) as well as commercialization of cassava planting materials through entrepreneurs (MEDA, 2016).

Furthermore, Haggblade *et al.* (2012) had suggested that strategic investment in areas of research and development, breeding and food science and technology should be increase in the Southeast African countries of Malawi, Mozambique and Zambia since cassava commercialization in those countries had concentrated in post-harvest processing of fresh roots int low quality cassava flour and starch extraction. Alene *et al.* (2018) reported a number of programs since 1970s on cassava researches with a view of fighting pest and diseases, notably Cassava Mosaic Disease (CMD) and Cassava Brown Streak Disease (CBSD). All these were geared towards supporting commercialization. In addition, Institutes such International Institute of Tropical Agriculture (IITA), International Centre for Tropical Agriculture (CIAT) as well as CGIAR Research programs played key role in the commercialization efforts.

3.5.7 Challenges in cassava commercialisation

Smallholding farmers face a number of challenges, among them is access to markets since most production systems do not easily allow equitable access to the most lucrative markets (IFAD, 2016). Factors such as infrastructure, prices, market information and cooperatives should attract policy attention for market participation (Onya *et al.,* 2016). Therefore, smallholder market access to and participation in markets is considered to be a key factor for poverty reduction in rural areas and increasing demand for food and agricultural products. Hence, improving rural households' market participation is of utmost importance for commercialization (Adjimoti, 2016).

Moreover, not only smallholding farmers faces market access challenges as a whole, the challenges are highly gendered as well, Masamaha *et al*. (2018), claimed that the lucrative nodes of cassava value chain such as marketing and transportation were highly dominated by men whilst women and children were concentrated in production and immediate post-harvest processing. Also, Ateke (2015), argues out that poor access to credit and enabling policies are other challenges faced by smallholding farmers in commercialization arena. Ojiako *et al*. (2017), claimed among other challenges facing were lack of knowledge in good agronomic practices which contribute to poor production and yield in turn resulting in less commercialization. Also, unavailability of extension services, lack of training and poor access to credit facilities. Adeyemo and Okuruwa (2018), found that lack of training, extension services and access to information to be among challenges facing smallholding farmers towards commercialization of agriculture in general and specific crops such as cassava in particular. Lastly but not least, difficulties in registration of agricultural enterprises hinders commercialization efficiency.

3.6 Methodology

3.6.1 Research design

This research adopted cross-sectional design which is looking at different groups of people with specific characteristic and allows data collection at single point in time with advantage that it can be done fairly quickly (Toledo-Pereyra, 2012). The reason for choosing this design is simply because it is flexible, economical and easy to manipulate data and information (Bailey, 1994).

3.6.2 Description of the study area

The study area is indicated on figure 3.1 below.

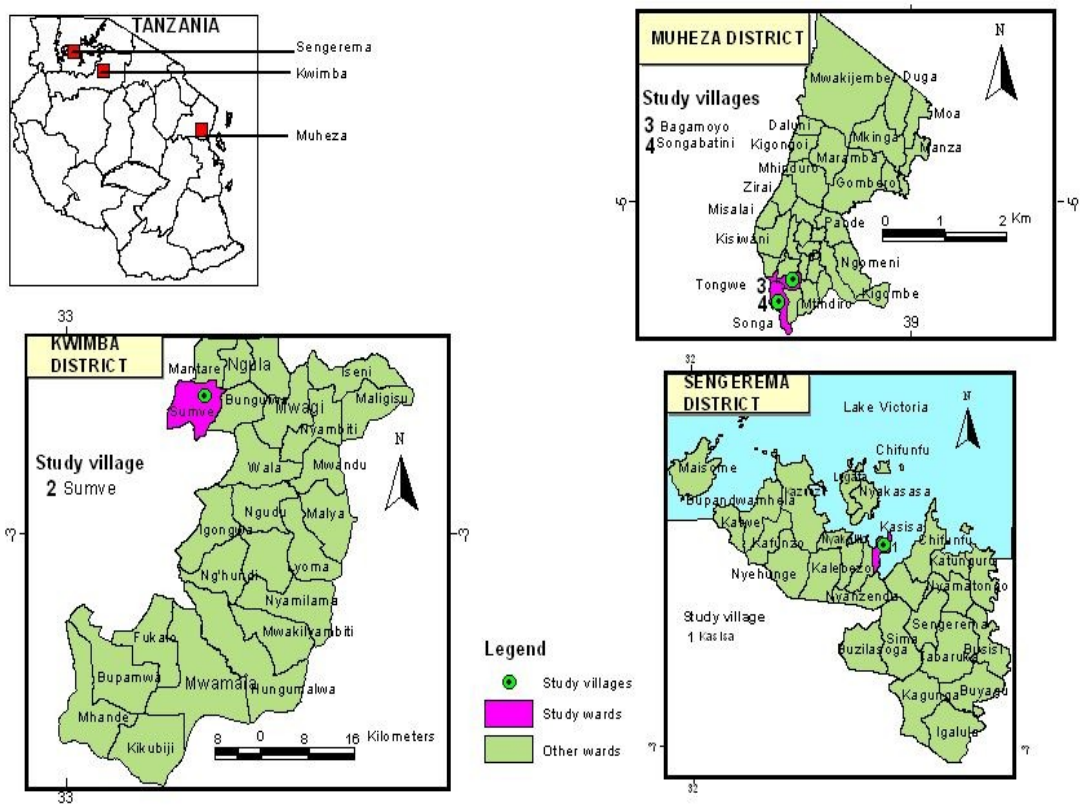

Figure 3.1: Map of the study area

The area was purposefully selected based on main cassava cropping zones in Tanzania, which according to Masumba (2012) are the Lakes Zone covering Geita, Kagera, Kigoma, Mwanza, Shinyanga and Simiyu regions; Coastal Zone covering Tanga, Dar Es Salaam and Coast regions and Southern Zone covering Lindi, Mtwara and Ruvuma regions. The regions were then randomly selected from the two zones. Thus, this study was done in Mwanza and Tanga regions for Lakes and Coastal zones respectively. The districts were also randomly selected, whereby Muheza was selected in Tanga region and Sengerema in Mwanza region. Also, Kwimba district was purposefully selected due to its vicinity to Tanzania Agricultural Research Institute at Ukiriguru in order to assess its cassava supporting interventions in production areas in Mwanza region.

The wards where the research was conducted were randomly selected whereby at Muheza district, Tongwe and Songa wards were selected. Tongwe is located at upland on the foothills of Eastern Usambara Mountains while Songa is located at low land of the mountains. Sumve and Kasisa wards were randomly selected at Kwimba and Sengerema districts respectively.

Sengerema district lies at Latitude 32.64° South and Longitude 2.65° East while Kwimba lies at Latitude 33.36° South and Longitude 3.06° East. Muheza district lies at Latitude 38.9° South and Longitude 4.92°.

3.7 Sample Size

The sample size was determined using Cochrane formulae (Cochrane, 1963). The sample size determination formulae is presented in equation 13.

$$n_o = \frac{Z^2 * p * (1-p) * N}{[(N-1) * E^2 + Z * p * (1-p)]} \quad \ldots\ldots(13)$$

Where: n_o is Sample size

Z is Confidence level at 95percent = 1.96

E is Margin of Error = 5percent = 0.05

P is the Probability = 0.5

N is the Population

Using Cochran's correction formulae: $n_{oc} = 384/[1+(384/\, n_{os})]$ ……………………(14)

Therefore, sample population = 384/[1+(384/1466)] = 302……………………………(15)

Therefore, targeted sample was 109 for Kasisa, 107 Sumve, 37 Songa and 48 Tongwe. However due to actual situation on site and repetitive responses during interviews only 35 respondents were interviewed at Tongwe ward, 41 at Songa, 70 at Kasisa and 90 at Sumve (Table 3). Also, the 35 satisfied the minimum criterion of 30 in accordance with Bailey

(1994). Thus, the sample population was 241 respondents in total as presented in Table . The study population encompassed smallholding cassava farmers in the study areas.

Table 3.2: Sample size

Region	District	Ward	Population (Persons)	Stratified Sample (Persons)	Village	Actual Sample (Persons)
Mwanza	Kwimba	Sumve	16 436	107	Sumve	90
	Sengerema	Kasisa	16 839	109	Kasisa	70
Tanga	Muheza	Songa	5 769	37	Kwamianga	41
		Tongwe	7 478	48	Bagamoyo	35

Source: URT (2012)

The sampling procedures involved purposive selection of four villages based on criteria that the villages are involved in cassava cultivation. Key informant's information was used to refine selection of the study sites and sample size. Also, Extension Officers provided key information on cassava cultivation over study areas. In addition, key informants dealing in cassava researches and seed system implementation were interviewed. These are personnel from TARI Kibaha Pwani and Mikocheni Dar Es Salaam as well as IITA and MEDA offices.

3.8 Data Collection and Analysis

3.8.1 Data collection

The sampling procedures involved random selection of four wards in the three districts however; villages were purposefully selected based on criteria that they are intensely involved in cassava cultivation. Key informant's information was used to refine selection of the study sites.

Data was collected from smallholder farmers first through Focus Group Discussion (FGD) and then through individual interviews. The demand for cassava as industrial raw materials was estimated using secondary data. Secondary data was collected from Sokoine National Agricultural Library (SNAL) and MEDA Tanzania.

3.8.2 Data analysis

This study used both descriptive in line with research conducted by Ahmed (2015). The quantitative data were analysed by using Statistical Package for Social Sciences (SPSS) by computing descriptive statistics to obtain frequencies and percentage distribution of the responses.

3.9 Results and Discussion

3.9.1 Respondents' social economic profile and other results

The total number of respondents was 241 with percentages in brackets as in Table 3.3 below. Female (49) and male (51), married (86), educated only up to primary school (89), with post primary school education (11), with monthly income below TZS 100 000 (29), income between TZS 100 000 and 300 000 (61) and above TZS 300 000 (10). In all four the wards in the three Districts of the two Regions, 100percent of the respondents were farmers, cultivating cassava, other crops and keeping animals.

Table 3.3: Respondents' social economic profile (percent)

Description	Songa Ward	Tongwe Ward	Sumve Ward	Kasisa Ward	Total Number
Sex					
Female	48	40	51	47	49
Male	52	60	49	53	51
Total	100	100	100	100	100
Marital Status					
Married	87	77	89	86	86
Not Married	13	23	11	14	14
Total	100	100	100	100	100
Education					
Up to Primary	93	77	91	88	89
Post Primary	3	23	9	12	11
Total	100	100	100	100	100
Monthly Income (TZS)					
Below 100 000					
100 000 – 200 000	20	51	29	24	29
201 000 – 300 000	69	34	58	73	61
Total	11	15	13	3	10
	100	100	100	100	100

3.9.2 Awareness for cassava commercialization and industrial uses

Table 3.4 below presents results of interviews carried with smallholding farmers at field sites in percentages with actual numbers in bracket. During FGDs, smallholding farmers were asked on their awareness of cassava as a commercial and export crop, whether or not are engaged in commercial activities of cassava, how they get access to markets and who determined price during crop selling and awareness of cassava as raw material for industrial processing and production. The study also queried on cooperation among farmers through ways such as farmers' groups and credit associations. Smallholding farmers were also asked on what need to be done to improve cassava commercialization level.

Table 3.4: Cassava commercialization awareness (percent)

Description	Songa Ward	Tongwe Ward	Sumve Ward	Kasisa Ward	Total Number
Awareness for cassava as cash crop	100	100	100	100	100
Selling cassava	91	100	99	99	97
Wholesale selling	50	66	0	0	19
Retail Selling	83	66	99	99	90
Buyer determines price	44	26	0	0	12
Farmer determines price	83	74	99	99	92
Taking cassava to market	39	28	94	86	72
Buyers coming to field	52	72	4	13	26
Awareness for cassava as export crop	26	71	14	10	24
Awareness for cassava as industrial raw material for production	44	80	47	37	48
- Starch	4	69	21	11	22
- Construction material	20	77	13	20	26
- Medicine and Drugs	20	66	21	17	27
- Confectionaries	39	100	22	9	33
Farmers' Group Members	76	57	0	0	23
Credit Association Members	67	80	32	30	45
Access to Market Information	78	86	55	42	59

From Table 3.4 above, all respondents were aware of cassava being also a cash crop, 97 percent were engaged in cassava selling either in retail or wholesale. Between 50 and 83 percent of smallholding farmers in the Coastal areas were engaged in both retail and wholesale whilst 99 percent of Lake Victoria areas were only engaged in retail. In Coastal areas, middlemen visit rural area and purchase cassava on farm, sometimes even not uprooted, pre-paying before uprooting or paying on the spot after uprooting with unit of measurement being either sacks or pickup truck body size, preferably one tonner; explaining the 44 percent in Songa and 26 percent Tongwe wards where it was recorded as farm gate price being determined by buyer. On the other hand, in Lake Victoria areas, cassava was mainly sold at market place, either as fresh roots or dried chips known as "makopa" in Coastal zone or "udaga" in the Lake zone according farmers terminologies, thus price exclusively determined by seller.

Moreover, only 24 percent of the respondents were aware that cassava was a commercial crop for export with highest level of awareness in Tongwe (Tanga Region) and least in Kasisa wards (Mwanza Region) respectively. Also, 48 percent were aware that cassava could be utilized as raw materials for industrial processing and production. The study further interviewed on awareness for utilization as raw materials by asking farmers on specific industrial utilization such as processing to starch and in production of confectionaries, construction materials and medicine in which it was found that only between 22 and 33 percent of smallholding farmers were aware of such uses. In addition, commercialization involves matters of readiness of access to capital when needed. Thus, this study also interviewed on availability of access to credit, wherein it found that 45 percent were members of some sort of credit association, ranging from exclusive cassava farmers group like the one at Tongwe to other groups such as social and village credit associations like at Kasisa.

Furthermore, the study found that at Tongwe there was a registered cassava farmers group named “Wakulima wa Muhogo Bagamoyo Tongwe” (WAMBATO) which was a result of PANTIL project. The group, WAMBATO owned cassava processing equipment such cassava shredder, grater, pressing machine for pressing grated bitter cassava, milling machine and packaging set. The group was well organized and advanced on rural cassava commercialization and members of the group spoke and acted with unity of purpose. At Songa a cassava farmers group was under the registration process, whereby smallholder farmers were less organized as compared to Tongwe. Their processing equipment had broken down with no capacity for repairs or replacement. Smallholding farmers at Kasisa and Sumve did not have any farmers’ group; farmers were not organized to the extent that it is difficult even to share quality cassava planting materials.

In addition, 59 percent of all the respondents were aware with market information access and the level of awareness was high at Tongwe followed by Songa then Sumve and lastly Kasisa. At Kasisa and Sumve smallholding farmers were less informed on cassava commercialization beyond local markets although they were conversant with performance of various village markets within Sengerema and Kwimba districts respectively. This was explained by the 99 percent of the respondents' who were involved in cassava retailing. Although there was low level of access to market information, 99 percent of the respondents at both Kasisa and Sumve determined prices of their products whilst between 26 percent at Tongwe and 44 percent at Songa had prices of their products determined by buyers. Songa ward is very easily accessible since the Tanga – Arusha road runs across the village and short distance from junction of Segera – Chalinze highway. This highway exposed the smallholding farmers to middlemen and volatility of markets of cities such as Dar Es Salaam, Tanga, Moshi and Arusha.

This study also noted during FGDs, that smallholding farmers at Songa preferred to sell their crop in wholesale manner since to a large extent cassava was cultivated as a cash crop with maize as staple food followed by rice both of which are grown at subsistence level or purchased from income obtained by selling other crops such as cassava and fruits. Also, at Tongwe cassava was not a staple and mainly cash crop as raw material for processing into shredded and grated cassava for high quality cassava flour production and selling to other flour millers and animal feed producers.

In addition, at Kasisa and Sumve (Lake Zone) cassava is cultivated as staple food due to its ability to remain stored at the field in soil. This technology of storing cassava is well exploited as it is harvested in piecemeal with some of varieties able to remain within soil for as long as three years. At Kasisa, farmers reported purposely growing late maturing

varieties as food security in the event of poor rains. However, they also grow early maturing varieties in order to enable them continuous harvest for household food supply and chips drying for sale at local markets. Also, these farmers reported growing bitter varieties in periphery of their field as shield against warthogs and porcupines.

3.9.3 Cassava demand for industrial consumption

The demand for cassava as cash crop and industrial raw material was estimated by using secondary data collected from MEDA Tanzania, that there are 6 industrial consumers in Eastern Zone with a current total capacity and potential processing capacity of 2 419 tons per month of the finished product. The Lake Victoria Zone has a total capacity of 1 234 tons whilst the Southern Zone has a capacity of 1 287 tons. The combined industrial finished products capacity is therefore, 4 940 tons. It was estimated that, to produce one ton of industrial cassava product requires three tons of fresh cassava. Therefore, the demand for cassava to be consumed for industrial production would be 14 820 tons. MEDA also estimated that there was a demand for 5,618 tons of fresh cassava from small to large aggregators. Bennet *et al,* (2012) had estimated a demand for cassava for industrial processing and production of about 672 000 tons if 10percent high quality cassava flour inclusion was made mandatory in all wheat flour milled in the country.

Moreover, Theodory *et al.* (2014) estimated that, in Kibaha and Muheza Districts the future production of cassava would be 128 571 from 80 000 tons per year which would be an increase of 60.7percent per year due to introduction of mechanized processing technology. A factory with a capacity to produce 6 000 tons of high quality cassava flour was opened in March 2019 in Southern Tanzania (TI.com, 2019), which will create a demand of 18 000 tons of raw cassava. Also, a cassava starch factory at Rufiji to produce 17,000 tons of starch using 70 000 tons of fresh cassava was established (FJS, 2010).

Survey data provided by JV Biotecth Company of Kiwangwa Pwani region indicates that 300 tons of fresh cassava roots are required during their starch production season between June and November.

Table 3.5: Cassava demand for industrial consumption

S. No.	Uses / Production	Fresh Cassava Quantity (Ton)
1.	High Quality Cassava Flour	14 820
2.	Aggregation for other uses	5 618
3.	10percent Cassava inclusion in wheat flour	672 000
4.	Rural Mechanize Processing	128 571
5.	Starch Factory in Lindi Region	180 000
6.	Starch Factory at Rufiji Pwani Region	70 000
7	Starch Factory at Kiwangwa Pwani	300
	Total	**1 071 309**

Source: MEDA Tanzania

Table 6 above indicates a demand of more than one million tons of fresh cassava per year for industrial consumption. This demand would increase farm acreage, increase demand for clean quality improved cassava planting materials, stimulate research and development in cassava subsector of agriculture, create more employment, commercialize the crop, increase household income and reduce poverty.

Therefore, with an average yield of about 10 ton/ha (FAO, 2018), about 100 000ha would be required to be planted in order to service the cassava demand for industrial consumption. This demand may have far reaching effects beyond mentioned above since may require land policy involvement. Also, health and environment would be areas of concern ranging from occupational hazards as starch for example is in form of dust and bi-product and waste from cassava peelings and residues all of which would have some economic importance. This would be achieved if also a reliable seed supply base is established.

3.10 Conclusion and Recommendations

3.10.1 Conclusion

Based on the findings of this study, it may be concluded that, smallholder farmers in Coastal and Lake Victoria areas of Tanzania are aware of commercialization of cassava and do participate in the commercial processes of the crop. Also, are aware of cassava as raw material for industrial processing and production as well as cash crop for export.

Moreover, it may be concluded that there are two commercial patterns in the two ecological areas of the study, whereas in the Coastal area smallholder farmers preferred to sell their crop on wholesale either through middlemen collecting the crop from farms or direct by farmers taking the crop to markets when the roots are fresh. In Lake Victoria area farmers preferred to sell dried cassava by taking their crop to local markets after drying.

In addition, only less than a half of smallholder farmers in both Coastal and Lake Victoria areas were members of credit associations and only at Tongwe there was a cassava farmers group (WAMMBATO) whereby smallholder farmers demonstrated high level of organization and cooperation and market their products through the group. Thus, it may also be concluded that, farmers group plays an important role in organizing smallholder farmers towards profitable commercial agriculture starting from implementing good agricultural practices to post-harvest handling, processing and selling. Also, it may be concluded that access to market information is an important aspect of commercialization since commerce deals with markets. Therefore, smallholder farmers need to access market information in order to make sound judgment on issues of cassava cultivation starting from choosing which variety to cultivate and sell as final product, whether processed or not, to the consumers.

Based on the findings of this study there is a potential increase of cassava demand for industrial consumption. Hence, it may be concluded that there is a potential for increase in yield, area under cassava cultivation or both. This potential provided opportunity both to smallholder farmers and researchers to increase production and development of more high yield and diseases resistant varieties respectively.

The research implication of this study is that there is opportunity for further studying the cassava commercialization drivers in order to devise an appropriate cassava commercialization model that may usher smallholder farmers from poverty alleviation farming to entrepreneurial agriculture. The practical implication of this study is that smallholder farmers are already participants in cassava commercialization thus, what the need is an impetus for increasing commercial participation.

Furthermore, this study is in line with earlier studies on cassava commercialization by Silayo *et al.* (2008), gender balanced as argued by Masamaha *et al.* (2018) and market access by IFAD (2016), Onya (2016) and Adjimoti (2016). It has also contributed to the knowledge base on how smallholder farmers participate in cassava commercialization in the two-cassava growing Coastal and Lake Zones.

The contribution of this paper to the body of knowledge is that it sheds light on level and modes of commercialization as practised by smallholder farmers in Coastal and Lake Victoria areas of Tanzania. The smallholder farmers in Coastal area prefer to sell fresh cassava roots in wholesale where as in Lake Victoria area the smallholder farmers prefer to retail sell dried cassava chips.

3.10.2 Recommendations

In accordance with the findings of this study, it is recommended that deliberated and purposive efforts be exerted by government and other cassava development stakeholders to assist and enable smallholder farmers form groups which may lead to formation of cooperatives which will unite and provide smallholder farmers with benefit of economies of scale in terms of access to input, credit and markets.

This is due to the fact that, cassava, by far is a very important crop in the farming systems in Tanzania, from food security concerns to poverty alleviations through commercialization and industrialization. It is therefore, recommended that cassava subsector be institutionalized with a proper and clear policy framework in order to assist smallholder farmers to access cassava seed varieties which are both disease resistant and high yield and support marketing.

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CHAPTER FOUR

4.0 ASSESSMENT OF SUPPLY BASE AND COST OF CASSAVA PLANTING MATERIALS (SEEDS) IN COASTAL AND LAKE VICTORIA AREAS OF TANZANIA

Issa Majid Maggidi[1] and Jeremia Makindara[2]

[1]MA Student, College of Social Sciences and Humanities, Sokoine University of Agriculture, P. O. Box 3024 Morogoro, Tanzania. immaggidi@gmail.com

[2]Senior Lecturer, School of Agricultural Economics and Business Studies (SAEBS), Sokoine University of Agriculture, P. O. Box 3140 Morogoro, Tanzania. makj@sua.ac.tz

Abstract

Lack of quality and clean quality improved cassava planting materials and use of planting materials which have been infected with Cassava Mosaic Disease (CMD) and Cassava Brown Streak Disease (CBSD) has been the major constraints to cassava production. Therefore, agricultural policies of the countries in Sub-Saharan Africa should put emphasis on seed system strategies which would result in clean quality seed of the right varieties. The objective of this study was to assess the supply base for cassava planting materials and the cost of planting materials in the study areas among others. The study was conducted in Coastal and Lake Victoria areas of Tanzania in Tanga and Mwanza regions respectively and adopted cross-sectional design. It was found that 98.8percent of respondents obtain planting materials from their own source. It was concluded that, smallholder farmers in the study areas obtain cassava planting materials outside formal seed system. It was recommended that community based or commercial planting materials farms should be established to overcome the challenge of using planting materials obtained outside formal seed system and of poor quality.

Key Words: Quality improved planting materials, commercially produced

4.1 Introduction

Cassava or manioc (*Manihot Esculenta Crantz*) is a perennial shrub of the New World. Currently is the sixth world food crop for more than 500 million people in tropical and sub-tropical Africa, Asia and Latin America. It is cultivated mainly by resource-limited smallholding farmers for its starchy roots, which are used as human food either fresh when low in cyanogen or in many processed forms and products, mostly starch, flour, and for animal feed. Due to its inherent tolerance to stressful environments, where other food crops would fail, it is often considered a food security source against famine (El-Sharkawy, 2004). Since its introduction into the African continent in the course of the 16th century, cassava has gradually become one of the dominant starchy staples, particularly in the humid lowlands where it may provide over 50percent of the local diet. The successful integration of cassava in African cropping and dietary patterns takes on a special importance (Carter *et al.,* 1992).

The tropical root vegetable cassava or Manioc (Manihot Esculenta) of the family Euphorbiacene is a staple part of the diet in many parts of Africa and elsewhere (Ajiwe *et al*, 1994). Besides being a food crop, cassava is attracting more attention as a commercial commodity; the rise in the commercial orientation of cassava is due to the fact that cassava products have important industrial applications for plywood, textile, bakery, pharmaceutical, and paper, alcohol, and food industries. (Odongo and Etany, 2018).

Moreover, in view of the current importance of cassava, any major outbreak of a disease and/or pests in Africa South of Sahara, could lead to a serious decline in production, increased food insecurity, reduced income and higher costs of food. To tackle the emerging diseases and pests' attacks, farmers need among other things, access to newly improved varieties (Dixon and Ssemakula, 2008). High-quality improved seed is essential

to achieving the higher yields necessary to feed the world's population and reduce rural poverty and in addition to increasing yields. Hence improved seed varieties can be adapted to deliver better nutrition and greater resilience to the impacts of climate change (USAID, 2016). There are two virus diseases, namely cassava mosaic disease (CMD) and cassava brown streak disease (CBSD) which are the most important constraints to cassava production in Africa (Ndyetabula *et al.,* 2016). Therefore, resulting to smallholder farmers to be faced with shortage of quality and disease-free planting materials (Mtunda, 2009).

This study therefore, assessed the supply base and cost of cassava planting materials in the study areas as part of a study undertaken to determine the willingness to pay by smallholding farmers for improved cassava planting materials when commercially produced.

4.2 Problem Statement

Seed system, is a framework of institutions linked together through a combination of components and processes of production, multiplication, storage and marketing of improved varieties of specific quality along with the interactions and support to make seed available to a particular end user (Loch and Boyce, 2003). Overall, some 80-90 percent of seed used by smallholder farmers in developing countries is sourced from informal farmers' seed systems on farm (Louwaars and de Boef, 2012).

A major reason for the low adoption of modern varieties among small-scale farmers in developing countries is the inability of formal, centralized seed production systems to meet their complex and diverse seed requirements. Thus, seed production by farmer seed enterprises (FSEs) as a strategy for meeting dual objectives: to sustainably distribute and promote modern crop varieties and to establish a regular source of "clean" seed of either local or modern varieties is considered as an alternative (David, 2004).

Seed security is vital for food and nutrition security therefore reliability and availability of seeds at the right time and in the right price, as well as easy access, are crucial for smallholder farmers (Bhuwon, 2012). Venkatesan (1994) argued that seed production and distribution are important amongst the factors which determine the pace of agricultural development. Agricultural policies of the countries in Sub-Saharan Africa (SSA)should therefore emphasize seed system strategies which would result in good quality seed of the right varieties being available to farmers at the right time and at affordable prices.

4.3 Objective of the Study

The objective of the study was to assess the supply base of cassava planting materials and the cost of planting materials incurred by smallholding farmers in the study areas.

4.4 Justification of the Study

Abbas *et al,* (2013), argued that the production of cassava in Africa is faced with serious biotic constraints, such as diseases and pests, poor supply of planting materials, poor agronomic practices, small and unorganized production systems, poor postharvest handling and processing. Lack of clean planting materials and use of CSD and CBSD infected planting materials has been the major constraints to cassava production thus communities need to be empowered to have a self-sustaining clean seed production system (Mwang'ombe, 2013).

MEDA (2016 a), identified problems in cassava planting materials as re-use of saved planting materials which leads to reduced production and spread of diseases; obtaining from informal source, farmer to farmer, close friends and relatives which are not reliable and spread diseases. In addition, donor sponsored programs provide support in planting materials but which are time based with fixed budget and not sustainable; national

sponsored programs which are budget constrained and not sustainable. Accordingly, Farm Concern International (2015), demand for clean and improved varieties and the prices of cassava cuttings increase tremendously in East Africa during the Cassava Commercialization and Processing Program supported by Alliance for a Green Revolution in Africa (AGRA) which was implemented In Kenya, Tanzania and Uganda. Therefore, this study sought to assess the supply base of cassava planting and the cost incurred in obtaining them by smallholder farmers.

4.5 Literature Review

4.5.1 Theoretical Review

4.5.1.1 Seed system framework

A seed system is a framework of institutions linked together through a combination of components and processes of production, multiplication, storage and marketing of improved varieties of specific quality along with the interactions and support to make seed available to a particular end user (Loch and Boyce, 2003). It is a legal and regulatory system that enables the development, access, and availability of high quality agricultural inputs which are essential to building a vibrant agricultural sector and commercially successful agribusinesses that will benefit small-scale farmers (USAID, 2007).

Seed systems are of two categories, formal and informal. The informal seed is usually defined as the total of seed production activities of farmers, mostly small-scale farmers whilst the formal refers to seed production activities by the public and commercial entities. Nonetheless, there is no clear-cut distinction between the two, as a situation where public or private institutions are engaged in the production of uncertified, unlabeled or registered seed lots (Almekinders, 2000). The formal seed sector is the primary source of new crop varieties, and is home to most of the capacity in scientific plant breeding, extension

services and credit whilst the informal sector is the primary link to farmers' and traditional knowledge, especially requirements for new varieties, inputs and services (FAO, 2010).

Moreover, seed production and distribution are important amongst the factors which determine the pace of agricultural development (Venkatesan, 1994). In order to ensure environmental sustainability, strengthen food security, create robust food systems and reduce rural poverty it is necessary to develop enabling environment for agro-inputs (USAID, 2007). Quality improved seed is necessary to achieve high productivity and feed the increasing world population (USAID, 2016). Also, farmers should benefit from a reliable availability of good quality seeds and a continuous supply of varieties with different traits, adapted to continuously changing agro-ecological conditions and market demands using a functioning market with seed entrepreneurs in seed production and marketing. (ISSD, 2017).

Therefore, for a functional seed system to be established, agricultural policies of the countries in Sub-Saharan Africa should emphasize on seed system strategies which would result in good quality seed of the right varieties being available to farmers at the right time and at affordable prices (Venkatesan, 1994). Thus, Development Partners and governments in developing countries should put in place policies aimed at fostering the privatization of seed systems by focusing on the farmers' seed sourcing behaviour and condition of public sector breeding-related activities to evolve a long-term support strategy for agricultural research (Rangnekar, 2001). This will then lead to, farmers to have access to seed (planting material) of adequate quality so that their needs are met and contribution to long-term restoration, rehabilitation, or improvement of agricultural systems is achieved (Sperling and Cooper, 2003).

4.5.1.2 Cassava planting materials

Cassava planting materials refers to propagation materials, namely stem cutting Chikwado (2012). The stem-cutting are constrained by short post-harvest life, build-up of viruses and low multiplication rate (Iglesias and Hershey, 1994). Also, not sufficiently and timely available for new entrants in cassava farming venture as well are affected by diseases and almost all the farmers obtain their planting materials from their neighbours thus aiding in disease dissemination and compounding the problem (Mwang'ombe *et al*., 2013).

Almekinders *et al.* (2017), argued that roots tubers and banana (RTB) seed systems are not well studied. Thus, in order to overcome those challenges, a well-established seed system with involvement of commercial producers is necessary (Venkatesan, 1994; Loch and Boyce, 2003). Also, as argued by Dyer, Gonzalez and Lopera (2011), commercial cassava seed system is required in order to avoid taking for granted that seed management in traditional farming systems and which is not well understood.

4.5.2 Empirical Review

In Tanzania, the seed industry is governed by an act of parliament, the Seed Act 2003 which provides regulations for seed matters, and that, any person, who intends to deal with importation, exportation, production, processing, distribution, sale or advertisement for sale of seeds shall obtain a permit from the Director or any other person authorized by the Director in that behalf; the Director is the Chief Seed Quality Controller. According to ASARECA (2014), the seed sector comprises of stakeholders from public and private sectors, as well as civil society actors. However, despite strong public sector involved in all steps of the seed chain, from plant genetic resource management to seed production and marketing as well as private seed companies only 5.3 percent of the seed used in Tanzania is certified and which does not come close to meeting farmers' needs.

Moreover, in SADC countries, seed supply of food crops has significantly improved as governments liberalized their seed sectors and put together suitable regulatory framework that ensure timely supply of quality seed to farmers. However most of the regulatory frameworks are limited to cereal food crops. That is, there are no regulations, controls or support for tuber crops including cassava which is one of the most important food crops. It is little recognized and often viewed as a poor man's crop (Gwarazimba, 2009).

In addition, there has been efforts to train smallholding farmers at household level on production, use and dissemination of clean quality planting materials in order to improve production and productivity, increase food security, raise income and alleviate poverty (Mukasa, 2015). For example, in Southern Tanzania, a pilot project to produce clean quality improved cassava planting materials using individual entrepreneurs have been implemented, with the produced planting materials disseminated to smallholding farmers (MEDA, 2016). In addition, Farm Concern International (2015), have implemented a project to produce and disseminate clean quality improved planting materials in Kenya, Tanzania and Uganda. In Malawi, a Farm Inputs Subsidy Program was implemented with the view of increasing production and marketing of planting materials for some crop, including cassava (ISSD, 2012). Also, a project to disseminate clean quality cassava planting material was implemented in Western Kenya (Walsh, Odero and Obiero, 2015)

Furthermore, Global Cassava Development Strategy was a framework for cassava development encompassing production enhancement, marketing linkages and entire value chain with support from a wide range of stakeholders including (FAO and IFAD 2005). Federal Government of Nigeria (2006), drew up a Cassava Master Plan in which cassava development policies from production to commercialization were outlined for implementation. In addition, Government of Zambia (2010), had a Zambia Cassava

Sector Development Strategy which stipulated policies for implementation in developing cassava sector, from planting materials to commercialization of the produce. The African Development Bank (AfDB) also put in place a Feed Africa Strategy which propagated large scale cassava production for commercialization and industrialization purposes (AfDB, 2016). Moreover, in 2015 Government of Gambia validated its cassava development strategy in which it was intended that cassava is developed into a commercial oriented crop to help alleviate poverty among smallholding farmers (B4Fa, 2019).

4.6 Methodology

4.6.1 Research design

This research adopted cross-sectional design which is looking at different groups of people with specific characteristic and allows data collection at single point in time with advantage that it can be done fairly quickly (Toledo-Pereyra, 2012). The reason for choosing this design is simply because it is flexible, economical and easy to manipulate data and information (Bailey, 1994).

4.6.2 Description of the study area

The study area is indicated on Figure 4.1 below, was purposefully selected based on main cassava cropping zones in Tanzania, which according to Masumba (2012) are the Lakes Zone covering Geita, Kagera, Kigoma, Mwanza, Shinyanga and Simiyu regions; Coastal Zone covering Tanga, Dar Es Salaam and Coast regions and Southern Zone covering Lindi, Mtwara and Ruvuma regions. The regions were randomly selected from the two zones and Mwanza and Tanga Regions for Lakes and Coastal zones respectively were selected. The districts were also randomly selected, whereby Muheza was selected in

Tanga region and Sengerema in Mwanza region. Also, Kwimba district was purposefully selected as it is home to Tanzania Agricultural Research Institute at Ukiriguru.

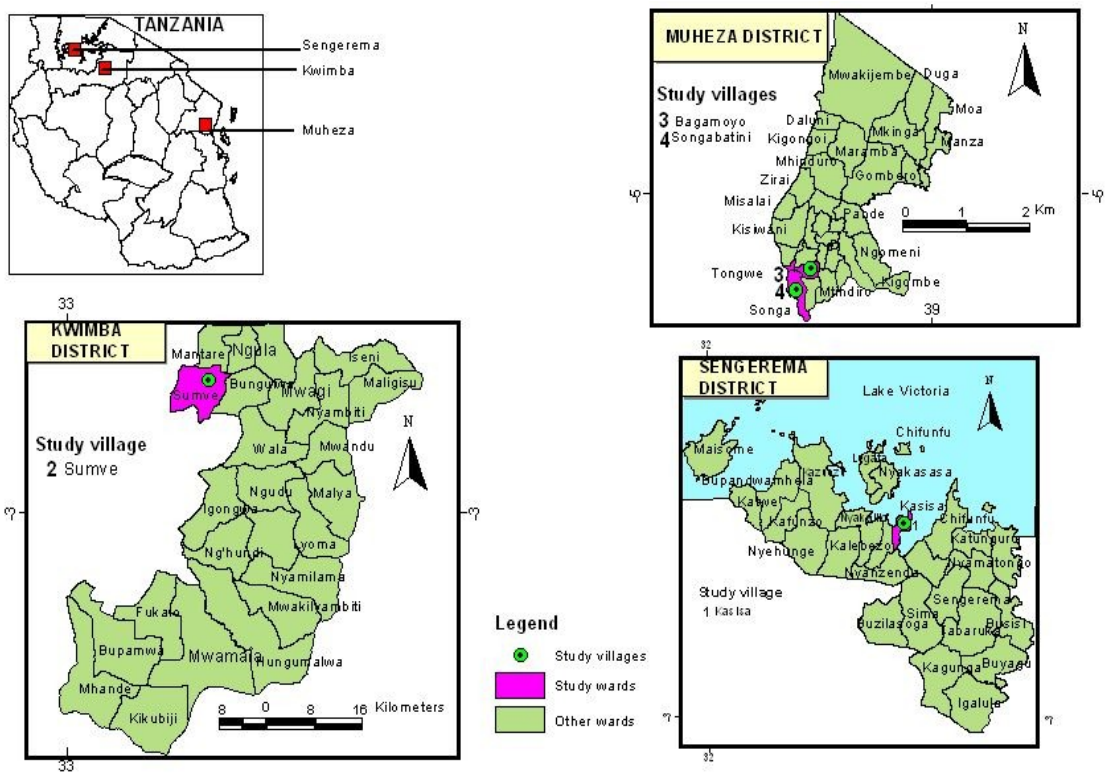

Figure 4.1: Map of the study area

The wards where the research was conducted were randomly selected whereby at Muheza district, Tongwe and Songa wards were selected. Tongwe is located at upland on the foothills of Eastern Usambara Mountains while Songa is located at low land of the mountains. Sumve and Kasisa wards were randomly selected at Kwimba and Sengerema districts respectively. Sengerema district lies at Latitude 32.64º South and Longitude 2.65º East, Kwimba lies at Latitude 33.36º South and Longitude 3.06º East and Muheza district, which lies at Latitude 38.9° South and Longitude 4.92º.

4.7 Sample Size

The sample size was determined using Cochrane Formulae (Cochrane, 1963). The Sample Size Determination Using Formulae:

$$n_o = \frac{Z^2*p*(1-p)*N}{[(N-1)*E^2 + Z*p*(1-p)]} \quad \ldots\ldots(16)$$

Where: n_o is Sample size

Z is Confidence level at 95 percent = 1.96

E is Margin of Error = 5 percent = 0.05

P is the Probability = 0.5

N is the Population

Using Cochran's Correction Formulae: $n_{oc} = 384/[1+(384/n_{os})]$ …………………(17)

Therefore, Sample Population = 384/[1+(384/1466)] = 302…………………..…..(18)

Therefore, targeted sample was 109 for Kasisa, 107 Sumve, 37 Songa and 48 Tongwe. However due to actual situation on site and repetitive responses during interviews only 35 respondents were interviewed at Tongwe ward, 41 at Songa, 70 at Kasisa and 90 at Sumve (Table 4.1). Also, the 35 satisfied the minimum criterion of 30 in accordance with Bailey (1994). Thus, the sample population was 241 respondents. The study population encompassed smallholding cassava farmers in the study areas.

Table 4.1: Sample size

Region	District	Ward	Population (Persons)	Stratified Sample (Persons)	Village	Actual Sample (Persons)
Mwanza	Kwimba	Sumve	16 436	107	Sumve	90
	Sengerema	Kasisa	16 839	109	Kasisa	70
Tanga	Muheza	Songa	5 769	37	Kwamianga	41
		Tongwe	7 478	48	Bagamoyo	35

Source: URT (2012)

The sampling procedures involved purposive selection of four villages based on criteria that the villages are involved in cassava cultivation. Key informant's information was used to refine selection of the study sites and sample size. Also, Extension Officers provided key information on cassava cultivation over study areas. In addition, key informants dealing in cassava researches and seed system implementation were interviewed. These are personnel from TARI Kibaha Pwani and Mikocheni Dar Es Salaam as well as IITA and MEDA offices.

4.8 Data Collection and Analysis

4.8.1 Data collection

The sampling procedures involved random selection of four wards in the three districts however, villages were purposefully selected based on criteria that they are intensely involved in cassava cultivation. Key informant's information was used to refine selection of the study sites.

Data was collected from smallholder farmers first through FDG and then through individual interviews. The demand for cassava as industrial raw materials was estimated using secondary data. Secondary data was collected from other literatures. Also demand for finished products made from cassava was used.

4.8.2 Data analysis

Data was collected from smallholder farmers first through Focus Group Discussion (FGD) and then through individual interviews. The demand for cassava as industrial raw materials was estimated using secondary data. Secondary data was collected from Sokoine National Agricultural Library (SNAL) and MEDA Tanzania.

4.9 Results and Discussion

4.9.1 Tanzania cassava seed system

Based on information gathered from key informants at IITA and MEDA, a formal cassava seed system in Tanzania, is at its early stages, such that between 90 – 95percent of cassava farmers obtain planting materials from informal system which is slightly higher than 80 – 90percent as presented by Louwaars and de Boef (2012). The cassava seed system comprises five key players in planting materials part of the value chain. These are pre-basic producers whose immediate consumers are basic producers who in turn supply their goods to commercial producers whose consumers are quality declared producers who supply to farmers. The pictorial form of part of value chain is as in Figure 4 below.

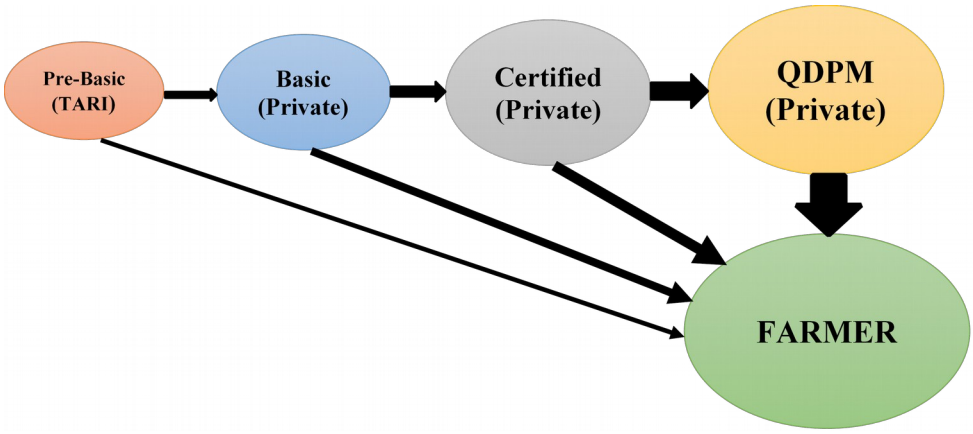

Figure 4.2: Tanzania Cassava Seed System Framework

In Tanzania, the pre-basic producers are government institutions, Tanzania Agricultural Research Institutes (TARI) which has the capacity for carrying out researches to develop and breed new varieties depending on requirements and environmental challenges such as diseases and pest. There are only five pre-basic produces and are located in the main cassava cropping zones of Eastern, Lake and Southern.

In Eastern zone there are two pre-basic producers which are TARI at Kibaha Pwani and Mikocheni Dar Es Salaam. Lake zone has two pre-basic producers, TARI at Maruku Kagera and Ukiriguru Mwanza whereas Southern zone has one, TARI at Naliendele Mtwara. The cassava cropping zones comprises regions as, Eastern –Morogoro, Pwani and Tanga; Lake – Geita, Kagera, Kigoma, Mara, Mwanza, Shinyanga and Simiyu; Southern – Lindi, Mtwara and Ruvuma. There is also emerging Central zone comprising of Dodoma and Singida and another area considered to be an independent zone is Zanzibar.

The pre-basic producers, also known as breeders, conduct researches, develop new varieties and disseminate their output products to basic producers. As far as pre-basic producers and the cassava seed system is concerned, there are only six cassava varieties which have been released. These are Kiroba and Mkuranga-1 for Eastern zone, Mkombozi and Mkumba for Lake Zone and Chereko, Kiroba and Mkuranga-1 for Southern zone. Also, there is a released variety for Zanzibar, which is Kizimbani. With only six released cassava varieties for the Mainland and one for Zanzibar, the bulk of the names for cassava varieties, are planting materials which are not part of the formal seed system. Thus, according to MEDA, there is 0percent of smallholding farmers sing cassava planting materials from formal seed system and about 5 – 10percent from semi-formal system.

The pre-basic producers sell to basic producers who multiply the planting materials through basic seed production farms which are required to be isolated from any cassava growing field by a minimum distance of 300m in every direction. The basic seed producers sell to commercial (certified) seed producers whose farms should be isolated by a minimum distance of 200m in all directions. The commercial producers who purchase

from basic producers should have farms isolated by 100m in all directions and sell to quality declared planting materials producers who should be isolated by a minimum distance of 50m. In addition, all producers have to be approved by Tanzania Official Seed Certification Institute (TOSCI) and certified accordingly. For all stages of cassava seed system, a producer first applies for registration and upon registration, TOSCI conducts field inspection to determine at which level an applicant can be placed among pre-basic, basic, commercial and quality declared then follows training of farm personnel.

Moreover, the minimum required field size in order to be considered as cassava planting materials farm is four hectares. The farm will be operated under TOSCI guidance and there is a bi-annual mandatory inspection for which the minimum allowable rate of infection is 1 percent for the farm to obtain a clean seed certificate. The 1 percent is determined from 200 randomly selected plants, which means out of the 200 selected plants, only two may be infected and the 198 must be clean and there is an inspection fee for every inspection conducted. Thus, for a field of 0 – 2.5 hectares the fee is TZS 100 000 and 400 000 for a field larger than 2.5 up to 10hectares.

Ideally, pre-basic producers are supposed to only sell to basic producers, basic in turn sells to commercial producers who then sells to quality declared producers who are then supposed to sell to farmers. However due to dynamicity and other factors such as increased demand and overproduction at one node of productions, sometimes any or all producers sell directly to farmers which has the advantage of lowering end-user price, benefitting the farmers. According to MEDA business model, pre-basic price per cutting would be TZS 93, basic 88, commercial 73 and quality declared 63 but sometimes all producers sell at flat rate price of TZS 40. There are 15 basic, 66 commercial and 277 quality-declared cassava planting materials producers so far.

Furthermore, among other activities in building up the cassava seed system are the ongoing efforts for mapping of cassava diseases, mainly cassava mosaic disease (CMD) and cassava brown streak disease (CBSD) with two projects undertaken. These are Cassava Diagnostic Project (2009 – 2016), to ensure sustainable cassava productivity in Africa which was implemented in Kenya, Malawi, Mozambique, Rwanda, Tanzania and Uganda and Community Phyto-sanitation which is ongoing since 2013. The main objective of Cassava Diagnostic Project was characterization of virus causing CMD and CBSD, it involved mapping of diseases spread by breeders, building capacity in terms of infrastructure such providing laboratory equipment and personnel training which included five PhD and seven MSc. level students as well as characterization of the diseases vector, whitefield fly. Also, the main objective of Community Phyto-sanitation project was to meeting farmers to map cassava varieties' characteristics, enabling multiplication center and distribution to farmers.

In addition, among challenges faced in the formal cassava seed system are continuous use of planting materials sourced outside the formal system with the potential of spreading diseases and pest as well as difficulty in dissemination of cassava planting materials due to bulkiness and short post-harvest life. Also, rigid mindset among smallholding farmers is a challenge as are difficult in adapting to changes in varieties and cropping system, such as adoption of mono crop and diseases and virus pressure at some places where cassava is cultivated, such Mkuranga in Eastern zone and Ukerewe in Lake zone. In addition, obtaining isolated planting materials fields which meets requirements such 300m and 200m from any nearby cassava cultivation field from any direction as well as lack of institutional framework and awareness.

In order to overcome the challenges, efforts are underway to increase awareness through advocacy forum, capacity building for institutions and formulation of planting materials producers and farmers' groups such as Seed Growers Association which is operational.

4.9.2 Respondents' social economic profile

Table 4.2: Respondents' social economic profile - Percentages

Description	Songa Ward	Tongwe Ward	Sumve Ward	Kasisa Ward	Total Number
Sex					
Female	48	40	51	47	49
Male	52	60	49	53	51
Total	100	100	100	100	100
Marital Status					
Married	87	77	89	86	86
Not Married	13	23	11	14	14
Total	100	100	100	100	100
Education					
Up to Primary	93	77	91	88	89
Post Primary	3	23	9	12	11
Total	100	100	100	100	100
Monthly Income (TZS)					
Below 100 000					
100 000 – 200 000	20	51	29	24	29
201 000 – 300 000	69	34	58	73	61
Total	11	15	13	3	10
	100	100	100	100	100

The total number of respondents was 241 with percentages as in Table 4.2 above. Female (49) and male (51), married (86), educated only up to primary school (89), with post primary school education (11), with monthly income below TZS 100 000 (29), income between TZS 100 000 and 300 000 (61) and above TZS 300 000 (10) (Table 4.2). In all four the wards in the three Districts of the two Regions, 100 percent were farmers, cultivating cassava, other crops and keeping animals.

4.9.3 Cassava varieties grown in the study area

During FGDs, a total number of 42 varieties were mentioned in all the 4 Wards but 16 varieties and have become redundant, 6 in Coastal area and 10 in Lake area, though respondents were aware of them. It was explained that the varieties which are no longer cultivated were frequently and heavily attacked by diseases, these were such as Kamsweke, Mkunungu, Kigoma, Mahonda and Makinda in Coastal area and for Lake areas were Musongomwa, Chemsha, Ngalabutwa, Malabe-Uzobe, Kasebo, Usiulize-Kigoma, Lumalampu, Burundi, Ngalabuto and Nyamu.

Table 4.3: Cassava varieties grown in the study areas

Variety Name	Number of Responses	Percentage
Kiroba	76	10.7
Rangimbili	75	10.5
Kikwete	66	9.3
Kikombe	63	8.9
Fuatanyayo	52	7.3
Dakikatatu	42	5.9
Lushika	41	5.8
Ikambula	30	4.2
Kwabanga	29	4.1
Lyongo	28	3.9
Nkamigwa	28	3.9
Ramahogoka	25	3.5
Mwanasili	22	3.1
Other Varieties	134	18.8

On varieties of cassava mentioned in the study areas, only 32 were mentioned as cultivated at the time of research interviews. District-wise, at Muheza, 15 varieties were mentioned in the two wards of Songa and Tongwe. At Kwimba 10, varieties were mentioned at Sumve and Sengerema 9 were mentioned at Kasisa. Kiroba which is cultivated at Songa and Tongwe wards had highest score responses, with percentage in brackets (10.7), followed by Rangi Mbili cultivated at both Kasisa and Sumve wards (10.5), Kikwete (9.3) at Sumve, Kikombe (9.1) at Songa and Tongwe, Fuatanyayo (7.3) at Kasisa, Dakika Tatu (5.9) at Kasisa and Sumve, Lushika (5.8) at Sumve, Ikambula (4.2) at

Sumve, Kwabanga (4.1) at Kasisa, Lyongo (3.9) at Kasisa, Nkomigwa (3.9) at Sumve, Rumarahogoka (3.5) at Kasisa and Mwanasili (3.1) at Sumve whilst other varieties had responses of below 3percent of which they account for 18.8 percent. Except for Tongwe ward where it was mentioned that smallholding farmers had received released variety, Kiroba through PANTIL project no other ward had formerly received quality improve planting materials.

Furthermore, out of about the 32 varieties mentioned as cultivated in the study areas only 13 had cultivation rate of above 3percent. From the 13 varieties, Sumve was cultivating a wide range of them, 7 whereas Songa and Tongwe cultivate only two of them, Kiroba which is quality improved and Kikombe. The smallholding farmers at Sumve offered an explanation to their reason for cultivating a wide range of varieties as they are not certain on the yield of any particular variety based on scientific data therefore, they cultivating many varieties on trial and error basis. This explanation is supported by the fact that, at Tongwe where Kiroba variety was disseminated through a project, PANTIL all smallholding farmers are cultivating the variety. Also, all the 41 smallholding farmers interviewed at Songa ward mentioned and was verbally confirmed by Bwembwera Division Officer "*Kiroba variety cultivated at Songa was dissemination by District Administrative Secretariat during an operation to fight hunger in Muheza, (Ondoa Njaa Muheza, ONJAMU).*".

In addition, during FGD at Kasisa it was mentioned that some of the varieties are least cultivated because they are bitter, and when cultivated it is done so on the periphery of the cassava field as a protection against pests such wild pig and porcupine. Moreover the bitter varieties are grown as food security because they are more resistant to drought.

Also, at Kasisa an Elderly Lady of 53 years revealed "*shortage of quality improved planting materials which are disease resistance and high yield lead to stealing planting materials from fellow farmers particularly when the owner is not willing to share the variety with others"*.

Furthermore, this study found smallholding farmers could did not cultivate 10 cassava variety claiming that they were not resistant to diseases and droughts, took very long time to mature sometimes up to two years, extreme bitterness and loss of starch in short duration after maturity and before harvest. Also, it was found that smallholding farmers could concentrate in few varieties which meet their expectations as the case of Songa and Tongwe, all 76 cultivate a quality improved variety. In addition, Kiroba which was formerly disseminated by PANTIL about 63 of farmers cultivate Kikombe variety whose yield are good according to respondents. Smallholding farmers at Sumve cultivated many varieties in effort to obtain good results in terms of disease resistance and yield on trial and error basis whilst at Kasisa smallholding farmers could justify any means of obtaining a perceived quality improved variety even by picking from others farms without their consent.

4.9.4 Cassava diseases and pest

Discussions with key informants involved in cassava researches revealed that major cassava diseases in Tanzania are Cassava Mosaic Disease (CMD) and Cassava Brown Streak Disease (CBSD). The smallholding farmers were interviewed on awareness regarding cassava diseases and pests and whether they had encountered them or not. The diseases mentioned were Cassava Mosaic Disease (CMD), Cassava Brown Streaks Disease (CBSD) and Brown Leaf Spot (BLS) whilst mentioned pests were mealy bugs, green mites, and rats. The smallholding farmers were also asked on awareness of White

Flies in which the response was very low. However, smallholder farmers could not explain on how to fight the pest as they have no technical knowhow as well as they do not use pesticides except occasional use of rat poisons to fight rat menace when heavily affected.

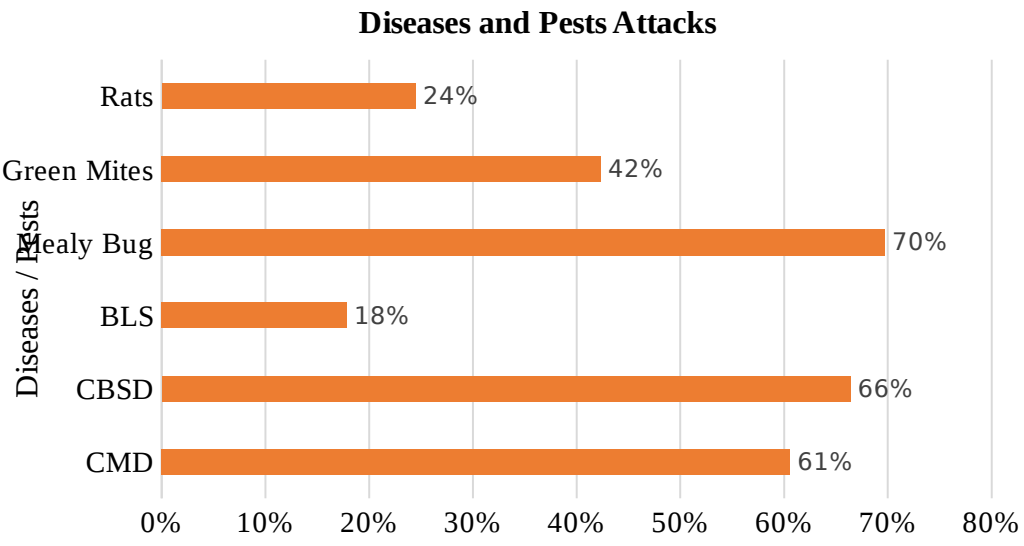

Figure 4.3: Smallholding farmers affected by diseases and pests attacking cassava

The diseases that affects cassava, CBSD had high level of awareness among smallholding farmers, with percentages in brackets, it affected (66) of respondents, CMD (61) and BLS (18) whereas, pests were mealy bug (70), green mites (42) and rats (24). There were other vermins mentioned such wild pig and porcupine. Smallholding farmers awareness on whiteflies was very low despite that the flies are vectors responsible for spread of the two diseases CBSD and CMD. The levels of awareness for CBSD and CMD were 66percent and 61percent of the respondents respectively based on the number of smallholding farmers who have encountered the attacks indicates the importance of the two cassava diseases.

4.9.5 Source and cost of cassava planting materials

The smallholding farmers were interviewed on source of planting materials and whether they had purchased the materials. The respondents who purchased planting materials were only 3 out the 241 making it only 1.2percent had purchased and 98.8percent obtained from their own source, serve for the smallholding farmers at Kasisa who picked from farms of others without consent.

This study found only about 1.2 percent of smallholding farmers interviewed had purchased cassava planting materials with price registered prices of TZS 225 000, 300 000 and 350 000 per hectare. The mean cost was TZS 292 000 per hectare. Although the data for cost of planting materials were few, this study adopts the mean to be the study's finding for the cost of cassava planting materials. However, during discussion with Key Informant at Songa Ward, it was revealed that cost of cassava planting materials ranges between TZS 300 000 to 350 000 depending on variety, with Kiroba variety fetching higher prices. In addition, survey data from Cassava Planting Materials Growers group indicate that price for cassava planting materials sufficient to plant in one-hectare area is TZS 343 750

Moreover, MEDA (2016a) in a pilot project, have calculated and pay a sum of TZS 400 000 to the cassava planting materials entrepreneurs who produce the material for dissemination over the project catchment area. The price of 400 000 was slightly higher compared to the survey prices, nevertheless, the entrepreneurs were paid by the project and produced planting materials to be issued freely to the needy communities.

4.9.6 Agronomic costs by smallholding cassava farmers in the study area

Cassava agronomic costs ranged from TZS 125 000 to 1 250 000. The costs included ploughing, harrowing, stem cuttings preparation, planting, weeding and harvesting. All smallholding cassava farmers interviewed were not using fertilizer as well as pesticides or herbicides. The smallholding farmers use hired power to attend their farms.

4.10 Conclusion and Recommendations

4.10.1 Conclusion

It may be concluded that the cassava seed systems in the study areas are not developed and based on finding of this study, the majority of smallholder farmers in the study areas use cassava planting materials from their own sources which is outside the established seed system. This conclusion is supported by the wide array of varieties mentioned as grown in the two ecological zones surveyed since with only one released variety, Kiroba grown at Muheza district. Despite Mkuranga-1 being another released variety for Coastal zone and Mkombozi as well as Mkumba for Lake zone, the three varieties were not even mentioned by smallholding farmers. Only about 11 percent of the respondents reported to grow Kiroba although from own source which is not in the formal seed system.

Moreover, it may be concluded that, there was prevalence of cassava diseases and based on the level of awareness among the smallholding cassava farmers for cassava brown streak disease (CBSD) 66 percent and mealybugs pest 70 percent. Even in absence of regular extension services and trainings farmers were aware of the disease and pest which indicates the importance of the two challenging factors in cassava cultivation. Lack of extension services and need for training were among issues highly raised by smallholding farmers which indicates lack of management and governance in the cassava subsector. In addition, smallholding cassava farmers are faced with high agronomical costs compared to

household incomes as the cost of purchasing planting materials put together with ploughing and weeding, they overrun monthly household income by more than twice, this may probably explain why despite several efforts through poverty alleviation project, the abject poverty among the smallholding farmers is not subsiding as projected.

Furthermore, the findings of this study agree with observation by MEDA that 0 percent of smallholding farmers in cassava growing zones obtain cassava planting materials from formal seed systems which is in line with previous studies by Mtunda (2009), that smallholding farmers face shortage of clean disease-free planting material; Mwang'ombe *et al.* (2013), that smallholding farmers re-use planting materials from their sources thereby spreading diseases; ASARECA (2014), which noted that key ingredient to increased agricultural productivity and production is farmer access to inputs, particularly quality seed of superior varieties and IITA (2016b) that there is poor access to improved planting materials.

The contribution of this paper to the body of knowledge is that it has among others presented the structure of cassava seed system in Tanzania (Figure 4), as it is emerging, whereas in accordance with Almekinders (2017) the roots tubers and banana (RTB) seed systems are least studied.

4.10.2 Recommendations

Therefore, based on findings of this study, it may be recommended that clean quality improved cassava planting materials should be disseminated to smallholding farmers through a sustainably economical way such subsidizing entrepreneurs and small and medium enterprises (SME) so that they can mass produce the planting materials and sell to smallholding farmers at affordable costs.

The findings also suggest lack of supervision, guidance and governance over the crop, therefore, it may be recommended that a proper and clear policy framework for implementation such as a Cassava Master Plan of the like of Nigeria (2006) and governance using an institution such as a Governing Board, the likes of Cashewnut, Cotton, Coffee, Tea and Tobacco Board are established and implemented.

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CHAPTER FIVE

5.0 WILLINGNESS TO PAY FOR CLEAN QUALITY IMPROVED CASSAVA PLANTING MATERIALS (SEEDS) COASTAL AND LAKE VICTORIA AREAS OF TANZANIA

Issa Majid Maggidi[1] and Jeremia Makindara[2]

[1]MA Student, College of Social Sciences and Humanities, Sokoine University of Agriculture, P. O. Box 3024 Morogoro, Tanzania. immaggidi@gmail.com

[2]Senior Lecturer, School of Agricultural Economics and Business Studies (SAEBS), Sokoine University of Agriculture, P. O. Box 3140 Morogoro, Tanzania. makj@sua.ac.tz

Abstract

Cassava is both food and food security crop in many parts of Africa, East Asia and Southern India. It is a cash crop sold for food and raw material for processing and production in industries. There are many factors that hinder cassava production among them being unavailability of clean quality improved planting material. This study was undertaken to determine smallholding farmers' willingness to pay for clean quality improved planting materials when disseminated on commercial basis. The study revealed that smallholding farmers are willing to pay TZS 62 500 per hectare for improved cassava seeds. Factors influencing WTP were age, household monthly income, agronomic cost and residential location. The implications of this study are creation of opportunity for further research and the entrepreneurial opportunity for investment into commercial production. It recommended that Tanzania Government should create a conducive environment for commercial production of cassava seeds as long as seed quality and certification requirements are availed to those producers timely and at reasonable costs.

Key Words: Cassava planting materials; improved cassava seeds; willingness to pay.

5.1 Introduction

This study was undertaken to determine smallholding farmers' willingness to pay (WTP) for clean quality improved cassava planting materials when produced and disseminated on commercial basis. Traditionally, cassava planting materials are non-marketed goods, thus their commercialisation would require an assessment to determine whether smallholding farmers are ready and willing to purchase them. Since cassava planting materials are not

usually marketed, to determined WTP, the Contingent Valuation (CV) theory was used. The study also assessed the demand for cassava as raw materials for industrial processing and production. The determination of WTP was based on survey conducted in the study areas whilst assessment for demand for raw materials was conducted through secondary data analysis.

Le Gall-Elly (2009) described Willingness to Pay (WTP) as the maximum given price a consumer accepts to pay for a product or service. It is of particular interest as is richer in individual information and the concept was first published by Davenport in 1902. According to Carson (2000), WTP could be based on Contingent Valuation (CV) theory, which is a survey-based method used for placing monetary values on goods and services not bought and sold at marketplaces. Nonetheless, Chilton (2007), claimed that CV was proposed by Ciriary-Wantrup in 1952 and first published in an empirical study in 1963 by Davis. In addition, ability to measure WTP enables calculation of the demand curve according to price and to set a price that offers the best possible margin. When prices can be customized, knowing the WTP could enable optimization of both sales volumes and margins (Le Gall-Elly, 2009). In addition, understanding the factors that influence WTP allows it to be raised and offers the opportunity of increasing sales volumes for a given price or, when possible, to customize prices (Le Gall-Elly, 2009).

Although, measurement of WTP allows calculation of the demand curve based on price and its setting for best possible margin which in turn enable sales volume to be optimized, many companies set up prices without profound knowledge on customer base and their preferences (Breidert *et al.*, 2015). Also, when factors influencing WTP are understood, customization of price is possible allowing price rise and offering opportunity for increasing sales volume. However, the magnitudes of households' WTP vary with the nature of goods or services offered (Ulimwengu and Sanyal, 2011), as well as the type of

payment, as demonstrated by Asrat *et al.* (2004) wherein, farmers were less willing to pay cash but willing to spend labour and time.

5.2 Problem Statement and Justification

A seed system is a framework of institutions linked together through a combination of components and processes of production, multiplication, storage and marketing of improved varieties of specific quality along with the interactions and support to make seed available to a particular end user (Loch and Boyce, 2003). Mtunda (2009), claimed that among factors which hinder cassava production is the unavailability of clean, disease free planting material, among others. Kapinga *et al.* (2015), found that lack of clean disease-free cassava planting material was a factor which contribute to spread of disease thereby negatively affecting both production and yield. Thus, FCI (2015), found that the demand and the prices for readily available clean cassava planting material in Kenya, Tanzania and Uganda has been increasing. USAID (2016), argued that, high-quality improved seed is essential for achieving high yields necessary to feed the world's population, deliver better nutrition and reduce rural poverty.

Thus, this study was conducted to assess whether or not smallholding farmers are willing to pay for the clean quality improved planting materials which are of high yield, takes shorter time to mature as well as resistant to drought, diseases and pests when such materials are disseminated on commercial basis.

5.3 Objective of the Study

The objective of this study was to determine smallholding farmers' willingness to pay (WTP) for clean quality improved cassava planting materials (CQI-CPM) when the materials are produced and disseminated under commercial environment in order to

improve production, yield and sustainability of cassava value chain in Tanzania. Also, to assess demand of cassava as industrial raw materials for processing and production in Tanzania.

5.4 Significance of the study

This study is significant, as it also takes on suggestion by Silayo *et al.* (2008) to proceed with improving production, utilization and marketing of cassava for sustainable livelihood with entry at dissemination of diseases-resistant varieties. Also, according to Mtunda (2009), smallholding farmers are faced with shortage of quality and disease-free planting materials and MEDA (2016), argued that farmers obtain cassava planting materials from own re-use, relatives, friends and other farmers thereby increasing risk of spread of disease, which, as well was observed by Mwang'ombe *et al.* (2013). Therefore, in order to overcome the shortage of clean quality improved cassava planting materials, their production and dissemination could be on commercial setting using private entrepreneurs as tested by Farm Concern International, FCI (2015) and MEDA (2016).

5.5 Conceptual Framework

In the conceptual framework of this study, it was envisaged that WTP for clean quality improved cassava planting materials was influenced by social economic characteristics of the res age, l old size, education level, access e; also as knowledge on seed charac pests, es, market prices and processing as shown in Figure 1.

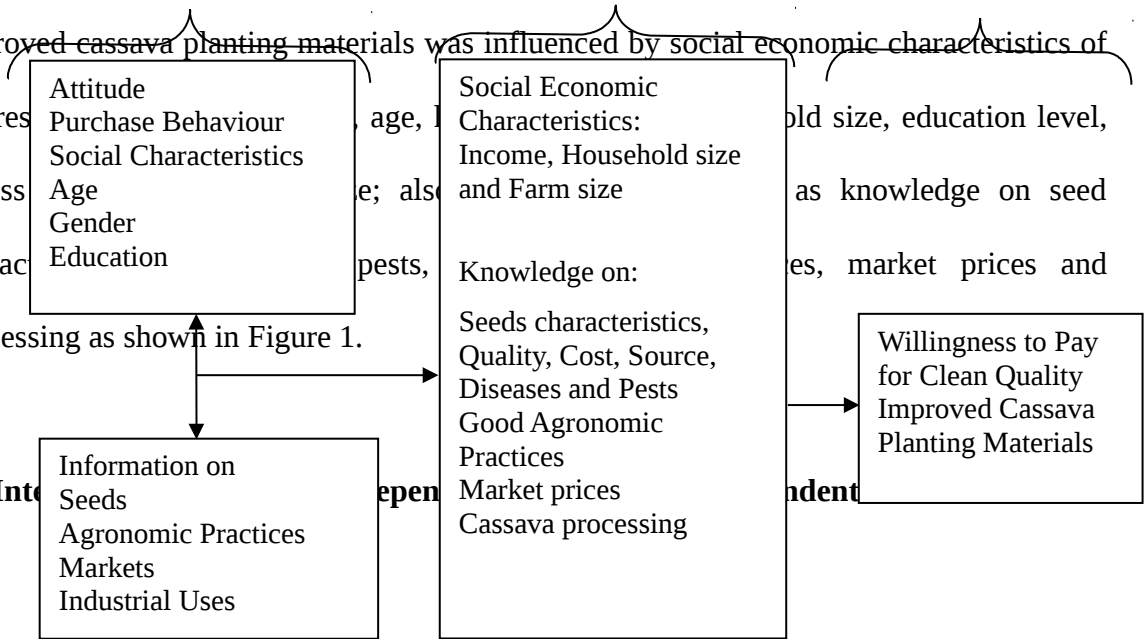

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Figure 5.1: Conceptual framework of the study

However, it is worthy to note that not all factors envisaged to affect WTP would affect the same way, as the case of similar studies on WTP for health care service in Tanzania by Bonu *et al.* (2001) and Walraven (1996) where income was found by Bonu to affect WTP whilst Walraven did not find it. Asrat *et al.* (2004) found that age to be a factor affecting WTP since young farmers were more willing to part with cash while the old ones were willing to spend labour and time. In a study by Kazuzuru (2018), age and education levels were significant factors.

5.6 Theoretical Framework

5.6.1 Contingent Valuation Theory (Contingent Valuation Method)

Contingent Valuation Theory also referred to as Contingent Valuation Method is a theory used to value non-marketed goods (Alberini, 1995a). According to Hoyos and Mariel (2010), Bowen in 1943 and Ciriacy-Wantrup in 1947 were the earliest to propose the use of a public opinion survey as a valid instrument to value public goods, based on the idea that voting could be the closest substitute for consumer choice and in 1952 Ciriacy-Wantrup defended the use of direct interview methods as a valid means to attain valuation of non-marketed goods. In addition, Mitchell and Carson (1989) played a central role in

defining the practice of contingent valuation particularly on the aftermath of Exxon Valdez accident and later on, Kling *et al*. (2012) after yet, another oil spill accident by Deepwater Horizon of 2010 which spilled five times more crude oil into sea than Exxon Valdez.

Moreover, Carson and Hanemann (2005), claimed that CV is deeply rooted in welfare economics: to be precise, in the Neoclassical concept of economic value under the framework of individual utility maximization. CV surveys are capable of directly obtaining a monetary measure of welfare associated with a discrete change in the provision of an environmental good, by substituting one good for another or the marginal substitution of different attributes of an existing good. CV surveys have been used to value large discrete changes such as the introduction of a new public good, the value associated with substituting one good for another, or the marginal value associated with changing one or more attributes of an existing good. (Carson and Hanemann, 2005). In addition, CV method is designed to create the missing market for public goods by determining what people would be willing to pay (WTP) for specified changes in the quantity or quality of such goods or, more rarely, what they would be willing to accept (WTA) in compensation for well-specified degradations in the provision of these goods. It circumvents the absence of markets for natural resource services by presenting consumers with a choice situation in which they have the opportunity to buy or sell the services in question (Carson *et. al.*, 2003).

However, Hanley *et al*. (2001), argues that choice modeling based on economic theory alone places behaviour burden to respondents as behaviour is not tested in an economic survey. Accordingly, Liebe *et al*. (2011) proposed other theories which would drive choices, these

include attitudes–behaviour paradigm or theory of planned behaviour, theory of public goods, altruistic or moral behaviour theory and norm–activation theory. Nonetheless, Kling *et al.* (2012), claimed that, there had been a protracted debate on the validity and efficacy of CV method, particularly between commercial practitioners and academicians, but opinioned it is now clear at least from academic and practical point of view such as a number of US Courts' decisions, that CV method is a reliable in estimating value for non-marketed goods.

Therefore, this study adopted contingent valuation theory since, until very recent, cassava planting material were non-marketed goods in Tanzania. In this particular context, cassava planting materials held passive value which has now been converted into monetary value by virtue of being sold, albeit not directly at market place.

5.6.2 Willingness to Pay Concept

Willingness to Pay (WTP) was defined as the maximum price a given consumer accepts to pay for a product or service. The WTP concept was first presented in economic literature by Davenport in 1902. Originally, WTP were designed to determine prices for pure public goods and services. WTP has been used in econometrics of varied subjects such as the value of human life, threatening human life risks minimization, the arts, social programs, marketing and corporate investments (Le Gall-Elly 2009).

Moreover, WTP can be conceived on the basis of a number of theories. These are economic theory in which the main factors influencing respondents' decision are income and the use of public good; theory of public good with influencing factors of dilemma concerns and other people cooperation; theory of planned behaviour or attitude–behaviour paradigm that is influenced by environmental concern, attitude toward paying, subjective norm and perceived behaviour control; altruistic moral behaviour theory which is influenced by general warm–glow and subjective behaviour to pay; also norm activation theory with influencing factors as awareness of need for paying and awareness of responsibility for paying (Liebe *et al.*, 2011).

In addition, Breidert *et al.* (2015), explained on classification of methods which could be used to measure WTP based on either revealed or stated preference. Revealed preference could be achieve through either market data or experiments, which include laboratory experiments, field experiments and auctions. Stated preference could be achieved through both direct and indirect surveys, whereby with direct survey it includes expert judgement and customer survey whilst indirect survey includes conjoint analysis and discrete choice analysis.

Furthermore, several methods of determining WTP have been proposed. Alberini (1995b) examined the effect of survey design on goodness of fit based on dichotomous choice contingent valuation data using Monte Carlo simulation. Hanley *et al.* (2001), argues that WTP could be estimated using OLS regression or maximum likelihood estimation procedures such as logit, probit, ordered logit, conditional logit, nested logic and panel data method.

Therefore, this study used economic theory in the survey design and logit, which is also known as logistic regression in the determination of smallholding farmers' WTP for clean quality improved cassava planting materials.

5.6.3 Logistic regression (Logit)

Golberg and Cho (2004), claimed that logistic regression was introduced by Galton in 18th century in his study on heredity wherein he proposed that the height of off-springs would regress toward a normal height and according to Cramer (2002), the logistic regression model was invented in 19th century by Verhulst while describing population growth as:

$$P(t) = \beta P(t) \{1 - P(t)\} \quad \ldots\ldots(19)$$

Where P(t) is the proportion of Population at any time t to the maximum (saturated) population and β is the constant rate of growth.

Czepiel (2018), argued that, in logistic regression, the function is the logit transformation which the natural logarithm of the odds that some event will occur. Also, Peng, *et al.* (2002), argued that, the central mathematical concept that underlies logistic regression is the logit, the natural logarithm of an odds ratio and accordingly, the logarithmic solution to the above equation (1) is:

$$P(t) = \frac{\exp(\alpha + \beta t)}{\{1 + \exp(\alpha + \beta t)\}} \quad \ldots\ldots(20)$$

Where α is the error term and this function tends to approach 1 as time passes infinitely and is known as Logistic Regression, that is, a population will tend to regress towards a certain figure as time passes infinitely. Figure 8 below depicts logistic regression curve.

Figure 5.2: Logistic Regression Curve

Peng *et al.* (2002), had put it that the probability of WTP is P(Y=1) and the logarithmic ratio of the probabilities of likelihood as:

$Log_e[P(Y=)] / [1-P(Y=)]$……(21)

Which according to Park (2013) can be equated to a linear function $\alpha + \beta X$ (22)

where P(Y) is the probability, β is the gradient of the linear equation, X is the variable and α is the error term.

Therefore, the logistic regression model of estimation can be written as:

$Log_e [P (Y = 1) |X_1, X_2...X_n] / [(1-P) (Y = 1) |X_1, X_2...X_n] = \alpha + \beta_0 + \beta_1 X_1 + ..\beta_n X_n$ .....(23)

Which can be generalized as:

$Log_e[P] / [1 – P] = \alpha + \beta_n X_n$ ……(24)

Obtaining on solving:

$P / [1 – P] = e^{(\alpha + \beta nXn)}$ or $P = e^{(\alpha + \beta nXn)} - P*e^{(\alpha + \beta nXn)}$……...……(25)

Or:

$P (1 + e^{(\alpha + \beta nXn)}) = e^{(\alpha + \beta nXn)}$ ……(26)

Therefore:

$P = [e^{(\alpha + \beta nXn)}] / [1+ e^{(\alpha + \beta nXn)}]$ ……(27)

Where:

β_0 is the Y intercept when X = 0 $\beta_1, \beta_2,$ ..... β_n are the slopes of regressions.

X_n are the independent variables (regressors) which were used in the analysis.

Then, the probability of WTP is thus, $1 \geq P > 0$.

And if P(Y=1) > 0.5 then there is WTP.

In addition, according to Carson (2000), the application of logistic regression in relation to CV method result into WTP distributions which are asymmetric with mean larger than

median, that is due to income distribution being asymmetric. Also, mean WTP is the traditional measure used in benefit-cost analysis, although, in these cases, median WTP, which corresponds to the flat amount that would receive majority approval, is a standard public choice criterion.

Therefore, this study applied logistic regression in relation to economic theory of CV method and the median was used as the measure of amount the smallholding farmers were willing to pay as it would represent the majority in the study survey.

5.7 Empirical Review

One of the present challenges is to find trade-off between increasing human wellbeing at the detriment of environment and natural resources, thus economists have developed a device that can be used to assist in determining people's readiness to pay for or forgo a perceived environmental or social value. The device is Contingent Valuation (CV) method which is used in the surveys for willingness to pay (WTP) or willingness to accept (WTA) (Kristrȯm, 1990). FAO (2000), describes CV method as creating a hypothetical market place where price could be determined, albeit from customers' perspective particularly for goods which are traditionally non-marketed and is a useful tool in determining values for agricultural and environment goods.

In agriculture, CVM have been used to determine WTP for a wide range of products and services. Whitehead *et al.* (2001), used it to estimate farmers' WTP to pay for services such as extension service and found factors such as education, household income, gender and age were influencing the WTP. Xiu *et al.* (2012) had determined farmers' WTP for cow insurance in which age and education were the highly significant factor. Tolera *et al.* (2014) used the method and found that household income had a positive influence on farmers WTP for extension services. Also, Ahmed *et al.* (2015), applied CVM in a study

to determine farmers' WTP for a planned adaptation programme to address climatic issues in agricultural sectors and found age, education, awareness on environmental issues, desire to protect the environment and risk posed by climatic changes were the factors affecting WTP.

Moreover, CVM has been used in several studies, such by Harun *et al*. (2015), in the analysis of factor of that influence the WTP for irrigation water in Iraq in which it was found that age and education were highly significant factors influencing the farmers; Ghazanfar *et al.* (2015), to determine farmers' WTP for crop insurance and found credit access, expected yield, farm income, land holdings, loss experience and land tenure system had significant impact on WTP. Also, Giannoccaro *et al*. (2016), in a study to determine factors influencing farmers' willingness to participate in water allocation trading in Southern Spain found positive relationship between the WTP and the level of information about available water, suggesting that uncertainty hinders decision making; Chancharoenchai and Saraithong (2017), with single and double bound models to assess consumers' WTP for cabbage produced under good agricultural practices (GAP) and found that the amount is lower for a justified increase in production cost by farmers to produce GAP cabbage. In addition, Afroz *et al*. (2017), in assessing WTP for crop insurance and found that household income, age, awareness to insurance, experience and farm size were the factors in influencing WTP.

Furthermore, CVM was used in Tanzania by Ministry of Natural Resources and Tourism in in a study for Eastern Arc Mountains Strategy Thematic Strategy – Mechanism for Payments for Water Environmental Services Rufiji River Basin Tanzania and found that age, gender, and place of birth were factors influencing WTP (URT, 2007). Ndetewio *et al.* (2013), in a study to determine factors influencing WTP for watershed services at

Lower Moshi, Pangani Basin found among factors affecting WTP were level of education, household income, household size, farm size and main economic activities of the area. Musa (2015), in a to determine WTP for improved soil waste management in Dodoma Municipality and found that age, marital status, education level, occupation, quantities of solid waste generated, location of the dump, and households' income were the factors influencing WTP.

CVM has been used in health sector as well; Walraven (1996), in which it was found that previous experience and residential location of respondent were factors influencing WTP. Kuwawenaruwa *et al.* (2011) in WTP study for voluntary health insurance and found location whether rural or urban, influence WTP. Nyamuryekung'e *et al.* (2018), in a study of patients' WTP for dental services in a population with limited restorative services and found that outpatient status, experience with previous dental services, age and income were the factors influencing WTP.

In addition, it was used in tourism sector by Bruner *et al.* (2015), in tourists WTP to visit Tanzania National Parks study and found that for foreigners, contribution to wildlife organizations was an influencing factor and thereby suggested on fee structures for various national parks based on whether the tourists were foreigners or citizens and Kazuzuru (2018) in a study for determinants of tourists spending in Tanzania who established that tourists' trip-related characteristics such as group size, purpose of visit and travel arrangement were more influential factors in spending by tourists than the destination attributes as well as the demographic characteristics.

5.8 Methodology

5.8.1 Research design

This research adopted cross-sectional design which is looking at different groups of people with specific characteristic and allows data collection at single point in time with advantage that it can be done fairly quickly (Toledo-Pereyra, 2012). The reason for choosing this design is simply because it is flexible, economical and easy to manipulate data and information (Bailey, 1994).

5.8.2 Description of the study area

The study area is indicated on Figure 5.3 below, was purposefully selected based on main cassava cropping zones in Tanzania, which according to Masumba (2012) are the Lakes Zone covering Geita, Kagera, Kigoma, Mwanza, Shinyanga and Simiyu regions; Coastal Zone covering Tanga, Dar Es Salaam and Coast regions and Southern Zone covering Lindi, Mtwara and Ruvuma regions. The regions were randomly selected from the two zones thus, this study was conducted in Mwanza and Tanga Regions for Lakes and Coastal zones respectively. The districts were also randomly selected, where Muheza was selected in Tanga region and Sengerema in Mwanza region. Also, Kwimba district was purposefully selected as it is home to Tanzania Agricultural Research Institute at Ukiriguru.

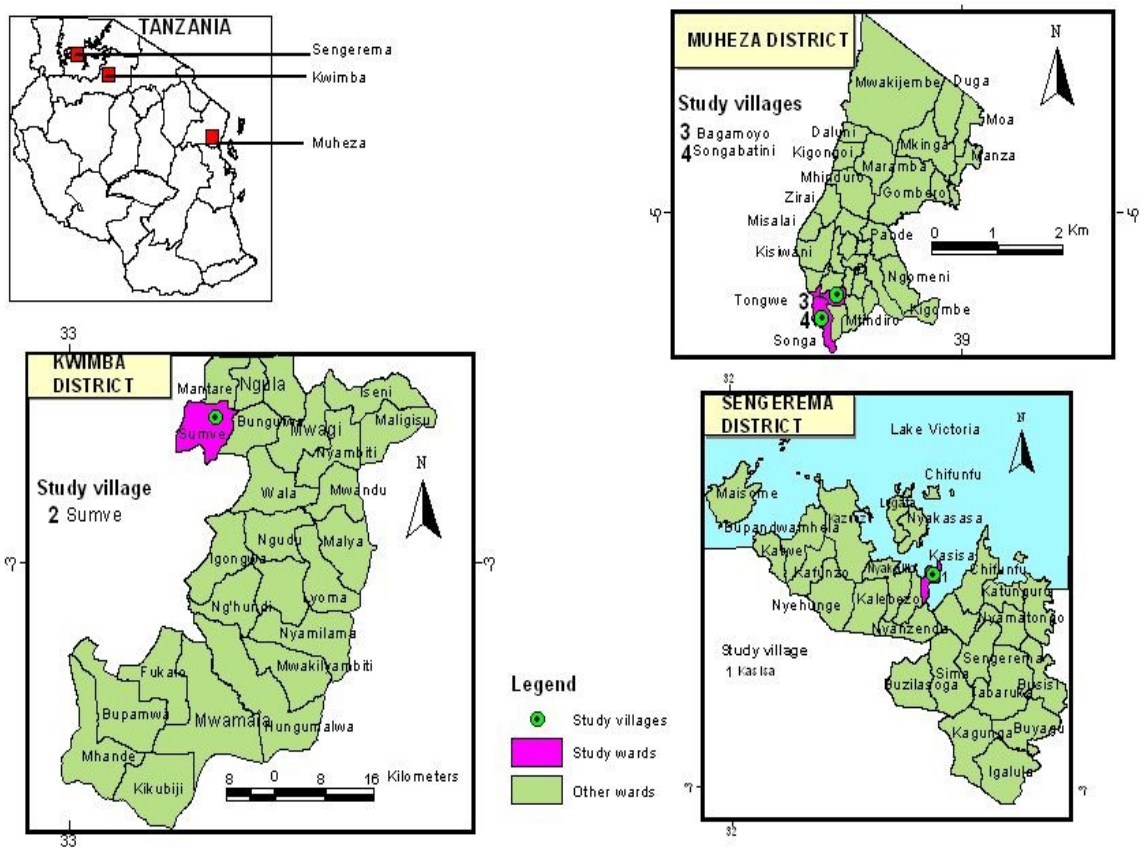

Figure 5.3: Map of the study area

The wards where the research was conducted were randomly selected whereby at Muheza district, Tongwe and Songa wards were selected. Tongwe is located at upland on the foothills of Eastern Usambara Mountains while Songa is located at low land of the mountains. Sumve and Kasisa wards were randomly selected at Kwimba and Sengerema districts respectively. Sengerema district lies at Latitude 32.64º South and Longitude 2.65º East, Kwimba lies at Latitude 33.36º South and Longitude 3.06º East and Muheza district, which lies at Latitude 38.9° South and Longitude 4.92º.

5.9 Sample Size

The sample size was determined using Cochrane Formulae (Cochrane, 1963). The Sample Size Determination Using Formulae:

$$n_o = \frac{Z^2 * p * (1-p) * N}{[(N-1) * E^2 + Z * p * (1-p)]} \quad \ldots\ldots(28)$$

Where: n_o is Sample size

Z is Confidence level at 95 percent = 1.96

E is Margin of Error = 5 percent = 0.05

P is the Probability = 0.5

N is the Population

Using Cochran's Correction Formulae: $n_{oC} = 384/[1+(384/ n_{os})]$ ……..……(29)

Therefore, Sample Population = 384/[1+(384/1466)] = 302 …….....….…..…….(30)

Therefore, targeted sample was 109 for Kasisa, 107 Sumve, 37 Songa and 48 Tongwe. However due to actual situation on site and repetitive responses during interviews only 35 respondents were interviewed at Tongwe ward, 41 at Songa, 70 at Kasisa and 90 at Sumve (Table 3). Also, the 35 satisfied the minimum criterion of 30 in accordance with Bailey (1994). Thus, the sample population was 241 respondents. The study population encompassed smallholding cassava farmers in the study areas.

Table 5.1: Sample size

Region	District	Ward	Population (Persons)	Stratified Sample (Persons)	Village	Actual Sample (Persons)
Mwanza	Kwimba	Sumve	16 436	107	Sumve	90
	Sengerema	Kasisa	16 839	109	Kasisa	70
Tanga	Muheza	Songa	5 769	37	Kwamianga	41
		Tongwe	7 478	48	Bagamoyo	35

Source: URT (2012)

The sampling procedures involved purposive selection of four villages based on criteria that the villages are involved in cassava cultivation. Key informant's information was used to refine selection of the study sites and sample size. Also, Extension Officers provided key information on cassava cultivation over study areas. In addition, key informants dealing in cassava researches and seed system implementation were interviewed. These are personnel from TARI Kibaha Pwani and Mikocheni Dar Es Salaam as well as IITA and MEDA offices.

5.10 Data Collection and Analysis

5.10.1 Data collection

The sampling procedures involved random selection of four wards in the three districts however; villages were purposefully selected based on criteria that they are intensely involved in cassava cultivation. Key informant's information was used to refine selection of the study sites.

Data was collected from smallholder farmers first through Focus Group Discussion (FGD) and then through individual interviews. The demand for cassava as industrial raw materials was estimated using secondary data. Secondary data was collected from Sokoine National Agricultural Library (SNAL) and MEDA Tanzania.

5.10.2 Data analysis

This study used both descriptive in line with research conducted by Ahmed (2015). The quantitative data were analysed by using Statistical Package for Social Sciences (SPSS) by computing descriptive statistics to obtain frequencies and percentage distribution of the responses.

Descriptive statistics was used to determine the minimum amount that smallholding cassava farmers were willing to pay for clean quality improved cassava planting materials in the event they are commercially produced. Inferential statistics on the other hand, was used to determine which factors are affecting WTP for those planting materials.

The factors which were tested for influence in deciding WTP are tabulated in Table 5.2 below.

Table 5.2: Logistic Regression Model – Regressors definition and measurement

S. No.	Regressor	Regressor Description	Measurement	Input
1	SEX	Sex	Nominal	F=1, M=2
2	AGE	Age	Numerical	Number
3	MARITAL_STATUS	Marital Status	Nominal	M=1, NM=0
4	EDU_LEVEL	Education Level	Nominal	P=1, >P=2
5	HH_SIZE	Household Size	Numerical	Number
6	HH_INCOME	Monthly Income	Numerical	Number
7	FARM_SIZE	Farm Size	Numerical	Number
8	CASSAVA_AREA	Area of Cassava	Numerical	Number
9	AGRO_COST	Agronomic Cost	Numerical	Number
10	CMD_ATTACK	Attacked by CMD	Nominal	Y=1, N=0
11	CBSD_ATTACK	Attacked by CBSD	Nominal	Y=1, N=0
12	MEALYBUG_ATTACK	Attacked by Mealybug	Nominal	Y=1, N=0

S. No.	Regressor	Regressor Description	Measurement	Input
13	GREENMITE_ATTACK	Attacked by Greenmite	Nominal	Y=1, N=0
14	CASSAVA_REVENUE	Revenue Cassava Sales	Numerical	Number
15	SELLING_PRICE	Cassava Selling Price	Numerical	Number
16	INDUSTRIAL_DEMAND	Awareness industrial raw material	Nominal	Y=1, N=0
17	EXTENSION_SERVICE	Extension Services	Nominal	Y=1, N=0
18	NEED_TRAINING	Need for Training	Nominal	Y=1, N=0
19	NEED_CAPITAL	Need for Capital	Nominal	Y=1, N=0
20	FARMING_GROUP	Faming Group	Nominal	Y=1, N=0
21	CREDIT_GROUP	Credit Group	Nominal	Y=1, N=0
22	WARD	Ward – Songa	Nominal	SO=1
	WARD	Ward (1) – Tongwe	Nominal	TO=2
	WARD	Ward (2) – Sumve	Nominal	SU=3
	WARD	Ward (3) – Kasisa	Nominal	KA=4
23	DISTRICT	District – Muheza	Nominal	MU=1
	DISTRICT	District (1) – Kwimba	Nominal	KW=2
	DISTRICT	District (2) – Sengerema	Nominal	SE=3

5.11 Results and Discussion

5.11.1 Key information on cassava planting materials

The study was conducted in two aspects, one aspect was to collect information from organizations which are involved in cassava value chain and the other aspect was the field survey involving key informants and farmers respondents. Organizations which were visited for key information on cassava value chain included TARI and IITA at Mikocheni Dar Es Salaam, MEDA at TARI offices Kibaha, Association of Commercial Cassava Planting Materials Producers, Eastern Zone at Chalinze Pwani and JV Biotech who produce cassava starch at Kiwangwa Pwani.

At TARI Mikocheni, it was informed that there are ongoing efforts for mapping of cassava diseases, mainly cassava mosaic disease (CMD) and cassava brown streak disease (CBSD) with two projects undertaken. The projects are Cassava Diagnostic Project (2009 – 2016), to ensure sustainable cassava productivity in Africa which was implemented in Kenya, Malawi, Mozambique, Rwanda, Tanzania and Uganda. The main objective of the project was characterization of virus causing CMD and CBSD, it involved mapping of diseases spread by breeders, building capacity in terms of infrastructure such providing laboratory

equipment and personnel training which included five PhD and seven MSc. level students as well as characterization of the diseases vector, whitefield fly. Another project was Community Phyto-sanitation with the main objective of meeting farmers to map cassava varieties' characteristics, enabling multiplication center and distribution to farmers.

Moreover, IITA are involved in research and development for cassava seed system in Tanzania in collaboration with Tanzania Agricultural Research Institutes at Mikocheni Dar Es Salaam, Kibaha Pwani, Naliendele Mtwara, Ukiriguru Mwanza and Maruku Kagera where pre-basic seeds are produced, on assistance by MEDA which is financed by Bill and Melinda Gate Foundation. In addition, MEDA has implemented a pilot project, Muhogo Mbegu Bora (MMB) translating as Quality Cassava Seed (2012 – 2016) as predecessor to main project, Building Economically Sustainable Seed System in Tanzania (BEST) for cassava which is ongoing (2017 – 2021). MMB was used to establish and test model for commercialization of quality declared planting material (QDPM). During MMB stage, district councils, farmers' groups and individual farmers were used to produce QDPM for the purpose of determining which group should be used during the main project phase. MEDA is now in implementation of BEST project and is using individual farmers for the production of cassava planting materials.

Furthermore, Building Economically Sustainable Seed System in Tanzania (BEST) project for cassava main objective was to establish a sustainable cassava seed system that will have ownership of the people involved, in this particular case, individual entrepreneurs who will sustainably produce and disseminated quality declared planting materials (QDPM) on commercial manner. The targeted number of individual cassava planting materials producers is 430 by close of the project in December 2021, meanwhile 362 producers are operational with 15 producing basic planting materials, 66 producing

certified and 277 producing quality declared planting materials. BEST cassava project is implemented in three zones, namely Eastern, Lake and Southern. Eastern zone includes Morogoro, Pwani and Tanga regions whilst Lake zone include Geita, Kagera, Kigoma, Mara and Mwanza regions and Southern zone includes Lindi, Mtwara and Ruvuma regions.

Ideally, the pre-basic producers sell to basic producers who in turn sells to certified producers who then sells to quality declared producers thus supposed to sell to farmers. However due to increased demand and overproduction at one node of productions, sometimes any or all producers sell directly to farmers, lowering end-user price to the advantage of farmers. In addition, according to MEDA there are only five approved cassava varieties in Tanzania, which are zone-wise recommended for cultivation. In the Eastern zone, the recommended varieties are Kiroba and Mkuranga-1, Lake zone are Mkombozi and Mkumba whilst in Southern zone are Chereko, Kiroba and Mkuranga-1. Also, although Zanzibar has not been marked as a separate zone, a variety known as Kizimbani is approved for that side of the country. Also, the built up selling price of cassava cutting are TZS 93 for pre-basic, TZS 88 for basic, TZS 73 for certified and TZS 63 for quality declared planting materials. However, the prevailing market price is TZS 40 per piece which translates to TZS 400 000 per hectare. According to the Association of Cassava Planting Materials Producers, Eastern Zone (CHAWAMBM – MASHARIKI), the price of quality declared planting materials is TZS 40 per cutting or TZS 400 000 per hectare. The packing is as plate depicted below.

Plate 5. 1: Quality Declared Cassava Planting Materials

5.11.2 Respondents' social economic profile

The total number of respondents was 241 with percentages as in Table 5.3 below. Female (49) and male (51), married (86), educated only up to primary school (89), with post primary school education (11), with monthly income below TZS 100 000 (29), income between TZS 100 000 and 300 000 (61) and above TZS 300 000 (10) (Table 5.3). In all four the wards in the three Districts of the two Regions, 100 percent of the respondents were farmers, cultivating cassava, other crops and keeping animals.

Table 5.3: Respondents' social economic profile

Description	Songa Ward	Tongwe Ward	Sumve Ward	Kasisa Ward	Total Number

Sex					
Female	48	40	51	47	49
Male	52	60	49	53	51
Total	100	100	100	100	100
Marital Status					
Married	87	77	89	86	86
Not Married	13	23	11	14	14
Total	100	100	100	100	100
Education					
Up to Primary	93	77	91	88	89
Post Primary	3	23	9	12	11
Total	100	100	100	100	100
Monthly Income (TZS)					
Below 100 000					
100 000 – 200 000	20	51	29	24	29
201 000 – 300 000	69	34	58	73	61
Total	11	15	13	3	10
	100	100	100	100	100

In all four Wards, 100 percent of the respondents were farmers, cultivating cassava, other crops and keeping animals. Other economic activities of the smallholding farmers are fishing, cotton farming animal and poultry keeping at Kisisa and Sumve. At Tongwe, farmers do engage in cultivation of black pepper and fruits whilst at Kwamianga they are producing fruits and rice. Smallholding farmers in all the wards do engage in maize cultivation.

5.11.3 General field survey results

At Kwamianga and Kasisa, the Wards' Extension Officers were Key Informants as they also attended the interviews. The structured interviews were conducted on various aspects of cassava, such as area under cassava cultivation, agronomic costs, attack by diseases and pest, revenue from cassava sales, cassava selling price, industrial demand awareness, getting extension services, need for training, need for capital, farming group membership and credit group membership. Also, it was found that all the respondents consume cassava in different degree and forms though at Kisisa and Sumve cassava is the staple food,

therefore mainly produced for food consumption. At all the Wards cassava is also cultivated as cash crop, sold mainly for making cassava flour.

Moreover, the smallholding farmers also responded on whether they sell cassava on harvesting, in which case 93 percent do sell cassava and 65 percent conduct grading of their crop before selling. About 72 percent of the respondents received marketing information on cassava through various sources such as radio, television and fellow farmers and 67 percent responded that they determine the price of their crop whilst only 33 percent would let buyer determine the price. On awareness of cassava as a commercial crop about 99 percent were aware and as raw materials for industrial production and processing, only 34 percent were aware.

Furthermore, respondents were interviewed on other aspects of cassava cultivation such as use of fertilizers and pesticides, whereas 100 percent of them use neither fertilizers nor pesticides in cassava cultivation and in particular at Tongwe, whereby smallholding farmers adhere to the agreed principle of non-use of industrial manufactured fertilizers and pesticides they rely on manure in cultivation of their crops. Also, only 17 percent of all respondents have received Extension Officers Services (EOS) in cassava cultivation, where at Sumve, 100 percent.; Tongwe 89 percent; Kasisa 80 percent and Kwamianga 52 percent have not received EOS in cassava cultivation. Smallholding farmers were interviewed on cassava and cassava products markets awareness where 75 percent reported that were not aware of any cassava markets other than those within the vicinity of their villages and when vendors visit them to purchase their products.

Table 5.4: Cassava varieties grown in the study areas

Variety Name	Number of Responses	Percentage
Kiroba	76	10.7
Rangimbili	75	10.5
Kikwete	66	9.3
Kikombe	63	8.9
Fuatanyayo	52	7.3
Dakikatatu	42	5.9
Lushika	41	5.8
Ikambula	30	4.2
Kwabanga	29	4.1
Lyongo	28	3.9
Nkamigwa	28	3.9
Ramahogoka	25	3.5
Mwanasili	22	3.1
Other Varieties	134	18.8

In addition, about 42 names of various indigenous and approved varieties of cassava were mentioned from all the four wards (percentage in brackets) with Kiroba (10.7) highly cultivated in Coastal Area followed by Kikombe (9.3) whilst in Lake Victoria Area Rangimbili (10.5), Kikwete (8.9) and Fuatanyayo (7.3) were the highly cultivated varieties (Table 5.4). Also, on the source of planting materials only 1 percent had purchased cassava planting materials whilst 97 percent obtain from their own source which is from previous year and at Kasisa during FGD smallholding farmers revealed that, those who did not have sufficient planting materials during planting season would steal from farms of others since some smallholding farmers cultivate varieties grown which takes up to 18months to be ready for harvesting.

Also, regarding the source of planting materials only 1 percent had purchased cassava planting materials whilst 99 percent obtain from their own source which is from previous year and at Kasisa during FGD smallholding farmers revealed that, those who did not have sufficient planting materials during planting season would steal from farms of others.

Moreover, according to Table 5.5 below, this study found that about 51 percent of the smallholding farmers interviewed cultivate cassava on areas between 1 to 5 hectares (0.4 to 2 ha) and only 49 percent on areas above 2 ha. Also, only about 1 percent incur agronomic costs per hectare of below TZS 100 000.00, about 24 percent pay between TZS 100 000.00 and 200 000.00 whereas about 75 percent incur agronomic costs which are above TZS 200 000.00.

However, comparing with only about 24 percent of the smallholder farmers with monthly household income which is above TZS 200 000.00 and the rest 51 percent incur total agronomic larger than their one-month household income which translates to having to spend 11 months income for a duration of 12 months implying living beyond means. Also, on challenges which they face in cassava cultivation, about 77 percent and 40 percent lacked of training in good agronomic practices and proper planting knowledge respectively and only 27 percent were cassava farmers group members.

Table 5.5: Areas under cassava cultivation and Agronomic costs incurred

Description	Songa Ward (Muheza)	Tongwe Ward (Muheza)	Sumve Ward (Kwimba)	Kasisa Ward (Sengerema)	Total Number

Cassava Cultivation Area (Hectare)					
Less than 1					
1 – 2	4	11	0	0	3
3 – 5	68	60	33	49	48
More than 5	28	29	58	48	45
Total	0	0	9	3	4
	100	100	100	100	100
Agronomic Costs (TZS)					
Below 100 000	7	0	0	0	1
100 000 – 200 000	30	12	14	73	24
201 000 – 300 000	63	83	50	3	54
Above 300 000	0	5	36	24	21
Total	100	100	100	100	100

5.11.4 WTP for clean quality improved cassava planting materials

Up to very recent years cassava planting materials were largely non-marketed goods in Tanzania, thus their commercialisation would be for non-marketed goods congruent to environmental goods as explained by Carson *et al.* (2003) in the case of Exxon Valdez and by Kling *et al.* (2012).

According to Carson (2000), for most environmental goods, WTP distributions will be quite asymmetric with mean WTP larger than median WTP, in part because the income distribution is asymmetric and in part because there is often a sizable part of the population that is fairly indifferent to the environmental good and a smaller group that care a great deal about its provision. Mean WTP is the traditional measure used in benefit-cost analysis, while Median WTP, which corresponds to the flat amount that would receive majority approval, is a standard public choice criterion.

Table 5.6: Amount smallholder farmers were WTP for cassava planting materials

Description	Songa Ward (Muheza) (percent)	Tongwe Ward (Muheza) (percent)	Sumve Ward (Kwimba) (percent)	Kasisa Ward (Sengerema) (percent)	Total Number (percent)
Up to 20 000	11	9	31	35	5
20 001 Up to 40 000	2	44	69	50	24
40 001 Up to 60 000	39	37	0	14	40
60 001 Up to 80 000	13	5	0	1	12
80 001 Up to 100 000	13	0	0	0	21
100 001 Up to 120 000	0	0	0	0	2
120 001 and Above	22	5	0	0	0
Total	100	100	100	100	100

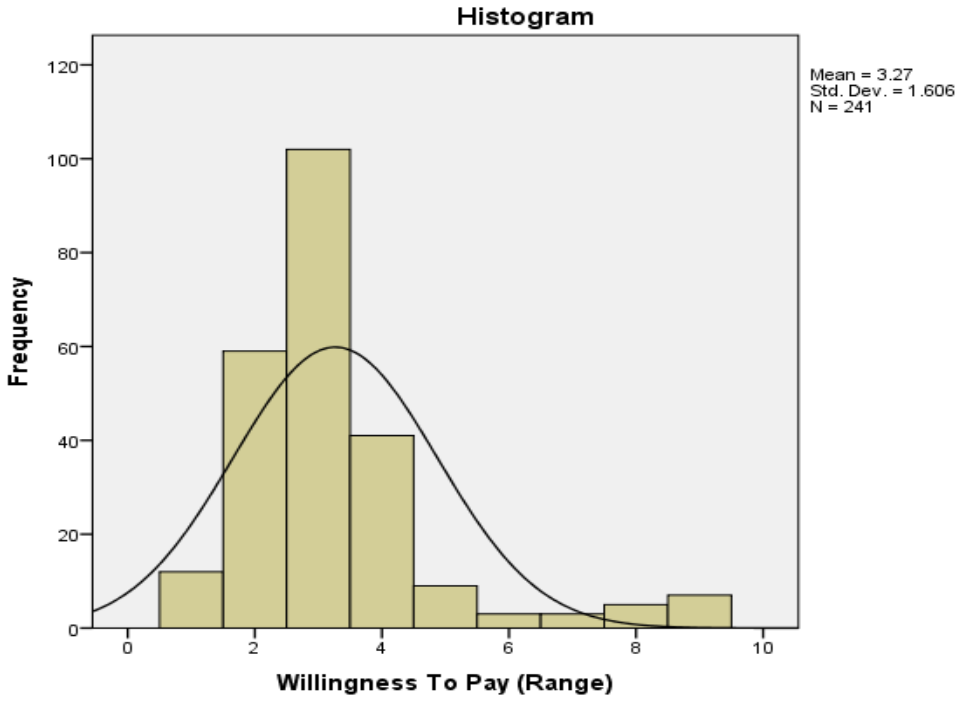

Figure 5.4: WTP Amount – Distributions

In this study, the overall mean WTP was TZS 40 112 per hectare which is larger than the overall median of TZS 25 000 per hectare in line with Carson (2003). Therefore, this study adopted median, in line with the study by Carson (2000) as the measure for WTP for quality improved cassava planting materials when commercially produced. Accordingly, all respondents who would pay TZS 25 000 per hectare and above were considered to be willing to pay for improved cassava planting materials when commercially produced. In consideration of the mean WTP, 70.5 percent of all smallholding interviewed were WTP

and 29.5 NWTP. In addition, farmers in Tongwe were more WTP followed by Songa and Sumve respectively. The least WTP was in Kasisa Ward.

Table 5.7: Amount Smallholder Farmers were WTP for Cassava Planting Materials

Ward	Mean TZS	Median TZS	Minimum TZS	Maximum TZS	Farmers WTP	percent Farmers WTP	percent Farmers NWTP
Tongwe	81 630	60 000	5 000	200 000	32	91	9
Songa	50 143	40 000	20 000	280 000	41	89	11
Kasisa	23 922	25 000	5 000	250 000	41	59	41
Sumve	28 627	25 000	10 000	40 000	57	63	37
Overall	40 112	25 000	5 000	280 000	170	70.5	29.5

5.11.5 Factors influencing smallholder farmers' WTP

Further to establishing the WTP by smallholding farmers for improved cassava planting materials, this study also looked into factors which influence the WTP. Therefore, binary logistic regression was used to assess these factors and the model included the independent variables as indicated in Table 5.8 below, which are sex, age, marital status, education level, household size, household monthly income, farm size, area under cassava cultivation, agronomic costs, attack by diseases and pest, revenue from cassava sales, cassava selling price, industrial demand awareness, getting extension services, need for training, need for capital, farming group membership, credit group membership ward and district.

The p-value of the model was 0.000 indicating that the model was highly significant. Also, the percentage of correctly predicted individual was 70.1 percent implying that the model is well predicting the individual into their respective groups (WTP / NWTP). Hosmer and Lemeshow test of goodness of fit indicated that the model fits well to the data ($p = 0.74$). These results provide confidence to the model results. The results showed that

respondent's sex (p = 0.558), marital status (p = 0.411), education level (p = 0.097), household size (p = 0.180), farm size (p = 0.175), credit group membership (0.925), CMD disease attack (p = 0.232), mealybug pest attack (p = 0.455), green-mite pest attack (p = 0.290) and need for capital (p = 0.102) were not significant factors in influencing WTP. Also, marital status, education level and credit group membership (– β-value) were regressing negatively, which in accordance with variables definition, imply that male would be more WTP than female respondents, also those educated up to primary school only as well as non-members to credit group were more WTP.

Moreover, age (p = 0.043), household monthly income (p = 0.002), area under cassava cultivation (p = 0.006), agronomic cost (p = 0.016), CBSD disease attack (p = 0.037), revenue from cassava (p = 0.013), cassava selling price (p = 0.005), industrial demand awareness (p = 0.012), getting extension services (p = 0.017), need for training (p = 0.000) and farming group membership (p = 0.04) were the significant factors which influenced WTP decisions. In addition, age and area under cassava cultivation had negative β–values, implying the younger the respondents the more WTP they were and respondents with small area under cassava cultivation were more WTP probably due to low total cost which they would incur. In addition, agronomic cost, household monthly income, CBSD attack, revenue from cassava, cassava selling price, industrial demand awareness, getting extension services, need for training and farming group membership had positive β–values, implying that WTP increased with increase in variable quantity.

Furthermore, ward was not significant but districts. Muheza was considered base district with WTP decreasing towards Kwimba and least in Sengerema, implying that there was no significant difference between wards but when Songa and Tongwe were combined, then district was significant. Thus, with Muheza as base district, both Kwimba (β =

-1.215) and Sengerema (β = -1.343) had negative β–values, thus WTP decreased from Muheza to Kwimba and further decreased to Sengerema. The finding showed that 59 percent of respondents at Kasisa Ward were willing to pay for clean quality improved cassava planting materials when commercially produced, 63 percent at Sumve, 89 percent at Songa and 91percent at Tongwe, thus WTP was high at Muheza then Kwimba and lastly Sengerema districts.

The findings are in line with the study by Tolera *et al.* (2014) in which age was significant with younger respondents more WTP; by Mussa (2015), Kasa and Teshome (2015) as well as Dube and Guveya (2016) that the households' monthly income was significant with positive β–value implying that the probability of households with higher monthly income to support the intervention was higher than those with lower incomes.

Due to high significance of the model, it may be inferred that the model was correctly predicted.

Table 5.8: Logistic Regression outcome on WTP for Improved Cassava Seeds

Regressor Description	β	S.E.	Wald	df	Sig.	Exp(β)
Sex	0.241	0.412	.343	1	0.558	1.273

Age	-0.062	0.031	4.096	1	0.043	0.939
Marital Status	-0.486	0.591	.676	1	0.411	0.615
Education Level	-1.221	0.736	2.750	1	0.097	0.227
Household Size	2.800	2.087	1.800	1	0.180	16.443
Household Monthly Income	0.0010	0.001	9.251	1	0.002	1.001
Farm Size	0.293	0.216	1.836	1	0.175	1.341
Area of Cassava Cultivation	-0.833	0.302	7.579	1	0.006	0.435
Agronomic Cost	0.0010	0.0001	5.789	1	0.016	1.001
Attack by CMD	0.718	0.601	1.430	1	0.232	2.051
Attack by CBSD	1.598	0.768	4.331	1	0.037	4.943
Attack by Mealybug	0.469	0.629	0.558	1	0.455	1.599
Attack by Green-mite	0.731	0.690	1.120	1	.290	2.076
Revenue from Cassava Sales	0.0010	.0001	6.159	1	0.013	1.001
Cassava Selling Price	0.0010	.0001	7.692	1	0.005	1.001
Industrial Demand Awareness	3.096	1.228	6.358	1	0.012	22.115
Getting Extension Services	1.663	0.699	5.655	1	0.017	5.273
Need for Training	2.864	0.790	13.141	1	0.000	17.535
Need for Capital	1.075	0.657	2.676	1	0.102	2.930
Faming Group Membership	1.661	.810	4.203	1	0.040	5.263
Credit Group Membership	-0.051	0.540	0.009	1	0.925	0.950
Ward – Songa			7.319	3	0.062	
Ward (1) – Tongwe	3.977	2.384	2.784	1	0.095	53.351
Ward (2) – Sumve	-2.718	1.534	3.137	1	.077	.066
Ward (3) – Kasisa	-2.907	1.574	3.413	1	.065	.055
District – Muheza			7.740	2	0.021	
District (1) – Kwimba	-1.343	0.495	7.370	1	0.007	0.261
District (2) – Sengerema	-1.215	0.502	5.857	1	0.016	0.297
Constant	1.829	1.468	1.553	1	0.213	6.228

p-Value for the model results = 0.000
Cox and Snell R^2 = 0.190
Negelkerke R^2 = 0.270
Hosmer and Lemeshow Test(sign.) = 0.701
Percentage of correctly prediction = 0.740

5.11.6 Challenges in cassava value chain

Findings from the FGDs indicated that availability of market for cassava was a major constraint. Respondents suggested establishment of proper means of dissemination of

cassava related market information. Post-harvest losses were identified as another challenge that smallholding farmers face, resulting to leaving the crop unharvested for long time, sometimes overlapping seasons as a way of storing the crop. Lack of training in good agronomic practices and general extension services in cassava were also identified as challenges facing smallholding cassava farmers. In addition, high cost for cassava planting materials was identified as a major challenge that forces smallholding farmers to use recycled planting materials from their own farms. Cassava disease, particularly CBSD and CMD were identified by smallholding farmers as most important challenge particularly when considering selling their crop since attacks by the disease are frequent on the varieties which they grow. Also, the overall cost of production was identified as another challenge faced by smallholding farmers since.

MEDA identified use of unapproved planting materials, lack of awareness on cassava seed system, obtaining planting materials outside the system, bulkiness of and short post-harvest life for planting materials as challenges facing the value chain. Also, there other challenges which include unwillingness to change mindset on the side of smallholding farmers, disease pressure at some districts such as Ukerewe Mwanza and Mkuranga Pwani, free distribution of planting materials, obtaining isolated sites for planting materials production purpose, low level of seed system adoption and lack of coordinated governance of cassava sub sector of agriculture.

5.12 Conclusion and Recommendations

5.12.1 Conclusion

This study showed that smallholding farmers are willing to pay for improved cassava seeds when commercially produced. However, the amount which smallholding farmers are willing to pay for clean quality improved cassava planting materials of TZS 25 000.00

per hectare is low compared to current market price of TZS 400 000.00. Thus, at present and immediate near future, smallholding cassava farmers will continue to be left out of the formal cassava seed system, since may continue to use and re-use planting materials obtained out formal cassava seed system as found by this study as only 11percent of respondents were using a released variety though outside the formal seed system.

In addition, industrial demand awareness, selling cassava and selling price were factors found to influence smallholding farmers' WTP for clean quality improved cassava planting materials suggesting that cassava commercialization can drive demand for the planting materials which in turn will improve production and yield thereby improve livelihood of the farmers. Also, Muheza District it was found to be more WTP compared Kwimba and lastly Sengerema suggesting high level of awareness of cassava processing and availability of approve cassava variety, Kiroba to have influenced the WTP.

This study is in line with previous studies by Carson *et al.* (2003) and by Kling *et al.* (2012) on minimum amount of WTP and that mean WTP is larger than the median as well as general contingent valuation study. It agrees with studies by Tolera *et al.*, (2014), Mussa (2015), Kasa and Teshome (2015), Walraven (1996), Liebe *et al*. (2011) as well as Dube and Guveya (2016) on factors which influence WTP as well as Silayo *et al.* (2014), that to improve production, utilization and marketing of cassava for sustainable livelihood, intervention entry should be at production node by disseminating diseases-resistant varieties.

In addition, it is in line with MEDA observation that about 90 – 95 percent of the cassava farmers in Tanzania obtains planting materials outside seed system and 5 – 10 percent obtains within a semi seed system. In addition, the research implications of this study are that there is a demand for improved cassava planting materials which creates opportunity for further research into the area whilst the practical implications are the entrepreneurial

opportunity available for investment into commercial production of clean quality improved planting materials and socially the results of this study will increase the knowledge that smallholder farmers are WTP for CQI-CPM.

It may further be concluded that, this study contributes to the body of knowledge that smallholder farmers are ready to use and willing to pay for clean quality improved cassava planting materials when are distributed on commercial setting. Therefore, cassava planting materials could be produced commercially become marketed goods. In addition, the research implications of this study are that there is a demand for clean quality improved cassava planting materials which creates opportunity for further research. The practical implications are the entrepreneurial opportunity available for investment into commercial production of clean quality improved cassava planting materials.

Cassava is a staple food to a section of the population of Tanzania, it is also a food security and cash crop. It is thus recommended that it should be accorded better governance.

5.12.2 Recommendations

Based on findings of this study, it is recommended that an intervention to bridge the gap of TZS 375 000 .00 per hectare between the current producers' price and amount the majority smallholder farmers are WTP be implemented if the smallholder farmers are to access clean quality improved cassava planting materials within a formal cassava seed system. The intervention could be implemented by enabling more entrepreneurs or small to medium enterprises (SME) companies to mass produce the clean quality improved cassava planting materials either by giving grants or soft loans.

It is also recommended that an intervention to provide smallholder cassava farmers with extension services and training on good agronomic practices. It could be implemented by

enabling entrepreneurs and SME companies by giving grants or soft loans so that farmers to be outreached at discounted rates.

In addition, it is recommended that research in cassava be enhanced, intensified and coordinated continuously and sustainably through adequate investment by way of congruent budgetary allocation and not through short lived projects and programs. It is also recommended that a governance framework is put in place and operational such that governance of cassava subsector and the entire value chain be institutionalized, to start with may be in form of Cassava Master Plan.

Cassava is a staple food to a section of the population of Tanzania, it is also a food security and cash crop. It deserves better governance.

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CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

In conclusion, this paper presented findings of assessment of the smallholder farmers' cassava commercialisation awareness and demand for industrial consumption in Coastal and Lake Victoria areas of Tanzania which are that the smallholder farmers are aware of cassava commercialization as they participated in cassava value chain commercial

processes at different levels. All respondents do sale cassava with majority of smallholder farmers in Coastal area do fresh roots wholesale either at farm gate or taking to markets where as in Lake Victoria area, farmers do process cassava into dry form before selling mainly by taking it to local markets. Also, the smallholder farmers are aware of demand for cassava for industrial consumption and are willing to produce for such consumption. In addition, there is an existing and potential demand increase for cassava as raw material for processing and production. The existing and potential cassava demand for industrial consumption is about 1 000 000 tons.

Moreover, this paper concludes that, the study has assessed the supply base of cassava planting materials in the Coastal and Lake Victoria areas of Tanzania and that, about 99 percent of all the respondents obtain planting materials from their own re-cycled stem cutting of previous crop. Despite 1 percent of respondents have purchased the planting materials, all respondents obtain planting materials from non-formal seed system. Also, although there are four approved and released varieties namely Mkombozi and Mkumba for Lake Victoria area and Kiroba and Mkuranga1 for Coastal area, only about 11 percent of the respondents do grow Kiroba, which is also obtained outside the formal cassava seed system. Thus, farmers obtain planting materials from own source.

In addition, the study assessed the cost of planting materials incurred by smallholding farmers in the Coastal and Lake Victoria areas and this paper concludes that the cost of planting materials could not be firmly established from respondents, since only about 1 percent of the respondents had purchased cassava planting materials, nonetheless, an average price of TZS 117 000 per hectare was paid by the respondents. However, according to Association of Cassava Planting Materials Producers, Eastern zone, the price of planting materials per hectare ranges between TZS 135 500 to 160 000. Thus, the cost of cassava planting material in the study area, ranged between TZS117 000 and 160 000.

Also, the study was also undertaken to determine smallholder farmers' WTP for clean quality improved cassava planting materials produced under commercial setting and based on the findings, this paper conclude that smallholder farmers are willing to pay for clean quality improved cassava planting materials when produced as such. However, the amount is smaller compared to what is being charged by seed entrepreneurs. The amount smallholder farmers are WTP was found to be TZS 25 000 which when compared to 160 000 there is a gap of 135 000 that will need to be bridged through an intervention by government, development partners or both.

Furthermore, based on findings, this paper also concludes that, smallholder cassava farmers do not get extension services for the crop, market information timely and only few were members of farming and credit groups. Also, are faced with high agronomical costs compared to household incomes as well as prevalence of cassava diseases and pest. Thus, these findings provide opportunity for further research in areas for cassava varieties which are resistant to diseases and pest as well as short term maturity.

The contribution of this dissertation to the body of knowledge is that it has among others studied the cassava seed system in Tanzania, whereas in accordance with Almekinders (2017) the roots tubers and banana (RTB) seed systems are least studied.

6.2 Recommendations

Based on the findings of the study, this paper recommends that smallholder farmers should be enabled to access lucrative markets beyond their farm gates and local markets through a working linkages network. Also, they should be enabled so that they can carry out immediate post-harvest processing at farmstead as raw cassava roots are perishable.

It is also recommended that smallholder farmers should be organized and form farming groups which will help by providing economies of scale in market access as well getting

assistance. Smallholder farmers should be assisted to form cooperative unions where are non-existent and where they are in existence, the union should not be an exclusion of a particular crop only.

Moreover, the overall recommendations of this paper are that deliberated and concerted efforts should be invested in terms of human resources to develop skills in good agricultural practices in order to make agriculture an employment of choice at smallholding level in general and make cassava a commercial crop of choice. Investment into research and development should be increased.

On the other hand, it is also recommended that a cassava subsector governance framework be well established and put into operation so that all cassava related matters are consolidated and acted upon in coordinated manner. This may be implemented by way of putting up a Cassava Master Plan and or forming a Cassava Governing Board.

APPENDICES

Appendix 1: Questionnaire for the Study

1.0 Introduction

Good morning/afternoon/evening!

My name is ..... from Sokoine University of Agriculture, Morogoro, and I am part of a research team conducting a study Mwanza and Tanga regions on willingness to pay for commercially produced cassava planting material. I would like to assure you that the information that you will reveal in this interview will be used solely for purposes of research, and that your identity as well as your answers will be treated with confidentiality. In answering my questions, please remember that there are no correct or wrong answers. We are just after your honest opinion.

Basic Information:

Name of Respondent: _____

District: _____

Ward: _____

Village: _____

Mobile Number: _____

Email Address: _____

Date: _____Time:_____

2.0 Questionnaire for Assessment of Socio-Economic Profile of Respondent

(Tick which is appropriate)

1. Age: Number of Years …….

2. Gender:

Sex	Code	Tick
Female	1	
Male	2	

3. Marital Status:

Status	Code	Tick
Married	1	
Not Married	0	

4. Education Level:

Level	Code	Tick
Up to Primary	1	
Post Primary	2	

5. Occupation:

Occupation	Code	Tick
Farming	1	
Non-Farming	0	

6. Employment:

Status	Code	Tick
Self-Employed	1	
Others' Employed	2	

7. Farm Size: Number of Hectares ……

8. Household Size: Number of Persons …….

9. Household Income: Amount TZS ……...

10. Contributors:

No of Persons	Code	Tick
1	1	
2	2	
More than 2	3	

3. Questionnaire on Cassava and its Information

11. Do you consume cassava?

Cassava Consumption	Code	Tick
YES	1	
NO	0	

12. What type of processed cassava do you consume?

Type of processed cassava consumed	Code	Tick
Cooked fresh cassava roots	1	
Deep fried fresh cassava roots	2	
Deep fried cassava wafers	3	
Cooked dried cassava chips (Cooked Makopa)	4	
Cassava flour ugali (Bada)	5	
Cassava flour bread / burns (Mkate / Maandazi ya Muhogo)	6	
Cassava leaves vegetable (Kisamvu)	7	

13. Source of cassava consumed:

Source of Cassava Consumed	Code	Tick
Self-grown	1	
Purchased	2	

14. Area under cassava cultivation: Number of Hectares ……

15. Source of cassava planting materials?

Source of Cassava Planting Materials	Code	Tick
Self-grown	1	
Purchased	2	

16. Cost of cassava planting materials per hectare: Amount TZS ……

4. Questionnaire on Cassava Agronomics Awareness

17. Awareness on cassava varieties.

No.	Variety Name	Grown = 1 Not Grown = 0	Production Tons / Sacks
1.			
2.			
3.			

4.			
5.			

18. Awareness on cassava diseases.

No	Disease	Attacked = 1 Not Attacked = 0
1.		
2.		
3.		
4.		
5.		

19. Awareness on cassava pests.

No	Pest	Attacked = 1 Not Attacked = 0
1.		
2.		
3.		
4.		
5.		

20. How many times do you plant cassava per year?

Number of Times	Tick
1	
2	

21. Which month do you plant cassava?

Planting Season	Planting Month
1	
2	

22. How many times do you do weeding before harvesting?

Number of Times	Tick
1	
2	
3	

23. Do you use fertilizer on cassava?

Do you use fertilizers?	Code	Tick
YES	1	
NO	0	

If Yes, how many kilograms of fertilizers per hectare?

Kg/hectare……

24. Do you use pesticides on cassava?

Do you use pesticides?	Code	Tick
YES	1	
NO	0	

If Yes, how many litres of pestcides per hectare? Lt/hectare……

25. Do you get extension services?

Do you receive ES?	Code	Tick
YES	1	
NO	0	

If Yes, how many times per season? Number of Visits……

26. Do you need training of cassava cultivation?

Do you need training?	Code	Tick
YES	1	
NO	0	

27. Agronomic costs for cassava cultivation per hectare: Amount TZS ……

5. Questionnaire on cassava commercial awareness and post-harvest activities

28. Cassava as cash crop for commercialization

Do you know that cassava is also a cash crop	Code	Tick
YES	1	
NO	0	

29. Sell of cassava

Do you sell your cassava?	Code	Tick
YES	1	
NO	0	

30. Selling Mode

How do you sell your cassava?	Code	Tick
Taking it to market	1	
Buyer coming to collect from farm	2	

31. Price determination

Who determines the price of cassava being sold?	Code	Tick
Farmer	1	
Buyer	2	

33. Price of cassava per hectare: Amount TZS ……

34. Cassava as cash crop for export

Do you know that cassava is also a cash crop for export?	Code	Tick
YES	1	
NO	0	

35. Knowledge of Cassava as industrial raw materials

Do you know that cassava is used as industrial raw materials?	Code	Tick
YES	1	
NO	0	

36. Cassava uses as industrial raw materials

What industrial uses of cassava as raw material do you know?	Code	Tick
Processing to produce starch	1	
Construction materials production processes	2	
Production of confectionaries	3	
Pharmaceutical processes and medicine production	4	

37. Production of cassava as industrial raw materials

Would produce cassava if there is a demand as raw materials?	Code	Tick
YES	1	
NO	0	

38. Membership of Farmers' Group

Are you a member of any farmers' group?	**Code**	**Tick**
YES	1	
NO	0	

39. Credit association such as SACCOS

Is there a credit association at your village?	**Code**	**Tick**
YES	1	
NO	0	

40. Membership of Credit association

Are you a member of any credit association?	**Code**	**Tick**
YES	1	
NO	0	

6. Questionnaire on Willingness to Pay (WTP) for clean quality improved cassava planting meterials

41. Source of cassava planting materials

Where from do you obtain cassava planting materials?	**Code**	**Tick**
Own Source	1	
Purchase	2	

42. If purchased how much do you pay per hectare: Amount TZS ……

43. New cassava varieties

If new cassava varieties are available would you try to use them?	**Code**	**Tick**
YES	1	
NO	0	

44. Clean quality improved cassava planting materials

If clean quality improved cassava planting materials are available on commercial basis would pay for them?	**Code**	**Tick**
YES	1	
NO	0	

45. How much would you pay per hectare: Amount TZS ……

46. Receiving quality improved cassava planting materials

How would you like to receive the clean quality improved cassava planting?	**Code**	**Tick**
Ready to plant cuttings	1	
Stems that will be cut at field	2	

47. To improve your cassava cultivation, what would you like to be done?

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Appendix 2: Check List for Key Informant

1.0 Introduction

Good morning/afternoon/evening!

My name is ..... from Sokoine University of Agriculture, Morogoro, and I am part of a research team conducting a study Mwanza and Tanga regions on willingness to pay for commercially produced cassava planting material. I would like to assure you that the information that you will reveal in this interview will be used solely for purposes of research, and that your identity as well as your answers will be treated with confidentiality. In answering my questions, please remember that there are no correct or wrong answers. We are just after your honest opinion

2.0 Personnel Information

Basic Information:

Name of Respondent: _____

Organization: _____

Position: _____

Mobile Number: _____

Email Address: _____

Date: _____ Time:_____

3.0 Involvement in Cassava Subsector

1. Involvement in cassava value chain

How are you involved in cassava value chain?	**Code**	**Tick**
Research and Development	1	
Extension Services	2	
Policy Implementation and Management	3	

2. Cassava varieties

No.	**Variety Name**	**Potential Production Tons / Sacks**
1.		
2.		
3.		
4.		
5.		
6.		
7.		

3. Cassava diseases.

No	**Disease**	**Attacked = 1 Not Attacked = 0**
1.		
2.		
3.		
4.		
5.		

4. Cassava pests.

No	**Pest**	**Attacked = 1 Not Attacked = 0**
1.		
2.		
3.		
4.		
5.		

5. What do you do currently do to improve cassava value chain performance.

_____

_____

_____

_____

6. What need to be done in to make cassava a commercial crop for smallholding farmers.

_____

_____

_____