FACTORS INFLUENCING ADOPTION OF IMPROVED CASSAVA VARIETIES IN INCREASING FARM YIELD. A CASE OF *MAGHARIBI* DISTRICT, ZANZIBAR, TANZANIA

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A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN AGRICULTURAL EDUCATION AND EXTENSION OF SOKOINE UNIVERSITY OF AGRICULTURE.MOROGORO, TANZANIA.

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ABSTRACT

Despite government and other stakeholders efforts to promote improved cassava varieties (ICV) to farmers in *Magharibi*District in Zanzibar, cassava yield is yet below the Tanzania's average of 8 t/ha and the average yield of 14 t/ha of Africa. Cassava Brown Streak Virus (CBSV) and Cassava Mosaic Virus (CMV) are the main causes of the yield losses; hence ICV were developed to address this issue, however, yet adoption of the ICVis poor. Farmers are still using local cassava varieties susceptible to pests and disease. This study is based on literature reviewed, interviews and collected data using semi structured questionnaireto determine factors influencing adoption of ICV in increasing farm yield. A cross sectional survey method was employed for the study. A total of 120 respondents were involved.In this study descriptive statistics tools and binary regression were employed to analyze the data using the Statistical Package for Social Science (SPSS). The study findingsindicated that smallholder farmers had negative attitude towards ICV.The major challenges observed were unavailability of inputs, scarcity of land and lack of training. Socio-economic factors such as age, household size, income, farm sizeand unreliable extension services significantly influenced the adoption of ICV. The study, therefore, concludes that poor adoption towards ICVhad reduced cassava production. The study recommended that the Government through the Ministry of Agriculture Natural Resources, Livestock and Fisheries should support training on the use of IVC. Again, further research needs to be conducted on the aspect of taste and maturity of *Kizimbani* (ICV), strengthen and motivate extension services as well as give support in terms of credit to smallholder farmers.

DECLARATION

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

_____ _____

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(MSc. MAEE - Candidate)

The above declaration is confirmed by;

_____ _____

Prof. JoyceG.Lyimo-Macha Date

(Supervisor)

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DEDICATION

This dissertation is dedicated to the Almighty God, my beloved late father Mr. KassimSalum and my late mother Mrs. Latifa Mohammed who contributed to my survival and laid the foundation of my education. May Almighty God keep their souls in your paradise.

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LIST OF ABBREVIATIONS AND ACRONYMS

ACMV	African Cassava Mosaic Virus
AGRA	Alliance for a Green Revolution in Africa
BEO	Block Extension Officer
CBB	Cassava Bacterial Blight
CBSD	Cassava Brown Streak Disease
CBSV	Cassava Brown Streak Virus
CGM	Cassava Green Mites
CMB	Cassava Mealy Bug
CMV	Cassava Mosaic Virus
EACMV	East African Cassava Mosaic Virus
FAO	Food and Agricultural Organization
FAOSAT	Food and Agricultural Organization Statistics
FDGs	Farmers Group Discussions
ICVs	Improved Cassava Varieties
IFAD	International Fund for Agricultural Development
IITA	International Institute for Tropical Agriculture
KII	Key Informant Interview
LRS	Likert Rating Scale
MANR	Ministry of Agriculture and Natural Resources
MANRLF	Ministry of Agriculture, Natural Resources, Livestock and Fisheries
NBS	National Bureau of Statistics
NRI	Natural Resources Institute
OCGS	Office of Chief Government Statistician

PHC	Population and Housing Census
SACCOS	Savings and Credit Cooperatives Society
SUA	Sokoine University of Agriculture
TARP	Tanzania Agricultural Research Project
TFNC	Tanzania Food and Nutrition Centre
TNBS	Tanzania National Bureau of Statistics
UgV	Ugandan Variant
URT	United Republic of Tanzania
VICOBA	Village Community Bank
ZARI	Zanzibar Agricultural Research Institute

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Cassava (*ManihotesculentaCrantz*)is an important staple food and cash crop in several tropical African countries. Currently cassava is a staple food for more than 200 million Africans and can survive in less fertile soil and in adverse climatic condition with low management (Balagopan, 2000). Cassava is widely grown staple crop in Sub Sahara Africa with a total production of more than 90 million tones which is greater than for any other crops in Africa (FAO, 2001). Around 70 percent of Africa's cassava output is harvested in Nigeria, the Congo and Tanzania (IFAD and FAO, 2000).

Cassava is a drought tolerant crop. It has an ability to grow in poor soils and harsh climatic conditions and makes particularly important in marginal areas that are vulnerable to climate variability and for poor resource farmers. Among the starchy staples, cassava gives a carbohydrate production which is about 40% higher than rice and 25% more than maize, with the result that cassava is the cheapest source of calories for both human nutrition and animal feeding (Tonukari, 2004).

Development and adoption of new agricultural technologies and management systems are central factors for improving productivity and efficiency. The adoption of new agricultural technologies is an important route out of poverty in developing countries (Bandiera and Rasul, 2005). However, the ability to adopt new technologies is a function of many factors that are both internal and external to any social system (Isham, 2000; Byakugila*et al.*,2008). Sometimes agricultural technologies that would improve productivity are not adopted at all or cease to continue soon after donor support ends (Doss, 2006; Byakugila*et*

al., 2008). According to Oladele (2005) agricultural innovations are often adopted slowly and some aspects of the adoption process remain poorly understood. Thus adoption and continual use of innovations/technologies remains the main challenge for agricultural productivity improvement.

Several initiatives have been employed by different cassava stakeholders to curb Cassava Brown Streak Virus (CBSV) and Cassava Mosaic Virus (CMV) problem. For example, collaborative research and conventional breeding work between Tanzania Agricultural Research Institutes, IITA and International Center for Tropical Agriculture have developed some new cassava varieties to address this disease. For the case of Zanzibar, Alliance for a Green Revolution in Africa (AGRA) operates a continuous "searchlight" function that analyzes how African farmers lose crop yields because of poor-performing crop varieties and then supports breeding programs to address those yield losses. Most of these breeding initiatives are implemented by breeders working within their own country's agricultural research institutes, where AGRA funding of operational costs is matched by government funding of fixed costs.

1.2 ProblemStatement

Tanzania's average cassava fresh root yield is about 8 t/ha (FAO, 2001). This is well below the continent's average of 10 t/ha and the average yield of 14 t/ha of Africa's (and the world's) largest producer, Nigeria. This yield gap is caused by many factors including genetically low yielding potential of local varieties, existence of abiotic stress factors (low soil fertility, drought and weed infestations) and biotic stresses (Mkamilo and Jeremiah, 2005). Biotic stresses include susceptibility of the commonly grown varieties to major diseases and pests such as cassava mosaic diseases, caused principally by the East African Cassava Mosaic Virus (EACMV), its Ugandan variant (UgV), and the African Cassava

Mosaic Virus (ACMV), Cassava Brown Streak Disease (CBSD), Cassava Bacterial Blight (CBB), Cassava Green Mite (CGM), Cassava Mealy Bug (CMB) and Nematodes. Previous research reported as high as 55% loss in the local cultivar 'Albert' (Mtunda, pers. Communication) due to Cassava Brown Streak Disease. A survey in Tanga, Tanzania has revealed crop losses up to 74% (Muhanna and Mtunda, 2002) due to Cassava BrownStreak Disease.

Several initiatives have been taken by the Zanzibar Agricultural Research Institute (ZARI) and the Ministry of Agriculture and Natural Resources (MANR) on sensitization of new Improved Cassava Varieties (ICVs) through farmers training, workshops, and with the assistance from Alliance for a Green Revolution in Africa (AGRA) in the supply of cassava improved planting materials to farmers.

However, despite all the efforts that have been made there is still poor adoption of the improved cassava varieties, farmers did not change and they are still using their local planting materials which are susceptible to pests and disease. Low adoption of the technologies is among the reasons for low impact of improved technologies (Michelles, 2005). From potential of more than 500 000 farmers in Zanzibar whom Improve Cassava Varieties has been distributed with, only some 10 000 farmers are currently growing these new varieties (ZARI MANR, 2008). It is on this ground that there is a need to study and find out what factors influence low adoption of improved cassava varieties and to come up with recommendations that will enhance more farmers to use the recommended cassava variety for the wellbeing of their livelihood in *Magharibi*District.

1.3 Justification

Findings from this study will empower farmers to have current knowledge and use effective methods of improving cassava productivity in small holder farmers in

*Magharibi*District. The result obtained will build the capacity of the farmers in making right decisions concerning use of improved varieties, by doing so it will enable them to improve food security of their household, also research findings will build a base for policy makers and other relevant authorities to come up with new strategies to enable farmers engaged in cassava production through adoption of improved cassava varieties. Also the Government will minimize the costs of importing and acquire food aid. Furthermore, the findings from this study will be used by extension personnel to mobilize farmers and to attain recommended knowledge, skills, and change their attitude towards the adoption of improved cassava varieties, methods of cassava farming and marketing. As a result, this will increase the productivity of cassava and lead to sustainable food production which will enable them to be food secure.

1.3 Objectives

1.3.1 Overall objective

The overall objective of the study was to determine factors influencing adoption of improved cassava varieties in increasing farm yieldin *Magharibi* District in Zanzibar.

1.3.2 Specific objectives

i. To identify cassava varieties grown by farmers in the study area.

ii. To determine knowledge, attitude and practices used by farmers.

iii. To determine whether socio-economic factors are responsible in influencing the adoption of improved cassava varieties by farmers.

iv. To assess the amount of yield obtained by small holder farmers engaged in production of improved cassava varieties.

1.3.3 Research questions

i. Which cassava varieties are grown by farmers in the study area?

ii. What are the knowledge level, attitude and skills of the farmers?

iii. Which factors influence adoption?

iv. How much yield farmers get from improved cassava varieties?

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Definition of Key Concepts

2.1.1 Adoption

Mitropoulos and Tatum (2000) have defined adoption as a process by which an individual or organization identifies and implements a new technology. In this study adoption is defined as a number of farmers who have adopted improved technologies. On other hand, adoption refers as process which starts from awareness to continued use of the innovation; the process has been explained to results into poor relationship between intention and behavior of adoption (Gollwitzer, 1999;Doss, 2003), who conducted a study on farm-level technology adoption in eastern Africa, came with distinction between discrete and continuous technology adopters among typical farmers who use either unimproved or improved inputs. The author defines a farmer as being an adopter if he or she is found to be using any improved materials. With respect to the adoption of improved varieties, discrete adoption refers to a farmer who stops using a local (traditional) variety and adopts an improved variety. In contrast, continuous adoption refers to situations where farmers increasingly planting more land to improved varieties, while continuing to grow some local varieties (Lopes, 2010).

2.1.2 Technology

Technology is a body of knowledge used to create tools, develop skills and extract or collect materials. In addition, technology is the making modification usage and knowledge of tools, machines, crafts, systems, and methods of organization in order to solve a problem, improve a pre-existing solution to a problem, achieve a goal, handle an applied input/output relation or perform a specific function (Liddell *et al*., 2000). Technology is

also assumed to mean a new, scientifically derived, often complex input supplied to farmers by organizations with deep technical expertise. Neill and Lee (2001) cited by Parvan (2010) point out that majority of existing literature on agricultural technology adopted is focused on Green Revolution (GR) technologies such as irrigation, fertilizers used, and the patterns of high-yield variety (HYV) seeds.

2.2Status of Cassava Production in Tanzania

Cassava production in Tanzania is estimated at 7 million metric tonnes (mt) per annum. It is mainly a subsistence crop where 84% of its total production is used for human food, making it second after maize in importance as food crop. The remaining amount is for other uses such as animal feed, alcohol brewing and starch production. Cassava is identified as one of the emerging market oriented commodities that could contribute to improve the livelihood of small holder farmers in the country (NRI, 2011; TFNC, 2012). Areas of cassava production in Tanzania include Zanzibar, Mtwara, Morogoro, Lake and Coastal zones. Cassava produces remarkable quantities of energy per day, even in comparison to cereals. In Tanzania according to FAOSTAT (2001), cassava produces about 409 calories per person per day.

2.3Agricultural Extension Services

Agricultural extension includes the provision of farmers with knowledge, information, experiences and technologies needed to increase and sustain productivity and for improved wellbeing and livelihoods (NRI, 2011). Delivery of quality agricultural extension services in Tanzania has been a centre of attention for a long time. Given the fact that the majority of Tanzanians (more than two thirds) live in rural areas and depend on small-scale agriculture for their livelihood and employment (URT, 2006), the Government's efforts have been geared towards improving production and productivity so as to attain self-food

sufficient at household and national level. These efforts are in line with the targets of the National Development Vision 2025 which envisages achieving a high quality livelihood through, among other things, food self-sufficiency and food security (URT, 1996).

2.4Role of Agricultural Extension

Agricultural extension is being used to enhance the improvement of food security in rural development programmes in many developing countries (Ison and Russeli, 2000; Rivera and Qamar, 2003). Extension organizations help to devise strategies that will help the achievement of such development programmes (Peterson, 1997). Agricultural extension is extremely important in helping confront the problems of availability, access and utilization of food (Rivera and Qamar, 2003). Extension can help to enhance the productivity and hence the production of food (Rivera andQamar, 2003). Extension can assist in providing opportunities for income generation and it generally provides improvement in nutritional advice, through home economics programmes. This led to improved nutritional intake and enhanced income generation to farmers.

2.5The Concept of Adoption of Agricultural Technologies

The use of agricultural innovations by farmers can be understood from the perspective of diffusion of innovations whereby innovations generated by agricultural research are passed to farmers through extension agents (TARP II SUA, 2005). Thus, in this process agricultural research is the source of innovation or change and farmers are its recipients. Moreover farmer's rationality is either adoption or rejection of innovation, which are seen as the outcome of an innovation-decision process. According to Rogers (1995) the innovation decision process can lead either to adoption, a decision to make full use of an innovation as a best course of action available, or rejection a decision not to adopt an innovation.

2.6 Adoption Process

The intensity of adoption refers to the level of use of a given technology, during any particular time period (Feder*et al.,* 1985). The intensity of adoption can be measured at individual farm level or at region level, during a given time period by the amount or share of farm area utilizing the technology, or by per hectare quantity of impact used, where applicable (Feder*et al.,* 1985). In the case of cassava technology, the number of hectare planted can be referred to as the "intensity of adoption" and this happened after the following adoption stages have taken place. However, many of the conventional extension approaches in Tanzania have received criticism for being limited to demonstration of technologies, limited use of farmer's knowledge and using the already packaged information (Mattee, 1994). Agricultural extension services help to educate farmers and assist to solve their own problems and thereby adopt improving farming technologies and increase production.

2.7Adoption of Agricultural Technologies

According to Oladele (2005), the importance of farmer's adoption of new agricultural technology has long been the interest to agricultural extensionist and economists. Several parameters have been identified as influencing the adoption behaviour of farmers from qualitative and quantitative models for the exploration of the subject (Feder and Umali, 1993).Social scientist investigating farmers adoption behaviour has accumulated considerable evidence showing that demographic variables, technology characteristics, information sources, knowledge, awareness, attitude and group influence affects adoption behaviour (Oladele, 2005).

2.8Studies in Adoption of Varieties

Earlier studies byDorp and Rulkens (1993), Agwu (2002), Springer *et al.*(2002) and Kimenju*et al.* (2005) show that farmers decisionto use particular crop cultivars were

influenced by anumber of reasons, some of which are market-driven orsocio-culturally based. This work, therefore, sought todetermine the level of use of improved and local cassavacultivars among farmers in Nnewi South Local GovernmentArea of Anambra State, Nigeria.Kavia*et al*. (2007) reported that among majorchallenges hamper the adoption trend in cassava growing area of Tanzania Lake Zone include the lack of information and skills from new technologies, availability of ICVand cassava diseases.

2.9 Categories of Adopters

Adoption studies identified and described five categories of adopters in a social system. The categories included innovators, early adopters, early majority, late majority, and laggards (Mosler*et al.,* 2001; Rogers, 1995). Furthermore, Rogers pointed out that majority of early adopters are expected to be younger, more educated venturesome and willing to take risk. In contrary to this group the late adopters are expected to be older, less educated, conservative and not willing to take risks. However, a study by Rundquist (1984) cited by Kotu*et al*. (2000) noted that the practical aspect of the classification of adopters into five categories (innovators, early adopters, early majority, late majority and laggards) is relevant to deliberate or planned introduction of innovation.

2.10 Theoretical Orientation and Conceptual Framework

For this study, the conceptual framework will base on the assumption that, for effective adoption to take place it will be influenced by several factors including, socio-economic factors such as income, sex, farm size, education level, exposure to information communication, institutional factors such as availability of input, access to extension services, inputs availability, infrastructures such as transport availability, access to market information, access to farm equipment, policy factors such as extension approaches, extension delivery systems and also organizational factors such as farm size, land tenure,

labour availability. Therefore the absence or lack of the mentioned factors may lead into poor and slow adoption process to take place among farmers. Hence, from the above explanation about conceptual framework, it is now clear that the main pivot for this study is the adoption of improved cassava varieties being the output expected as a dependent variable and the above mentioned factors are the independent variables that are used to influence adoption as inputs. This idea is summarized in Fig.1.

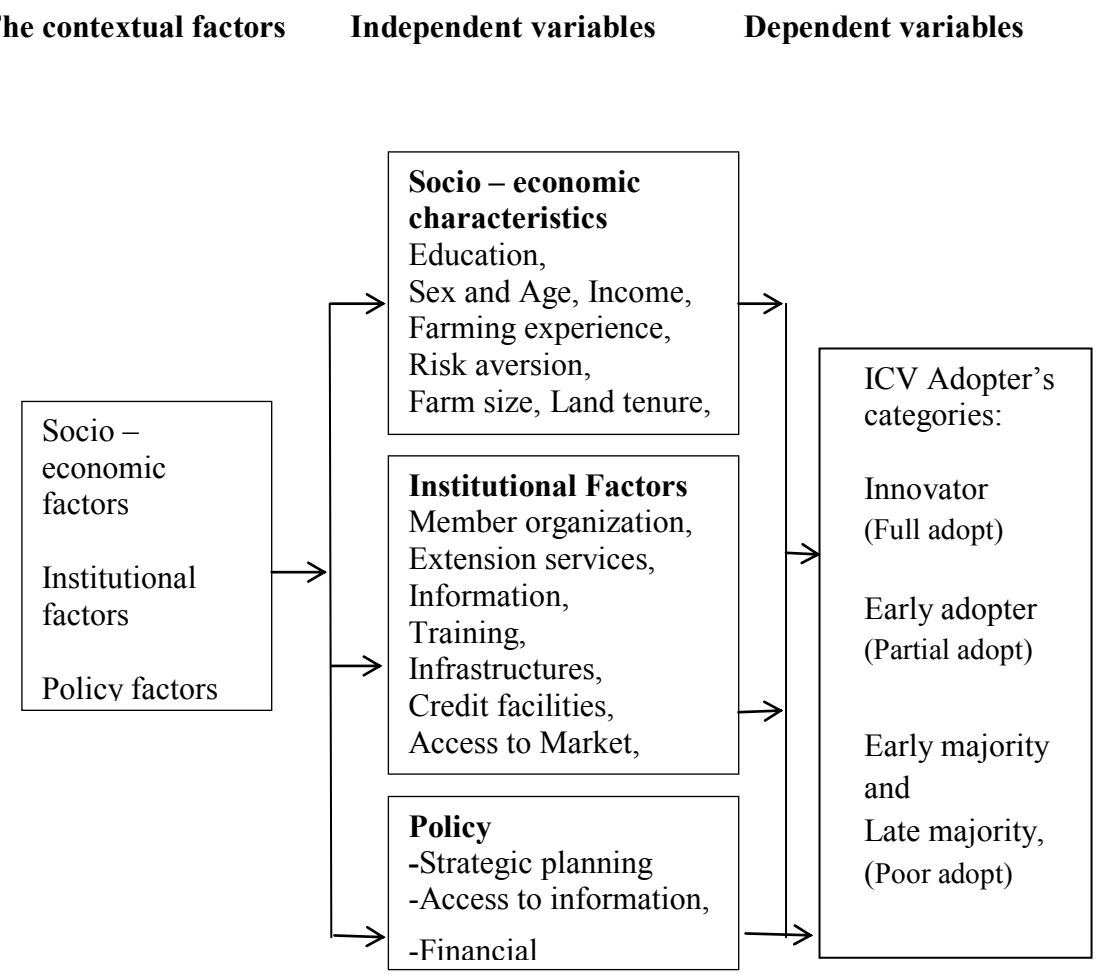

Figure 1: Conceptual framework

CHAPTER THREE

3.0 METHODOLOGY

3.1 Description of the Study Area

The study was carried out in Zanzibar,*Magharibi* District.The District is bordered to the north by North Region, to the east by Central/South Region, to the south by Kiwani Bay, and to the west Urban District, Fig. 2. Its population is estimated to be about 370 645 with total land area of 208 km² (NBS, 2012). The study area has been selected purposively for the reason thatmajority (90%) of its household are smallholder farmers and Cassava being their major food crop that occupies the largest area (NSCACS, 2012). Other activities for the community in the District include crops and livestock production and fishing.

Climate

*Magharibi*District is dominated by bimodal rainfall patterns. There is a long rainy season which starts from March and ends in June with an average of 900 -1 000 mm. In the District, the erratic short rains start from October through December with the average of 400 – 500 mm of rainfall. The average temperature of *Magharibi* District is around 25^{o} C and rises up to 30 ^{o} C (June to September), (NBS and OCGS, 2008).

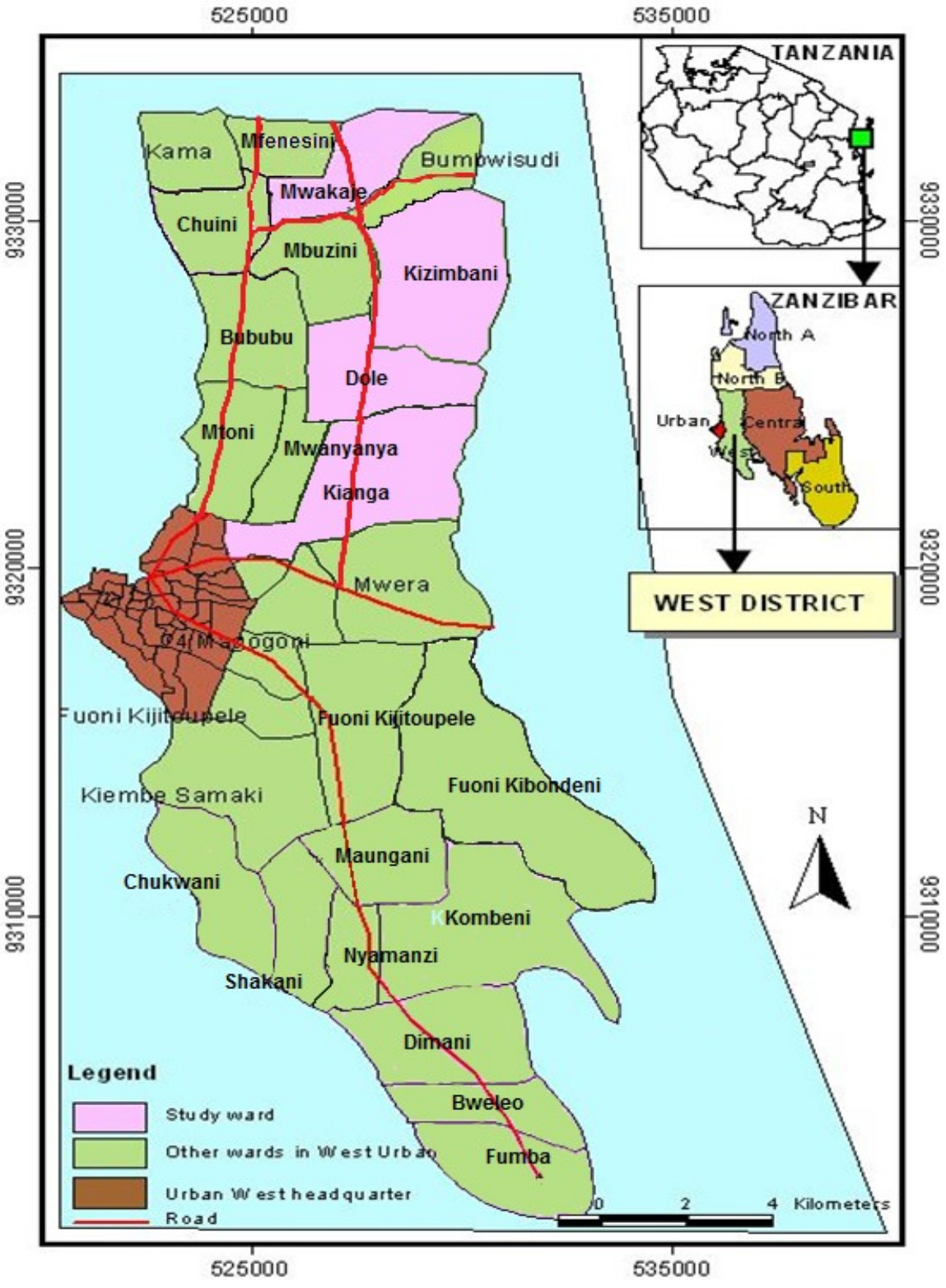

Figure 2: Map of geographical location of study area

3.2 Research Design

The study employed a cross-sectional research design. It was used on the basis that it allows collection of data to be at one point at a time from a sample selected. The kind of design can be used to describe, explain and draw inferences of population (Olsen and George, 2004) using descriptive study.

3.3.1 Study population and sampling frame

The study was conducted in the rural areas where four *Shehia* in *Magharibi* District (Kianga, Dole, Kizimbani and Mwakaje) were purposivelyselected due toconcentration of cassava farming. Again, in these areas the Alliance for a Green Revolution in Africa (AGRA) distributed improved cassava planting materials to poor farmers. The sampling frame included cassava farmers growing local and improved cassava varieties, trained and untrained farmers on Improved Cassava Varieties (ICV's) from four *Shehia.*

3.3.2 Samplingprocedure and sample size

A multi stage sampling techniques was employed, in the first stage, four *Shehia* involved in cassava production were purposivelyselected out of 39 *Shehia* in the district. The second stage was selection of two villages in each *Shehia* using simple random sampling technique. Third stage fifteen respondents were randomly selected from each village; these were then stratified to get trained and untrainedon Improved Cassava Varieties to have a sample size of 120 (78 males and 42 females) respondents. This wasbased on the list of cassava farmers from resident's registers at the respective *Shehia*/Villages.Matata*et al.* (2001) argued that having 80 - 120 respondents are adequate for most socio-economic studies in Sub-Saharan Africa household.

3.4 Data Collection

Primary data were collected using household questionnaire andchecklists were used for Focus Group Discussion and interview of key informants.

3.4.1 Primary data

Primary data were collected through field observation,a structured questionnaire administered to the 120 respondents. Structured questionnaire was designed in a set of open and close ended questions in respect to all four specific objectives. Checklist was administered for focus group discussion and interview of key informants.

3.4.2 Focus group discussions

FGDs were used to collect primary data.20 participants were involvedin making 4 groupsone from each *Shehia* in the directed discussions. Each group had 5 participants(including 1 to 2 females) who were purposivelyselected among cassava producers(2 adopters and 3 non-adopters) in order to make collection of qualitative data easier. The rationale for the choice of focus group discussion method was that it helped to capture in-depth information. The focus group discussion created a situation in which participants were more willing to disclose information on cassava production and their related challenges.

3.4.3 Key informant interviews

Key informants (KIs) interview were used to collect primary data. Key informants were composed of all 4 ward extension staff, 4 Local leaders one from each *Shehia* in the study area respectively, one District SMS and one Research officer from ZARI to make a total number of 10 KIs in the discussions in ordertoobtain their opinion on improved cassava varieties, adoption, challenges, and also to cross check what was collected during focus group discussions.

3.4.4Secondary data

Secondary data were collected through reviewing documents, reports, from the district agricultural office, Zanzibar Agricultural Research Institute and from the Ministry of Agriculture and Natural Resources documents. The use of this information is to substantiate and augment the information/data gathered from the other sources (Creswell, 2003).

3.5 Data Analysis

Quantitativedata collected were coded, summarized and then analyzed using statistical package for social science (SPSS) version 16.0, a computer program for quantitative data analysis. In this package, descriptive statistics such as mean, mode, frequency and percentage was used to analyze specific objectives number 1, 2, and 4. Attitude of farmers towards improved cassava varieties were judged using*Likert Scaling rating*. *Likert*rates used were strongly agree, agree, undecided/neutral, disagree and strongly disagree.Specific objective number 3 were analyzed using binary regression analysis. The symbolic expression of the model is stated as:

In $Y = \beta_1X_1+\beta_2X2+\beta_3X_3+\beta_4X4+\ldots\ldots\ldots\ldots\ldots +\varepsilon_i$

Where by;$\beta_1\ldots\ldots\ldots\ldots\beta_6$ = Constants

Variable	**Description**
Y	Rate of adoption of cassava varieties(0 = Not adopted, 1 = Adopted)
X_1	Sex (0=female, 1=male)
X_2	Age (years)
X_3	Education level (0=no formal education, 1=formal education)

X4	Household size
X5	Total income earning per annum (Tshs)
X6	Farm size (hectares)

Qualitative data

Qualitative data from focus group discussion and key informantswere analyzed using content analysis. The analysis focus on the meaning of statements given by the respondents depending on the theme of the study werethen sorted and coded on the basis of their similarity in meaning to give relevant and appropriate conclusions and this was done in order to validate the information obtained from questionnaires. There was no serious limitation encountered during performing of this study. However, some few shortfalls were experienced with people who were rigid and took time before they agreed to provide the required information. Based on the nature of questions, the discussions was long because farmers were free to express their views hence, it was not possible to stop during discussion.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSIONS

In this chapter results were discussed with help of tables, figures and statistical data to have clear, statistical approved information from this study.

4.1 Characteristics of Respondents

The most important demographic characteristics dealt with were: sex, age, and marital status, level of education, household size, major occupation, income per annum and farm size. Findings are presented in Table 1.

4.1.1 Sex

Sex is essential characteristic on adoption of improved cassava varieties. The implication of sex of respondents in the study is that at household level, when we compare men and women who were engaged in cassava production; men seem to be engaged in more activities than women. Regarding sex of the respondents, as presentedin Table 1, it is revealed that more than half (65.0%) of the respondents were males,and 35.0%werefemales.This implies that males dominated in cassavaproduction. This was probably because most of the land for cassava production is under the ownership of men.

4.1.2 Age

This is important to know about the age distribution in a population because most of the demographic events that determine population dynamics such as birth, death, dependency ratio and mobility are highly associated with the age variable. Physical strength depends also on age. Therefore, performance of economic activities can be influenced by age of a person. According to findings presented in Table 1, many(38.3%) of the respondents were

adults ranging between 36 and 45 years old, while 34.2% of the respondents were between 46 and 55 years old, also 20.0% of the respondents were between 20 and 35 years of age and only few 7.5% were 56 years of age and above. This implies that most of the farmers engaged in cassava farming were youth (20 -35 years old) and middle age people. The effect of age on the adoption of improved cassava varieties could be negative or positive. The age of farmers could contribute to how new ideas are perceived and could thereby influence adoption (Bekele and Drake, 2003).

4.1.3 Marital status

In this study the respondents were asked to indicate their marital status. The category used to classify the status of respondents were single, married, divorced and widow. Marital status is an institutional factor that has great influence on family matters. The results obtained shows that majority (86.7%) of the respondents who were engaged in cassava production were married, followed by respondents who are single 26.7%, divorced 4.1% and widowed who were 2.5% (Table 1). These results suggest that married respondents dominated in cassava production probably due to the fact that they had households' responsibilities hence, income obtained from cassava is important for alleviating household income and improving household food security. On the other hand Van den Ban and Hawkins (1996) contend that married couples tend to share experience of technologies. Therefore, their engagement in cassava production was conceived to be means of livelihood to sustain their families.

Table 1: Characteristics of respondents (n=120)

Variable	Frequency	Percent
Sex		
Female	42	35.0
Male	78	65.0
Total	**120**	**100**
Age (yrs)		
20 – 35	24	20.0
36 – 45	46	38.3
46 – 55	41	34.2
56 and above	9	7.5
Total	**120**	**100**
Marital status		
Single	8	26.7
Married	104	86.7
Divorced	5	4.1
Widowed	3	2.5
Total	**120**	**100**
Education level		
No formal education		
Primary education	7	5.8
Secondary education	45	37.5
Tertiary education	67	55,8
Total	1	0.8
Household size	**120**	**99.9**
Less than 2	6	5.0
2-5	96	80.0
6 and above	20	18.0
Total	**120**	**100**
Household annual income		
Less than 100 000Tsh	110	91.7
100 001 to 300000 Tsh	10	8.3
Total	**120**	**100**
Farm size		
Less than 1 hectare	104	86.7
1 hectare	7	5.8
2 hectare	4	3.3
3 hectare	5	4.2
Total	**120**	**100**

4.1.4 Education level

In terms of education background, about 55.8% of the respondents had secondary education, followed by primary education (37.5%) and non-formal education (5.8%). Only 0.8% of the respondents had tertiary education. This implies that majority of the respondents engaged in cassava production in the study area were literate and are capable for adopting new improved cassava varieties. Education has been found to have a positive and direct influence on adoption of technologies (Oluoch-Kosura*et al.*, 2004). In other words, education could increase the ability of farmers to use their resources efficiently, while giving them leverage on effective information diagnosis, analysis, and interpretation. Hall and Khan (2003) showed that education was positive and significantly associated with adoption level. Therefore, it is expected to positively influence adoption of improved cassava varieties.

4.1.5 Household size

Household size was determined by considering all members who were present in each household including parents, children and other dependents. The results presented in Table 1 showed that the household category with household size of 2-5persons had the highest percentage (80.0%) of the respondentsand only few (5.0%) of therespondents had households size of less than 2 people. Most of cassava smallholder farmers had an average of household size of 5 people, which similar to the average household size of 5 people of the Zanzibar Island (NBS, 2012).

4.1.6 Major occupation

The study shows that all respondents interviewed stated that agriculture in terms of crop productionwere their main occupation. This is implication that they dedicate their time in

cassava production. Full time farmers were expected to have positive or negative influence on the adoption of improved cassava varieties.

4.1.7 Household income per annum

Findings from the study indicated that majority(91.7%) of the farmers who wereengaged in cassava production earned income about 100 000Tshs per annum and the remaining 8.3% of the farmer earn between 100 000and 300000 Tshs. The study also indicated that 33.3% of the respondents who do not grow recommended improved cassava variety only few (0.83%) earned income of between 100000 and 300000 Tshs per annum. Farmers who are well off can afford the price of new improved technology than low income farmers (Rogers, 2003). Many studies report positive contribution of income to household'sadoption of recommended agricultural practices like use of improved seed varieties,fertilizers application, spacing, weeding, and pest management. For instance, differentrecommended agricultural practices adoption studies conducted by Kidane (2001)indicated positive relationship between income and adoption of recommended agriculturalpractices.This result indicated that household income has influence in the adoption of improved cassava variety.

4.1.8 Farm size

The result obtained on the farm size of the respondents shows that, majority (86.7%)of the respondents had a land holding less than a hectare, with only few 4.2% of the respondents cultivating threeor more hectares of land.Those farmers who have larger land are likely to practice improved technology than the landless farmers (Samson 2007). From the analysis, majority of the cassava farmers in the study area engages more in small scale production hence they are smallholder farmers.

4.1.9 Farmers experience in cassava production

Most (78.3%) of the respondents indicated that they have been in farming activities for quite some period of time and are not novice in farming activities especially in cassava production.This indicated that study sample was composed of experienced farmers including those who were reluctant to change towards the use of ICV.

4.2 Cassava Varieties Grown by Farmers

The findings from the study indicated that 66.7% of the respondents grow improved cassava varieties and 33.3% of the respondents grow local cassava varieties. The varieties were more promising in yield, planting material and disease resistance. However, the study also shows that 45.0% of the respondents grow improved cassava variety only where as 21.7% of the respondents they mixed improved cassava varieties and other local varieties and the rest (33.3%) of the respondents interviewed they grow other local cassava varieties only.For the case of preference, the study findings show that more than half (59.2%) of the respondents preferred Kizimbani cassava variety which is improved, and the rest (40.8%)of the respondents preferred local cassava varieties as shown in Table 3. The main reasons for their preference were business for Kizimbani cassava variety and sweet taste, early maturity and yield for the localcassava varieties respectively. The finding was consistent with findings by Agwu and Anyaeche (2007)who noted that farmers' adoption of improved cassava varieties could be determined by the extent to which they possess desirable qualities. Such qualities could include high yield, enhanced shelf life, ease of harvest, colour of peeled tuber, early maturity, pests and disease resistance and ability to suppress weeds. Thus, varieties that are not desirable to farmers might not be adopted. This is the reason why the farmers in the area are still cultivating the local cassava varieties.However, there is no farmer who grew more than one variety of the same category at the same time.

Table 2: Farmer's preferences on Cassava Varieties (n=120)

Cassava varieties	n	%
Kizimbani	71	59.2
Mwari	11	9.2
Mwafaka	11	9.2
Sepideh	8	6.6
Joya	19	15.8
Total	**120**	**100**

Farmer's reasons for the cassava varieties grown

The findings from the study reveal that majority (76.2%) of the farmerswho adopted the improved cassava varieties said that high yield were the reason that made them grew the variety, whereas 22.5% and 1.3% of the respondents said availability of planting materials and resistance to pests and diseases respectively were the reasons that made them grow the varieties.

For non-adopters of improved cassava varieties the majority (92.5%) of the farmer interviewed stated that easy available of planting materials were the reason that made them grew the variety, and the rest of the respondents stated that resistant to pests and diseases were the reasons which drive them to make that choice. This implication is consistent with findings from Nigeria, Agwu and Anyaeche (2007) noted that farmers' adoption of improved cassava varieties could be determined by the extent to which they possess desirable qualities. Varieties characteristics play a vital role in influencing farmer's adoption behavior. If thecharacteristics satisfy the need and interest of the farmers they will adopt (Tadesse, 2008).Findings are shown in Table 3.

4.3 Knowledge on Improved Cassava Varieties

To determine the knowledge of respondents on improved cassava variety production, the majority (81.7%) of the respondents indicated that they do not have the knowledge and

only few (18.3%) of the respondents said they do have knowledge on good agronomic practices on improved cassava varieties production. Implication of this is that inadequate information on availability of innovations could limit farmers' adoption. According to Oni (2009) various technologies forincreasing agricultural production have beendeveloped and imported into the country but lackof awareness on such technologies by farmershave hindered their adoption.

Table 3: Distribution of farmers by reasons of growing cassava varieties (n = 120)

Category	ICVs&Local varieties	ICV	Local varieties	n	%
Adopter					
Resistant to pests and diseases	5	1	-	6	7.5
Availability of planting materials	21	13	-	34	42.5
High yield		40		40	50.0
Non-adopters					
Resistant to pests and diseases	-	-	3	3	7.5
Availability of planting materials			37	37	92.5
Total				**120**	**100**

4.3.1 Farmer's perception on knowledge towards improved cassava variety

Study findings revealed that most (70.0%) of the respondents are not aware or do not know there are knowledge and skills on improved cassava variety. They were not aware because the knowledgeon improved varieties was obtained through training. However, 12.5% of the respondents were aware of that knowledge but they were not given opportunity to attend the training, and onlyfew (17.5%) of the respondents have theknowledge on improved cassava varieties through training.Awareness or exposure to agricultural technologies through information either from extension agents, mass media, or mobile phone has been identified as one of the vital determinants of technology adoption

(Diagne and Demont, 2007; Dontstop – Nguezet*et al*., 2011). Certainly the adoption of ICVs is not likely to be possible if the farmers are not aware of or exposed to ICVs through access to information, shown in Table 4.

Table 4: Distribution of farmers' awareness and training (n = 120)

Knowledge	ICV & Local	ICV	Local variety	n	%
Trained	9	11	1	21	17.5
Aware, not trained	-	11	4	15	12.5
Not aware or trained	17	12	35	84	70.0
Total				**120**	**100**

4.3.2 Farmer's practices on cassava production

The findings of the study shows that more than half (55.0%) of the respondents do not use ICV, improved recommended planting spacing, fertilizer, disease and pest control measures. Whereas 20.0% of the respondents do not grow ICV, or follow recommended spacing, and fertilizer and few (6.7%) of the respondents grew local cassava varieties locally usingpoor agronomic practices and this makes a total (81.7%)of the farmers whogrew cassava using less productive agronomic practices. Only few (18.3%)of the respondents grew cassava according to recommendations as shown in Table 5.This impliesthat respondents had limited contact with extension agents or access to extension services.The findings are in line with the findings by Bamire*et al*. (2002),who in their study noted that a one-unit increase in access to extensionservices increases the probability of adoption by about0.02.Mazvimavi*et al*.(2009) also found that the validity ofextension activities is a key factor in promoting the uptakeof new technologies.

Table 5:Distribution of farmers based on their agronomic practices(n = 120)

Practices	ICV and Local	ICV	Local only	n	%
All agronomic practices	9	11	2	22	18.3
Land fertility, disease and pests control measures	-	6	2	8	6.7
Recommended plant spacing ,land fertility disease and pest control measure	14	20	32	66	55.0
Recommended spacing, and land fertility	3	17	4	24	20.0
Total				**120**	**100**

4.3.3 Socio-economic factors influencing adoption of improved cassava varieties in the study area

Table6 shows that Wald statistics are non-zero values, which implies that there is interaction between the dependent and independent variables. According to Norusis (1990) and Powers and Xie (2000), the non-zero Wald statistic values indicate the presence of relationships between the dependent and explanatory variables. Thus, on the basis of the results of this study the null hypothesis was rejected in favour of the alternative hypothesis that socio-economic (income, market and preferences) factors significantly influence the rate of adoption of improved cassava varieties at 5% level of significance.

4.3.3.1Sex has a negative regression coefficient (b) of 0.302 and the odds ratio (Exp b) of 0.739 (Table.6). This implies that a unit increase in this variable, which was statistically insignificantly at probability of 5% (p=0.545), decreases adoption by a factor of 0.739. Sex may influence ownership to land and hence adoption of improved cassava varieties. Regarding the relationship of household's sex with adoption of agricultural technologies,many previous studies reported that household's sex has positive effect on adoption infavor of males (Tadesse, 2008).It also influences adoption depending on

ownership of resources in the household such as ownership of radio, TV and other assets, all of which are important in determining access to information.

4.3.3.2 Household's Age has a positive regression coefficient (b) of 0.032 and the odds ratio (Exp b) of 1.033 (Table.6). This implies that an increase in age, which was statistically insignificantly at probability of 5% (p=0.192), increases adoption rate of improved cassava varieties by a factor of 1.033. In this study, the mean age of respondents was 42.24 years. This indicates that majority of the cassava farmers in the study area were within productive age range. Age has influence oninformation andknowledge variation in a given place. Age is vital in explaining experience of various innovations brought in the given place. The findings are in line with the study by Bekele and Drake (2003) in Eastern highlands of Ethiopia who noted that age offarmers could contribute to how new ideas are perceivedand could thereby influence adoption. Younger farmers may be more willing to bear therisks associated with early adoption of innovation. But also is consistent with the study by Tsosho (2004) in Nigeria, where it has been reported that young farmers have higher aspiration to accept new technologies than conservative older farmer that always seem to be more satisfied with their traditional methods.

4.3.3.3 Education level has a positive regression coefficient (b) of 1.508 and the odds ratio (Exp b) of 4.516 (Table.6). This implies that a unit increase in this variable, which was statistically insignificantly at probability of 5% (p=0.156), increases the adoption rate of improved cassava varieties by a factor of 4.516. Education has been found to have a positive and direct influence on adoption of technologies as found in studies byNkonya*et al*. (1997); Alene*et al*. (2000); Oluoch-Kosura*et al*. (2004).People who are educated are able to access information and recognize the usefulness of new innovations early than people who are illiterate and vice versa.

4.3.3.4 Household size has a negative regression coefficient (b) of 0.320 and the odds ratio (Exp b) of 0.726. This implies that a unit increase in this variable, which was statistically significant at probability of 0.05 (p=0.048), decreases adoption of improved cassava varieties by a factor of 0.726. Household size influences a number of factors. Large household size may influence income earnings and expenditure; it may influence the level of labour force and may as well influence diversification in farming activities,(Oluoch-Kosura*et al*., 2001; Bamire*et al*., 2002; Bekele and Drake, 2003).

4.3.3.5 Total income earned per year has a positive regression coefficient (b) of 0.0001 and the odds ratio (Exp b) of 1.000 (Table.6). This implies that a unit increase in this variable, which was statistically insignificantly at probability of 5% (p=0.690), increases adoption of improved cassava varieties by a factor of 1.000. Income influences a number of factors. People with high income earnings can afford to buy items like radio and TV, and hence are able to access information on improved cassava varieties. The findings were in line with study by Msuya (2005) and Kidane (2001), both indicated positive relationship between income and adoption of recommended agriculturalpractices.

4.3.3.6 Farm size has a positive regression coefficient (b) of 3.021 and the odds ratio (Exp b) of 20.505 (Table6). This implies that a unit increase in this variable, which was statistically highly significant at probability of 5% (p=0.016), increases adoption of improved cassava varieties a factor of 20.505. Land size has influence in adoption of improved cassava varieties because people with big land may have a chance to apportion certain land for testing the newly improved cassava varieties compared to people with small land sizes.The finding was consistent with the finding of Diagne*et al.,* (2009) and Mendola (2006) who found a significant difference in farm size between the technology adopters and non-adopters with the adopters cultivating larger farm size.

Table 6: Results of Regression analysis(n=120)

Variables							95.0% C.I.for EXP(B)	
	B	**S.E.**	**Wald**	**df**	**Sig.**	**Exp(B)**	**Lower**	**Upper**
Sex	-0.302	0.500	0.366	1	0.545	0.739	0.278	1.968
Age	0.032	0.025	1.705	1	0.192	1.033	0.984	1.084
Educ. level	1.508	1.064	2.009	1	0.156	4.516	0.562	36.318
H/H size	-0.320	0.162	3.903	1	0.048	0.726	0.528	0.997
Income	0.0001	0.0001	0.159	1	0.690	1.000	1.000	1.000
Farm size	3.021	1.256	5.783	1	0.016	20.505	1.749	240.471
Constant	-3.667	2.175	2.843	1	0.092	0.026		

Table 7: Model evaluation

Tests	χ^2	**df**	**P-value**
Model evaluation (overall):			
Likelihood ratio test (Omnibus Tests of Model Coefficients)	16.969	6	0.009
Goodness-of-fit test:			
H-L test	2.663	8	0.954
Accuracy in Classification, %: Null model = 56.8; Model with predictors = 67.4			
Cox & Snell R^2 = 0.164			
Negelkerke R^2 = 0.219			

4.3.4 Overall Evaluation of the Model

The model fits very well as indicated by Omnibus Test of model coefficients being below 0.05 (p=0.009) and Hosmer and Lemeshow Test being above 0.05 (p=0.954), Table.7 above. Results from the binary logistic equation indicate that the variables influencing the rate of adoption of improved cassava varieties contributed by 16.4% and 21.9% as explained by Cox and Snell R square and Nagelkerke R square values in Table 7. Household size and farm size contributed uniquely to the variation in adoption of improved cassava varieties because their p-values are below 0.05 (0.048 and 0.016

respectively). All the other predictors contributed equally to the model because they had probabilities greater than 0.05.

4.3.5 Factors limiting the adoption of improved cassava varieties

Findings from the study show that many(42.4%) of the respondents whom were reluctant to adopt or growing recommended improved cassava varieties with a local cassava varieties stated that bitter taste and late maturity are the reasons for not to adopt or solely growing the variety, varieties characteristics play a vital role in influencing farmers' adoption behavior. If thecharacteristics satisfy the need and interest of the farmers they will adopt (Tadesse, 2008). While 34.9% of respondents said that low market price of the improved cassava varieties was the reason. Again,22.7% of respondents stated that unreliable extension services and lack of training contributing on their pooradoption or solely depends on the improved cassava varieties. It is thought that the respondents who are not frequently visited by extension agents have lower possibilities of adoption than those frequently visited (Oluoch-Kosura*et al.,* 2001; Bamire*et al*., 2002).

In section 4.3.5, many(40.9%) of the respondents suggested that more training should be provided on improved cassava varieties to farmers, whereas 37.9% of the respondents suggested that government should intervene to regulate market price of the farmer's produce and 21.2% of the respondents suggested that more research work are required on aspect of taste and maturity of all improved cassava variety. This implication is that there is possibility to increase in adoption of recommended cassava variety once the problems of taste and maturity has been worked upon, as shown in Table 8.

Table 8: Distribution of respondents by limiting factors and suggestions (n = 66)

Limiting factors	**n**	**%**
Bitter taste and late maturity	28	42.4
Unreliable extension services and lack of training	15	22.7
Low market price of improved cassava varieties	23	34.9
Total	**66**	**100**
Suggestions		
Training should be provided to more farmers	27	40.9
Market price should be regulated by the government institution	25	37.9
Conduct more research on aspect of taste and maturity	14	21.2
Total	**66**	**100**

4.3.6 Farmers' attitude towards improved cassava varieties

To determine how smallholder farmers perceive improved cassava varieties a Likert scale of five statements were constructed. A five point Likert Rating Scale (LRS) was graded from 1 to 5 scores as follows, 1=Strongly Agree, 2=Agree, 3=Undecided/Neutral, 4=Disagree and 5=Strongly Disagree. Respondents were asked to grade their responses into one of the above grades against each Likert statement, however, due to the few responses in categories;who said *strongly agree,*were added to category *agree* and those said *strongly disagree,*were added to category *disagree*. Hence, the scale was later categorized into three Likert rating scale as follows: 1=Agree, 2=Undecided/Neutral and 3=Disagree in order to bring meaningful results. Finally, the general attitude of all respondents was presented after computing the averages scores of the agreed, undecided/neutral and disagrees.

The findings as presented in Table 9 indicate that, more than half (53.3%) of the respondents disagreed that Cassava planting materials are easily available while 46.7%

respondents had agreed and none of the respondents were undecided on availability of cassava planting materials. This may provide impression that improved cassava planting material still is a problem to cassava farmers. Furthermore, the finding indicates that 70% of the respondents mentioned that Cassava planting materials are not cheap in price; other respondents (28.3%) had agreed with the statement, while the rest (1.7%) respondents were undecided with the statement that Cassava planting materials are cheap in price.

In addition, majority (92.5%) of the respondents disagree that improved cassava varieties taste good and sweet, whereas 4.2% respondents had agreed on the statement and only few (3.3%) of the respondents were undecided. This was also noted during focus group discussion that, one male farmer said:

"Majority of the improved cassava varieties have a bad taste which is bitter"

This was also supported during KII where one extension agent said:

"Bitter taste is the reason why farmers choose not to grow improved cassava varieties"

From the statement that improved varieties are resistant to pests and diseases, majority (86.7%) of the respondents had agreed with the statement. Whereas few (7.5%)of respondents did not agree with the statement, and 5.8% of respondentswere undecided. This implies that the varieties flourish well since they are not vulnerable to pests and diseases attack. On the other hand all the respondents agree that the improved cassava varieties yield higher than the local cassava varieties. This shows that in terms of yield the Improved Cassava Varieties is much preferred by the business cassava producer as shown in Table 9.

Table 9: Respondent's Attitude on ICV: (n= 120)

Statement	Agree (1)	Neutral (2)	Disagree (3)	Total
Cassava planting materials are easily available	56	0	64	120
Cassava planting materials are cheap in price	34	2	84	120
Improved varieties they taste good and sweet	5	4	111	120
Improved varieties are resistant to pests and diseases	104	7	9	120
Improved varieties yield high than local varieties	120	0	0	120

4.3.7 Overall farmers' attitude towards improved cassava varieties

The findings from the study as presented in Table 9 show that many respondents had negative attitude on three aspects of improved cassava varieties which were availability of planting materials, the price is cheap and the good taste, while those with positive attitude were on two aspects of improved cassava varieties which were on resistant to pests and diseases as well as high yield. This implies that the varieties are more for business rather than for food.

This was also noted during FGDs and supported by KII where one farmer said

"I am not growing ICV because thevariety is for people who aredoing business"

Also one agricultural officer said during KII:

"*Notmany people likeICVbecause the variety is for the people who aredoing business and it needs a large area of land of which many farmers do not have"*

4.4 Cassava Production and Yield

The findings from the study revealed that all the respondents indicated that there was increase in cassava production. The results also show that there is a vivid difference in yield between improved cassava variety (recommended) which yield high as compared to local cassava varieties as shown in Table 10. The results were in line as in Table 9 where respondents revealed that improved cassava varieties yield higher than local cassava

variety. The findings, further indicated that the average yield is high to the respondents who did not mix improved cassava variety and local cassava variety, whereby respondents solely grew one variety improved or local cassava varieties yield more than their counterparts who mix two cassava varieties as shown in Table 10. The result also shows that mean yield was high in all the three categories of respondents during season 2014/15. This implies that other factors might had contributed in that result which includes favourable climatic condition, lesser disease and pest infestation, lesser theft incidence and crop destruction by animals. However, these results reflect that adoption of improved cassava varieties since its introduction in 2007 did not impress many farmers despite its high yield and resistant to pest and diseases due to many factors as it has been noted in Table 9as result a number of respondents were still mixing improved and local cassava varieties in their farming practices as shown in Table 3. Full results of cassava yield in all seasons are presented in Appendix 3.

Table 10: Farm yieldsfrom local and improved cassava varieties from 2010 to 2015

Categories	Total yield kg per ha	Mean yield kg per ha	Ave hectare per person
Improve Cassava Variety Only	7800	652	12
Improve & Local Cassava Variety			
Improved Cassava Seasons	4830	728.6	7
Local Cassava Seasons	1540	197.5	1.2
Local Cassava Only	2200	234.7	3

4.4.1 Benefits from increased yield of cassava production

The study findings revealed that half (50.0%) of the respondents benefited from increased yield of ICV. The money they got after the sales of ICV were used to pay school fees, this was also observed from more than half (62.5%) of respondentswho grew local varieties as

shown in Table 11. Other benefited by having good house, better nutrition and transport. This was also confirmed during FDG and KII sessions where one farmer said:

"*Cassava despite its problems still the little yield I get are used to cover my other domestics needs*"

Also this was supported by Village local leader who said:

"*Cassava is very important agriculture economic activities for my people since Itenables them to pay school fees,eat better food even buy means of transport*"

Table 11: Distribution of adopters and non-adopters farmers benefited from increased yield

Benefits	ICV&Local	ICV	Local only	n	%
Adopters					
Good and balanced nutrition	9	4		13	16.2
Good and better house	6	3	-	9	11.3
Tuition fees(School)	28	12	-	40	50.0
Means of Transport	11	7	-	18	22.5
Total				**80**	**100**
Non adopters					
Good and balanced nutrition	-	-	3	3	7.5
Good and better house	-	-	9	9	22.5
Tuition fees (School)	-	-	25	25	62.5
Means of Transport	-	-	3	3	7.5
Total				**40**	**100**

4.4.2 Challenges faced by smallholder farmers engaged in cassava production

This section describes the results on the challenges faced by smallholder farmers who are engaged in the cassava production which include adopters and non-adopters of improved cassava varieties included as part of objective 4 assessing yield obtained by smallholder

farmers. Among the challenges facing farmers in the cassava production were crop damaged by livestock, thieves and shortage of land, lack of credit scheme and support to farmer, low market price of cassava, and lack of training to farmers.

4.4.2.1 Crop damaged by livestock

The findings show that crop damaged by livestock was the greater challenge among all, whereby livestock keepers let loose their animalswhich destroy farmers produce, these include cattle and goats. Most (46.6%) of the respondents indicated that this challenge has ranked the first among other challenges, the problem lead to low yield of cassava production in the study area, Table 12. This was also revealed during focus group discussion and KII where one respondent and supported by one Ward leader said: *"Livestock keepers are the one who hinder our development in the village wherebythey let loose their animals who later destroy our farms."*

4.4.2.2 Thieves and shortage of land

Study results have shown that 29.1% of the respondents mentioned that theft and shortage of land ranked second among the contributing factors towards low cassava production. They reported that middle age group youth within the range of 15 – 25 years are directly involved in theft in *Magharibi* district. In some cases cassava may be stolen while still young or matured. These incidences forced the farmers to harvest their crop before being matured, hence fetching low market prices. On other hand shortage of land goes hand in hand with the theft of farmer's crops since they did not have enough land to grow their cassava as shown in Table 1 that majority (87.6%) of the respondents owned less than a hectare.This was also noted during FGD and supported during KII when one respondent and supported by Ward Local leader said:

"*We cannot progress in cassava production because thieves hinders our development in our village by breaking in our farms and uproot our cassava even when they are immature*"

Table 12: Challenges encountered by farmers (n = 120)

Challenges	Rank	n	%
Crop damaged by livestock	1	56	46.6
Theft and shortage of land	2	35	29.1
Lack of credit scheme and support to farmer	3	15	12.5
Low market price of cassava	4	13	10.8
Lack of training to farmers	5	1	0.8
Total		**120**	**100.0**

4.4.2.3 Lack of credit scheme and support to farmer

The results show that about 12.5% of the respondents considerlack of credit scheme and support to farmer is a problem and it ranked third among the challenges facing cassava production. On other hand this problem contributes in lowering adoption of improved cassava variety as a result lowering the cassava yield since the availability of credit is essential to the adoption of innovation and enhancement of productivity. Ani (2004) noted that agricultural production is capital intensive and farmers in developing countries like Nigeria need to inject money into it. Credit makes it easy for farmers to use new machines, improved seeds and livestock breeds, fertilizer and even extension services. Adoption would increase as farmer gain more access to credit related to agricultural production. A significant positive effect of access to credit on the adoption of improved maize varieties, was also reported by Feleke and Zegeye (2006); Paudel and Matsuoka (2008). This was also noted during FDG and supported during KII when one Village Local leader said:

"*We cannot progress in cassava production because we lack credit*."

4.4.2.4 Low market price of cassava

The findings from the study show that about 10.8%of the respondents were affected due to low market price and it ranked fourth among the challenges facing cassava producer,it also contributes in lowering the cassava yield since many farmerswere hesitated to be involved in cassava production. Cassava farmers confirmed that market was a problem and it was limited on their local area. This situation occurred because transportation of their produce from their farms to distant and a larger market was very costly and they could not afford it. As a result, farmers sold their fresh cassava to nearby markets and most of the time at lower price.

4.4.2.5 Lack of training on improved cassava varieties to farmers

The findings from the study area showsfew (0.8%) of the respondents mentioned this problem which ranked fifth among their challenges facing cassava production and it also contributed in lowering the cassava yield since they produce cassava without following recommended agronomic practices. However, despite training being a key factors on managing agricultural production in optimizing yield, farmers in the study area have taken this challenges with the lesser concerned. This was contributed by farmers themselves since many of them relied on farmer to farmer as a method of obtained agricultural information since extension agents are few and not always readily available.

4.4.3 Source of cassava cultivars

Findings fromthe study shows that more than half(63.3%) of the respondents who grew local cassava variety mentioned they depended on their fellow farmer to get cassava cultivars, on other hand remaining 36.7% of the respondents who grew improved cassava variety stated they depended on ZARI for cultivar they were using. This implies that respondents were still depended on one another to get cassava cultivars.

4.4.4 Source of agricultural information and training

Findings from the study shows that most(58.3%) of the respondents engaged in cassava production mentioned that they depended on their fellow farmers to get agricultural information used in cassava production, others (41.7%) of the respondents depended on Village extension staff (Block Extension Officer) to get agricultural information, refer to Table 13. This implies that respondents depended on one another to get agricultural information which is not adequate since many new information on improved cassava varieties were disseminated through village extension staff asstudy of Moser and Barrett (2006) who found that extension contacts played a major role in the adoption of agricultural technologies and were all significant to technology adoption (Yanguba, 2005, Kamara, 2009 and Mbavai, 2013).

Findings from the study also shows that majority (81.7%) of the respondents engaged in cassava production mentioned that they were not trained on improved cassava varieties production but used their experience and other information from their fellow farmers for cassava production. Whereby, few (18.3%) of the respondents were trained on improved cassava varieties production, refer to Table 13. This implication shows that, cassava farmers in the study area may not be aware of new innovations in cassava production and hence, may be implementing their production processes using the local method being practice which may likely not yielding the desired results in terms of expanding their techniques, intensifying crop yield per unit area, adopting new and improved innovations as it is hypothesized that the respondents who are not frequently visited by extension agents have lower possibilities of adoption than those frequently visited (Oluoch-Kosura*et al*., 2001; Bamire*et al*., 2002) as shown in Table 15.Results from the study area also shows that majority (95.5%) of respondents trained, went on residential training, and only few 4.5% of respondents went to farmers field school training as shown in Table 13.

Table 13: Farmers responsetowards sources and types of training delivered (n = 120)

Source	ICV & Local	ICV	Local variety only	n	%
Village extension staff (BEO)	13	32	5	50	41.7
Fellow farmer	13	22	35	70	58.3
Total				**120**	**100**
Training on improved cassava varieties					
Trained	10	11	1	22	18.3
Not trained	16	43	39	98	81.7
Total				**120**	**100**
Training respondents attended					
Farmers Field School	1	0	0	1	4.5
Residential training	9	11	1	21	95.5
Total				**22**	**100**

4.4.5 Satisfaction with the extension services

This study had shown that majority (85%) of the respondents engaged in the cassava production mentioned that they were not satisfied with extension services provided in the study area. Only few (15%) of the respondents said they were satisfied with kind of extension services provided. The majority of the respondents who lack extension services are found in *Shehias*ofKianga, and Mwakaje which are situated further from Zanzibar Agricultural Research Institute (ZARI)located at Kizimbanivillage which produced Improved Cassava Varieties (ICV) and those nearer the Institution were Dole and Kizimbani. This implies that extension services have a direct effect in influencing adoption of improved cassava varieties as a result optimize the production of cassava in the study area, and this was also indicated during FGDs, some participants said that:

> "*ManyExtension personnel are not known who they are, and those who are known they are few here in our area and this deprived us with extension services which is our right."* They said further that: *Low*

production of the cassava contributed with the absence and unavailable of extension services".

The extension agents who contacts with farmers doincorporate farmers'skills and knowledge on their production activities to the importance and application of innovation. This happened through counseling and demonstrations by extension agents on a regular basis. It was thought that the respondents who are not frequently visited by extension agents have lower possibilities of adopting than those frequently visited (Adesina and Zinnah, 1993; Shiferaw and Holden, 1998; Bamire*et al*., 2002).

4.4.6 Strategies to improve cassava production

The findings from the study area revealed that about 32.5%of the respondents interviewed indicated that strengthening extension services ranked first among the strategies to improve cassava production, while training to farmers ranked second and this can be achieved through regular training of farmers and visit by extension agents as it has been quoted that access to extension services and participation in land management programs may havea positive impact on farmers' access to information, managerial capabilities and productivity (Abdulahi and Huffman, 2005). Strict rules against livestock keepers and thieves ranked third. Research on taste and maturity of ICV ranked fourth. Strengthen market regulation ranked fifth. Government inputs support and Credit support to farmers ranked sixth and seventh respectively as were the things to be done to improve the cassava production in the study area as shown in Table 16. This was also mentioned during FDG and KII where by one respondent said:

"*To increase cassava production extension agents and officers must visit us regularly to update us on new agriculture innovations and information*"

This was also ensured by District Agriculture Officer who said:

> "*There are many problems with availability of village extension agents visiting farmers but my office will make sure regular visits to farmers are made by agricultural officers including village extension officerin order to optimize production of cassava in the district."*

Table 14: Strategies adopted to enhance cassava production: (n = 120)

Type of strategies	**n**	**%**
Strengthen extension services	39	32.5
Training to farmers	26	21.7
Strict rules against livestock keepers and thieves	19	15.8
Research on taste and maturity of ICV	16	13.3
Strengthen market regulation	12	10.0
Government input support	5	4.2
Credit support to farmers	3	2.5
Total	**120**	**100**

CHAPTER FIVE

5.0 CONCLUSIONSAND RECOMMENDATIONS

The general objective of this study was to examine factors influencing adoption of improved cassava varieties among smallholders in *Magharibi*District. The study, examined the socio-economic factors influencing adoption improved cassava varieties. Areas covered by the study include famers' cassava varieties grown, attitude towards improved cassava varieties, yield of improved and local cassava varieties, reasons of using both varieties, challenges facing cassava producers, extension services as well as what to be done to improve cassava production.

5.1 Conclusions

Based on study findings it can be concluded that, majority of smallholder farmers had negative attitude towards the improved cassava varieties since many of them have little awareness on the benefits obtained from them. However, there are still a quite number of smallholder farmers who adopted the improved cassava varieties. Season 2010/11 yield was at its lowest among the three seasons studied and this was expected by most farmers due to adverse conditions prevailed. However in the future many farmers are worried due to the fact that currently most of the potential farm land for agricultural activities isoccupied by infrastructures like electricity, roads and building of residential houses, pest infestation and senile palms (old palms) in *Magharibi*District.

Also, it has been revealed that smallholder cassava farmers were faced with many challenges, the major ones includes weak extension services, lack of training, poor soil fertility and fertilizer availability, reliable skills and plant spacing, lack of government support, credit facilities, theft, land scarcity, unpredictable weather

condition.Nevertheless, the regressions results have revealed that farm size, income from cassava and education level of the respondents have strongly influence cassava production.

In the study it has been found that learning is more occurred amongst farmers themselves through farmer to farmer than extension officers to farmers. This phenomena has impacted the farmers perception towards improved cassava variety in the negatively way.

5.2 Recommendations

Rural farmers should be encouraged by the extension agency to belong to farmers' groups such as cooperatives so as to increase their access to extension services. This will also enable them enjoy other benefits accruable from such groups such as starting up savings, obtaining loans/credits and getting agricultural services at reduced prices.

i. Government and its agencies should put more efforts on strengthening extension services to be more efficient and available in rural areas. This can be achieved through the recruitment of more extension staffs, since many of them are nearly retiring, organizing routine training for all cadres of extension staff and farmers and improve ways of obtaining information.

ii. In order to increase extension contacts and utilization of a variety extension methods the government in collaboration with other development partners should strengthen extension services, by enhancing public - private extension delivery methods at timely and appropriate way to disseminate effective agricultural technologies and information.

iii. More sensitization by local government, central government and other agricultural institution is required in order to raise farmers' awareness on improved cassava

varieties, in order to increase its uses and ultimately increase production for more income.

iv. The government and credits, loans and other relevant financial institutions should provide loans and credit facilities targeting rural farmers by facilitating establishment of SACCOS, VIKOBA and village financial groups.

v. Government and policy on land and agricultural sector stake holders should ensure existing land ownership act and agricultural policies are reviewed. Similarly, policies and issues affecting land ownership should as well be reviewed so as to promote access to land by the majority of the smallholder farmers.

vi. Government in collaboration with land development partners and other stakeholders should ensure that small holder farmers are entitled to adequate land in order to improve production and productivity of cassava.

vii. ZARI should conduct further researches on the aspect of taste and maturity of the selected improved cassava varieties so as many farmers may adopt once those attributes has been worked out.

viii. Village and ward community safety leaders and people should strengthened security in their area in order to combat theft and other offenders by establishing By Laws and strict rules that will maintain law and order in their community.

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APPENDICES

Appendix 1: *Magharibi* district cassava farmer's questionnaire

Introduction: Dear respondent, good morning/good afternoon/good evening

The objective of this interview is intends to collect information concerning assessment of factors influencing adoption of improved cassava varieties in increasing farm yield for cassava farmers in *Magharibi*District, Zanzibar. This intension will be successfully achieved through your answers which will be helpful to successful of the above mentioned service (FACILITATION) and help you to meet your need (INCREASEDYIELD)

Your responses will be treated with high confidentiality and the findings will be used for the study purpose only.

Please kindly respond to all items in this questionnaire. Put *(√)* alongside the option that is most applicable to you or fill in the spaces provided.

Village……..…***Shehia***…… Date……

1. **Respondent number…….**

A. GENERAL INFORMATION

Socio-economic characteristics

A1. Sex	**A2. Age (yrs)**	**A3. Marital status**	**A4. Education Level**
1. Male □	1. Below 20 □	1. Single □	1. No formal □
2. Female □	2. 20 – 35 □	2. Married □	2. Primary □
	3. 36 – 45 □	3. Divorced	3. Secondary □
	4. 46 – 55 □	4. Widowed	4. Tertiary □
	5. 56 d above □	5. Widower □	5. Others

A5. Household size	A6. Major occupation	A7. Per month income earned
1. Less than 2 □	1. Agriculture □	1. Less than 100 000 Tshs□
2. 2 – 5 □	2. Civil servant □	2. 100 000 – 300 000 TShs□
3. 6- 10 □	3. Petty business □	3. 300 001 to 500 000 TShs□
4. 11 and above □	4. Other (specify)…..	4. Above 500000 TShs□

A8. Farm size
1. Less than 1ha. □
2. 1 ha. □
3. 2 ha. □
4. 3 ha. □
5. 4 ha. and above □

B: CASSAVA VARIETIES GROWN BY FARMERS

B1. Which Cassava varieties do you grow in your farm?

B2. Improved varieties	B3. Local varieties
1. Kizimbani□	1. Boma□
2. Machui, □	2. Mzungu□
3. Mahonda,□	3. Kaniki□
4. Kama □	4. Mwari□
5. Others Specify ……	5. Others Specify ……

C: KNOWLEDGE, ATTITUDE AND PRACTICE USED BY FARMERS

C1. Do you have any improved knowledge of Cassava production?

1. Yes □
2. No □

C2. If your answer is YES, for any improved knowledge mentioned them.

……..

……..

……..

C3. If your answer is No, for any improved knowledge give reasons!

1. ……..

2. ……..

3. ……..

C4. What skills on Cassava production do you practice?

1. Land preparation □
2. Clean cuttings selection □
3. Improved Cassava varieties □
4. Recommended planting spacing □
5. Weeding □
6. Land Fertility □
7. Diseases and Pests control measures □
8. Harvesting methods □

C5, How many years of experience do you have in variety of cassava you produce?

1. One Year □
2. Two Years □
3. Three Years □
4. 4 Years. and above □

C6. What are the reasons of using the cassava varieties you are growing?

C4. 1. Improved varieties	**C4. 2. Local varieties**
1. Taste □ 2. Mature early,□ 3. Resistant to pest and disease□ 4. Easy available planting materials□ 5. High yield □ 6. Other specify……	1. Taste □ 2. Mature early □ 3. Resistant to pest and disease □ 4. Easy available planting materials □ 5. High yield □ 6. Other specify ……

D: FACTORS INFLUENCING THE ADOPTION OF IMPROVED CASSAVA VARIETIES

D1. What are the factors influencing the adoption of the Improved Cassava Varieties?

……
……

D2. What are the solutions of the problems mentioned above?

……..
……..
……..

D3. Are you still growing Improved Cassava Varieties?

1. Yes □
2. No □

D4.Please select the number below that best represents how youfeel about factors limiting the adoption of Improved Cassava Varieties.

	StronglyAgree	**Agree**	**Undecided**	**Disagree**	**StronglyDisagree**
Planting materials are easilyavailable	1	2	3	4	5
Planting materials are cheap in price	1	2	3	4	5
They taste good	1	2	3	4	5
They are resistant to Pests and Diseases	1	2	3	4	5
They yield high	1	2	3	4	5

E: AMOUNT OF YIELD OBTANINED FROM GROWING IMPROVED CASSAVA VARIETIES)

E1. Did you grow cassava crop in the following seasons?

1. 2010 /2011 Yes □

No □

2. 2012 /2013 Yes □

No □

3. 2014 /2015 Yes □

No □

E2. If your answer is Yes, which cassava variety did you grow?

1. Improved Cassava Varieties □
2. Local Cassava Varieties□

E3. Is there any increase in productivity in the cassava yield?

1. Yes □
2. No □

E4. If your answered is No in Qn. above, what is the reason of not growing cassava in that season of the years?

……..

……..

……..

E5. How many hectare(s) for improved cassava varieties?

…….

E6. How many hectare(s) for local cassava varieties?

……

E7. Harvest before and after adoption, Yield per season, Hectare(s) cultivated.

Variety	**Yield before Adoption Kg**	**Yield after Adoption Kg**	**Season 2010/2011**	**Season 2012/2013**	**Season 2014/2015**
1.					
2.					
3.					
Total (Kgs)					
Hectare(s)					

E8. What things you were not able to do before but now you have done it, because of increased of Cassava yield. Mention them.

1……..

2……..

3……..

4……...

F1. Which variety do you prefer most?

……..

F2. What are the reasons for your preference of the mentioned variety?

1……..

2…….

3…….

F3. What challenges did you face during cassava production?

……

……

…….

F4. Who introduced the cassava varieties you are growing?

…….

……

F5. What is your main source of Agricultural Information?

1……..

2…….

3……..

F6. Who gave you the training of production of improved cassava varieties?

…….

……

F7. How did you get the training?

1. Farmers Field School □
2. Residential Training □
3. On farm training □
4. Farmer to farmer □
5. Study visit □
6. Others specify ……..

F8. Are you satisfied with the extension services provided by your extension officer?

1. **Yes** ☐
2. **No** ☐

F9. What should be done to improve cassava production?

…….

…….

……

Thank you for sharing your response with us.

Appendix 2: Checklist for Key Informants Interview

1. How long have you been in this village/ward (*Shehia*)?
2. Do you know anything about Improved Cassava Varieties?
3. In your opinion, what are the advantages of improved cassavavarieties?
4. Did you attend any ICV training?
5. If yes, how long was the training?
6. If no, why did you not attend the training on ICV?
7. Who provided and facilitated the training on ICV?
8. How the training was influenced your work effectiveness? In terms of area worked, number of farmers reached in disseminating new technology?
9. How many villages an extension officer is serving?
10. How do you offset the gap of shortage of staff?
11. In your opinion, what are the advantages of improved Cassava production?
12. In your opinion, what are the disadvantages of improved Cassava production?
13. Why cassava production yield is low compared to the past period?
14. What is the difference in the level of cassava production before and after the adoption ICV's?
15. What is the district cassava production record?
16. What is the strength of local varieties?
17. What is the weakness of the local varieties?
18. What should be done to increase awareness and use of improved cassava varieties?
19. What specific should be done to improved adoption of improved cassava varieties here in Zanzibar?
20. What do you consider as the role of the adopted agricultural technology to cassava production?
21. What is the rate of adoption in terms of improved cassava varieties in the district?

22. How does the improved agricultural technology in cassava production contribute to the economic development of Zanzibar?
23. What challenges are faced by farmers when using improved agricultural technology in cassava production?
24. What should be done to address the challenges of using improved agricultural technology?
25. What should be done to improved production of cassava in the study area?

Thank you for sharing your response with us.

Appendix 3: Cassava yield for seasons 2010/2015

Cassava yield season 2010/15

Improve Cassava Variety Only	Max	Mean	S/D
Seasons 2010/2011	2500	160.2	490.4
Hectare	12	0.48	1.91
Seasons 2012/13	2900	701.4	666.8
Hectare	12	1.7	2.69
Seasons 2014/2015	2400	1094.7	572.7
Hectare	12	2.1	2.52

Cassava yield season 2010/2015

Improve Cassava Variety	Max	Mean	S/D
Seasons 2010/2011	1575	296.5	542.8
Hectare	7	0.6	1.5
Seasons 2012/13	1505	744.2	545.5
Hectare	7	1.4	1.5
Seasons 2014/2015	1750	1145.3	391.6
Hectare	7	1.7	1.3
Local Cassava Variety			
Seasons 2010/2011	350	60.7	108.6
Hectare	1	0.2	0.4
Seasons 2012/13	490	181.3	126.8
Hectare	1.5	0.5	0.4
Seasons 2014/2015	700	350.5	148.9
Hectare	1	0.6	0.3

Cassava yield season 2010/15

Local Cassava Variety Only	Max	Mean	S/D
Seasons 2010/2011	750	72.5	164.2
Hectare	3	0.4	0.6
Seasons 2012/13	750	251.6	225.1
Hectare	3	0.9	0.8
Seasons 2014/2015	700	380.2	147.0
Hectare	3	1.2	0.5