

**ASSESSMENT OF FACTORS INFLUENCING THE USE OF ICTs IN
ACCESSING MARKET INFORMATION AMONG SMALLHOLDER RICE
FARMERS IN KILOMBERO DISTRICT, TANZANIA**

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**A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE
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ABSTRACT

Information and Communication Technologies (ICTs) in agriculture have the potential to facilitate greater access to market information and it can connect the rural poor farmers with well-established markets. The aim of this study was to assess the factors influencing the use of Information and Communication Technologies in accessing market information among smallholder farmers in Kilombero District. A cross-sectional research design was used and data were collected using structured questionnaire, where 120 respondents were interviewed. The data were analyzed using descriptive and inferential statistics. Results revealed that middlemen and traders were the most reliable source of market information (43.3%) and middlemen are the one who buy the produce from the farmers (79.2%). Also the findings indicate that 83.3% of the farmers have access to ICTs sources of information while mobile phone being the source that is mostly accessed (50.7%). The cross tabulation results (Chi-square test) found that, there was a positive significant ($P \leq 0.05$) effect between access to ICTs sources of information and marital status, sex and income level. Among all farmers who have access to ICTs source of information, the study found that only 45% are using the technology in accessing market information where awareness and poor access and networks being the most challenge among others. The results of the logit model indicate that sex of the farmers, education level, farmer's income level, awareness of the farmers about ICT's sources of information and access to ICT's sources of information are positively significant ($P \leq 0.05$) factors influencing the farmers to use ICTs at 5% significant level. From these findings it is concluded that the mobile phone is the most ICT's source of information that is used in rural areas, also most of the smallholder farmers in Kilombero are not aware of the ICT's benefits in accessing market information. Therefore, the government and other agricultural stakeholders should find a way that

farmers will be trained and being informed on the new technologies that could help them accessing market information, promote the availability of reliable power source and opening up new market. Also Network operators should increase their services in rural areas with strong signal.

DECLARATION

I, Samwel Eskia, do hereby declare to the senate of Sokoine University of Agriculture that this dissertation is my original work done within the period of registration and that it has neither been submitted nor being concurrently submitted in any other institution.

Samwel Eskia
(MSc. Candidate)

Date

The declaration above is confirmed by;

Dr. Christopher G. Magomba
(Supervisor)

Date

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DEDICATION

I dedicate this work to my late father Mr. Ahadi M. Eskia, my lovely mother Mrs. Eskia, my friend Frank Hajembe and my young brother Mr. Michael Eskia and all my blood relatives together with all my lovely friends for their heartfelt courage.

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LIST OF ABBREVIATIONS AND ACRONYMS

AASR	Africa Agriculture Status Report
AGRA	Alliance for a Green Revolution in Africa
EUCORD	European Cooperative for Rural Development
GDP	Gross Domestic Product
HEP	Hydroelectric Power
ICT	Information and Communication Technology
IT	Information Technology
IVR	Interactive Voice Response
KPL	Kilombero Plantation Limited
MAFSC	Ministry of Agriculture Food Security and Cooperatives
MT	Metric Tons
MVIWATA	Mtandao wa Vikundi vya Wakulima Tanzania
NAFCO	National Agriculture Food Corporation
NAP	National Agriculture Policy
NBS	National Bureau of Statistics
NIE	New Institutional Economics
PC	Personal Computer
RLDC	The Rural Livelihood Development Programme
SAGCOT	Southern Agricultural Growth Corridor of Tanzania
SMS	Short Message Services
SSA	Sub-Saharan Africa
TAM	Technology Accepted Model
TCRA	The Tanzania Communications Regulatory Authority

TTCL	Tanzania Telecommunications Company Limited
TV	Television
UNESCO	United Nations Educational, Scientific and Cultural Organization
USAID	United States Agency for International Development
USSD	Unstructured Supplementary Service Data
VAS	Value Added Services

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Agriculture contributes about 28.3% of the annual Gross Domestic Product (GDP) in Tanzania (NBS, 2017). Rice is one of the most important staple food crops being the second most common cereal food crop after maize, widely consumed as a staple food by poor rural and urban households. The total area planted with paddy in Tanzania is 8.8% of the total area planted with annual crops, also its production increases by 34.5% in 2016 (AASR, 2016). The quantity of marketed rice is approximately 42% of the total production while that of maize is 28%, thus being more commercialized than maize (MAFSC, 2016). The rice sub sector contributes 2.67% on the country's Gross Domestic Product (EUCORD, 2012).

Rice production is predominantly dominated by smallholder farmers both under rain-fed (up-land and low-land) and irrigated (low-land) production contributing more than 90 percent in domestic production (EUCORD, 2012). In Tanzania, the average production of rice in the country is lower than the actual rice demand, for example in 2009, 2010 and 2011 rice milled equivalents was lower by 39 607, 1 493, 3 288 MT respectively (NBS, 2013). This is evidenced further by the decreasing rice food supplies in the country, example 36.88, 31.71 and 25.29 rice milled equivalent kg/capita/year in 2010, 2011 and 2012 respectively (MAFSC, 2013). It is estimated that over 400 000 hectares are under rice cultivation in various parts of the country (Minot, 2010).

The main rice producing regions include Mwanza, Morogoro, Mbeya, Shinyanga and Tabora. Rice is mainly grown by small-scale farmers who typically cultivate 1 to 5 acres

while small irrigation farmers grow about 5 to 6.5 acres in an irrigation scheme often initiated and controlled by the government (Minot, 2010). Large scale commercial rice production is limited to few private farms which emerged following the privatization of the National Agricultural and Food Corporation (NAFCO).

Agricultural sector has been now and then the major sector for poverty reduction in many developing countries, but current the important debates remain as to how best to create conditions of growth of the sector. According to Chapman and Slaymaker (2002), reported that in many rural areas the private sectors specialized in agricultural development growing slowly compared to how the agricultural liberalization continuous so rapidly. In case of policy advice and dissemination this translates into a concern to tie together private sector development towards poverty reduction objectives, and provide social protection for marginalized and vulnerable groups.

Further, it is increasingly recognized that, rather than running counter to market interests, the provision of basic public goods (social and environmental) can enhance market development. The need to “make markets work for the poor” has led to a focus on building institutions to support markets and manage growth more effectively. In particular, through improving market access for poor farmers, mitigating and managing market related risk and realizing the comparative advantage of different parts of the agricultural sector (e-Transform Africa, 2013). Some of these Institutions are such as, Tigo, Vodacom, “*Mtandao wa Vikundi vya Wakulima Tanzania*” (MVIWATA, Technoserve, The Alliance for a Green Revolution in Africa (AGRA) mentioning the few, also markets have been identified as key institutions for driving economic transformation because it is at the market that value is directly attached to production (MVIWATA, 2014).

For the last thirty years there is a lot of discussion about the important role that Information and Communication Technologies (ICT) could play for a more effective application of new policies and practices in Agriculture and related activities (Sekabira and Qaim, 2017 and Beth *et al.*, 2007). Information and communication technology (ICT) is an extended term for information technology (IT) which stresses the role of unified communications and the integration of telecommunications (telephone lines and wireless signals), computers as well as necessary enterprise software, middleware, storage, and audio-visual systems, which enable users to access, store, transmit, and manipulate information (Karamer *et al.*, 2007). The study will focus on Mobile phone, Internet, Radio and TV only when we are talking about ICT.

Devendra *et al.* (2012) defined electronic commerce as a process of buying and selling of products or services over electronic system such as internet and other computer network. E-Commerce emerged on the business scene during the 1990s (Shahriari *et al.*, 2015; and Goel and Chanana, 2012) and with the rapid development of internet and the overall promotion of trade globalization internet has become a new power impacting the marketing development of enterprises (Zou and Huang, 2013). Product marketing has been the key factor in the process of agricultural development (Achandi and Mujawamariya, 2016).

In spite of the market importance a firm's or farmer's ability to take advantage of existing marketing strategies (such that Tigo Kilimo, Vodacom Club, MVIWATA system, listening to radio and watching TV news concerning agriculture market information) is highly dependent on institutional and personal factors to adopt the new marketing channels like agricultural E-commerce (Musah *et al.*, 2014).

Agricultural E-commerce enables good trading possibilities and opportunities by supporting different business modes such as multi-supplier, e-sales and several types of auctions whereby the farmer will be able to have access with market information very easily, in which traditional marketing system could not adopt new market trend (Jianmei and Chen, 2014; and Folorunso *et al.*, 2016). Similarly, according to Houghton (2009) as reported by Urassa and Mvena (2015), the ICT has enabled livestock owners in Swaziland to access different markets thereby trading their cattle more efficiently. The link between ICT, including mobile phone, internet, radio and Tv made the performance of agriculture sector rising largely from recognizing that information sharing is a crucial component in the development of any sector (Gakuru *et al.*, 2009).

1.2 Problem statement and justification of the study

The present innovative in information technology development helps to solve social, organizational and economic problems at the enterprises level and individual farmer who are engaged in production or service providing. In Tanzania, mobile telephones sector is one of the fastest growing sector both in terms of numbers of services providers, number of users and diversify of services. By the end of 2016, Tanzania had 40.08 million mobile phone users and seven providers namely Vodacom, Airtel, Tigo, Zantel, Halotel, Smart and TTCL (TCRA, 2017).

Among all network services providers in Tanzania, only two providers have the information communication technology programs that support the flow of agricultural information which are TIGO and VODACOM in TIGO KILIMO and KILIMO CLUB respectively, while MVIWATA has its own way of providing information to the farmers. However, the actual number of mobile phone users might be higher than the available statistics in present time.

The number of internet users in Tanzania has increased to 45% in 2017 from 17% in 2012 (TCRA, 2017). Given the increase of mobile phone and internet services in many rural areas in Tanzania, little is known regarding their contribution to marketing of the agricultural produce, and in spite of these changes the number of farmers who are using ICT is very low. For example, since its inception of the programs, the service providers that support the flow of agricultural information are TIGO and VODACOM in TIGO KILIMO and KILIMO CLUB respectively, also MVIWATA through MVIWATA-SMS trading project. Despite the spread of internet services where people could use social medias only 44.1% and 24% of the farmers are aware and use the ICT services in their agricultural activities, maize and rice respectively (Palmer and Pshenichnaya, 2015 and Urassa and Mvena, 2015).

Furthermore, Siziba *et al.* (2011) found that distance to market have a negative and significant effect on both the farmer's decision to participate and the extent of farmer participation in the market due to transaction cost and other factors. Low market prices, poor infrastructure and limited access to market information are major disincentives to farmers in developing countries as they hinder efficient marketing and undermine farmers' income (Katengeza *et al.*, 2011).

Moreover, the failure of agricultural markets for small business and smallholder farmers have been linked to lack of access to information and the endemic problem of information asymmetry between farmers and buyers. Previous studies (Sife and Kisusi, 2013; Urassa and Mvena, 2015; Lwoga, 2010; Angelo and Wema, 2010) in Tanzania have largely focused on the role, contribution and important of ICT in agriculture by the farmers. This makes it very important to understand what factors influencing farmers in accepting and

use ICT. Therefore, this study intends to fill that knowledge gap, by assessing the factors behind the use of ICT in accessing market information in Kilombero district.

1.3 Objectives

1.3.1 General objective

The general objective of the study is to assess the factors influencing the use of Information and Communication Technologies in accessing market information among smallholder rice farmers in Kilombero District.

1.3.2 Specific objectives

- i. To identify the ICT's sources of information accessed by the rice farmers.
- ii. To analyze factors influence the use of ICT's sources of information among rice farmers.
- iii. To assess the extent of use of ICT by farmers in accessing rice market information.

1.4 Hypothesis

- i. Ho: Social- economic characteristics, Institutional factors and Technological factors have no effect on the use of ICT's in accessing market information.

1.5 Research Question

- i. What are the ICT's sources of information accessed by the farmers in the study area?

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 The concept of ICT in Agriculture

Mcnamara *et al.* (2012) says that agriculture is facing the new and severe challenges where high food price, transaction cost, information cost to farmers and traders too. But ICT have been the solution and has recently unleashed incredible potential to improve agriculture in developing countries specifically. With the booming mobile, wireless, and Internet industries, ICT has found a foothold even in poor smallholder farmers. Zly (2012) also says that African agriculture is largely traditional and practiced by smallholders and pastoralists. This type of agriculture is predominantly rain-fed, has low-yielding production, and lacks access to critical information, market facilitation, and financial intermediation services. The strategic application of ICT can play in addressing these challenges is increasing as personal ICT devices such as mobile phones tablet PCs, Radio and TV are becoming more widely available.

2.2 E-Commerce Agricultural Marketing

Schmitz and Moss (2012) says that, gains from E-Commerce accrue for three main reasons; reduced transaction costs, increased participation in auctions, and coordination of contracting through supply-chain management. Devendra *et al.* (2012) and Shahriari *et al.* (2015) defined that electronic commerce, commonly known as e-commerce, consists of the buying and selling of products or services over electronic system such as internet and other computer network.

Each of these possibilities can be addressed using the New Institutional Economics (NIE) paradigm, which focuses on the nature and content of institutions, transaction costs, and diseconomies of scope.

2.3 ICT and market information

The main focus of ICT in agriculture is meeting the farmers' needs for information. The following are some vital needs of farmers and what ICT can offer that seem to be imperative for the growth and development of agriculture as reported by Ahuja (2011). Market information including price updates of agricultural commodities of surrounding districts on a daily basis. For farmers, the price updates of markets outside their villages have a higher priority so that they can compare the prices and choose to sell at the appropriate place, Provision of detailed information on Government initiatives for rural development for those the programs are addressed. The areas that suffer from droughts, floods or other natural disasters frequently receive grants and subsidies from the Government. Information related to these programs is particularly important to small and marginal farmers.

Urassa and Mvena (2015) and Kisusi and Sife (2015) reported that, mobile phone is the most ICT's source of information for agriculture-based small and medium holders in Tanzania. They explained that, the good and frequently communication through mobile phone improves the effectiveness of managerial decision which translates into higher return. Also said that the cell phones have complemented traditional communication pathways in term of rapid access to technical and market information among smallholder farmers.

Where Tomar *et al.* (2015) found that, Radio television, mobile phones help farmers to understand what to produce, how to produce, where to sell, how much to sell with increase production, access to input, sell at reasonable price and increase income. The Developing Countries Farm Radio Network (www.farmradio.org), a pioneer in using radio to support

farmers, is now exploring how content can be distributed creatively through a variety of technologies ranging from radio and mobile phones to portable audio players.

2.4 Tigo Kilimo, Vodacom Kilimo club and MVIWATA-SMS Trading

Tigo Kilimo and Vodacom Kilimo club are the agricultural value added service (Agri VAS) provided by mobile network operator Tigo and Vodacom in, Tanzania. The service offers information for farmers via mobile phone and can be accessed via four mobile, channels: Unstructured Supplementary Service Data (USSD), push SMS subscription, Interactive Voice, Response (IVR) and a helpline. Tigo Kilimo and Vodacom Kilimo club provides agronomic tips on around ten major crops (maize, rice, Irish potato, cassava, onions, banana, citrus, sweet potato, tomato and cashew); market price information on the abovementioned crops for main markets, (Palmer and Pshenichnaya, 2015). MVIWATA-SMS Trading is the project where it's establishment of a market information system (MAMIS SMS Trading) enabling farmers and traders to access information on prices and available crops via a short messaging service (SMS), (MVIWATA, 2014).

2.5 Overview of Rice industry

2.5.1 Rice Production in Sub-Saharan Africa (SSA)

From a low base, rice consumption and production have increased extremely in SSA over the past decades and this trend is expected to continue. However, as argued by Hossain (2006), local rice production cannot meet the increasing demand for rice in many African countries. This has therefore made many African governments to accord high priority to developing their local rice sector as an important component of national food security, economic growth and poverty alleviation (Balasubramanian *et al.*, 2007).

2.5 2 Rice production and Marketing in Tanzania

In Tanzania the main producing regions includes Mwanza, Morogoro, Mbeya, Shinyanga and Tabora (Minot, 2010). Tanzania productivity is lower than most neighboring countries and one among the lowest in the world at large, but it is the second largest producer in southern Eastern Africa, (SAGCOT, 2010). According to RLDC (2009), Morogoro region is the second largest producer of rice in Tanzania after Mbeya region, driven by Kilombero Plantation Limited (KPL) with 12% of the total production, followed by Ulanga, Malinyi, Kilosa and Mvomero. It is estimated that over 400 000 hectares are under rice cultivation in various part of the country, (Minot, 2010). Rice is popular in Urban areas as it symbolizes increased status and easy also quickly to prepare. Eskola *et al.* (2005), reported that 70% of rice produced in Tanzania is sold in Dar es Salaam markets (Tandale and Tandika).

2.6 Theoretical framework

2.6.1 The Technology Acceptance Model (TAM)

The technology acceptance model (TAM) is an information systems theory that models how users come to accept and use a technology (Chuttur, 2009). The model suggests that when users are presented with a new technology, a number of factors influence their decision about how and when they will use it, the variable that will be used in this study are, demographic factors, social-economic characteristics, institutional factors and technological factors.

2.6 2 Theory of the firm

Again, the study based on the theory of the firm at the micro level, in which it looks on the behavior of a particular business entity as it is said to be driven by profit maximization subject to budget constraint. When such an entity (farmer) decides to use new technology,

simplification and less cost, is highly expected by farmers so as to generate more profit from minimization of cost of production with high yield from that technology. As for the use of ICT's, (farmers who decide to use of ICT's), farmers incurred less cost to access agricultural information compared to local ways of obtaining information and easily market information will give high price and will make high gross margin compared to those who didn't use of ICT's. Hence farmers who are using ICT's will maximize profit subject to budget constraint. Theory interacts with market to determine price and demand and then resources allocation and decision making (Nicholson and Snyder, 2008), since it governs decision making in resource allocation i.e. income of the rice producer to access market information from services providers (TIGO KILIMO, KILIMO CLUB and MVIWATA), also from other ICT tools including internet, radio and TV.

2.6.3 Transaction cost economic theory

Also the study used the New Institutional Economic (NIE) paradigm under the Transaction cost theory due to the fact that; transaction costs are originated from the activities such that, search for information about potential contracting parties and prices of the products also the quality of the resource in which they have property right. These costs are attributable to endogenous factors related to household characteristics (farmers) and other factors. It is argued that the main reason for this is the cost caring out the exchange, (Hubbard and Weiver, 1991).

The NIE paradigm focus is on the nature and content of institution, transaction cost and diseconomies of scope (Schmitz *et al.*, 2002). Most commodities, such as rice, are relatively easy to store and transport. From this perspective, E-Commerce may reduce asset specificity by expanding the geographic region of the market. Moreover, under the transaction cost theory, traders will be able to identify marketing cost like; transport,

handling, packaging, storing etc. also the use of ICT the unobservable transaction cost like; cost of information search, bargaining, monitoring, contract enforcement and product differentiation will be identified, (Delgado, 1995).

2.7 Empirical Framework

Jiannei and Chen (2014) and Kinsey and Buhr (2013) say that the agricultural firms and individual farmers have to grasp the opportunity of electronic marketing, build their brand, keep up with times vigorously promote this mode and establish a networking system. The application of ICT's in agricultural sector is increasingly becoming important where it is an emerging field focusing on the use of ICT's for improving efficiency in agricultural development processes and services (NAP, 2013). Achand and Mujawamary (2016) explained that the farmer's decision to produce for the market is negatively affected by the distance of the market which is associated with the transaction cost of selling in distance market.

Also, Katengeza *et al.* (2010) noted that ICT-based intervention can enhance integration of spatially located distant market, and that was due to provision of marketing information enabled smallholder rice farmers to access better market and better price for their produces. The study done by Kibambila and Lwesya (2017), results show that many farmers seemed to appreciate the importance of ICT in the agriculture sector, James (2004) reported that rural telephone and community radio services initiated in India has received a positive response from farmer communities, where Das (2014) found that in India radio had the vital role in disseminating agricultural information.

An assessment carried out by MVIWATA on rural markets in Tanzania revealed the informal nature of trading conducted by farmers (specifically smallholder farmers), as a

major challenge to the full realization of their dream of an improved lifestyle. The study also reported that, the limited access to reliable market information for agricultural produce. Farmers, as opposed to the buyers, had no access to information on past and current prices on the local and national markets. These problems, coupled with the existence of middlemen in the villages, who buy crops from the rural farmers at low and subdued prices in order to sell the same at much higher amounts, disenfranchised the farmers (MVIWATA, 2014).

In Bangladesh, as report by Dey (2008), the study found that three information needs of farmers that potentially could be met using mobile phones and telecentres. Sources and prices of inputs including fertilizers are important information needs of Bangladesh farmers. Also the results show that the telecentres did not address this issue, but that simply substituting mobile telephone calls to suppliers into their existing processes worked. ICT has contributed positively and significantly to output and productivity for large Philippines firms (Brynjolfsson and Hitt, 1995) while radio programmes in the Philippines have increased business and agricultural productivity (UNESCO, 1996).

ICT can accelerate agricultural development by facilitating knowledge management where farmers can take full advantage of ICT to enhance productivity and generate more income by adopting new technologies, including new varieties, adding value and marketing their products. Timely access to market information via communication networks also helps farmers make well informed decisions about what crops to plant and where to sell their produce and buy inputs (Rao, 2007).

2.8 Conceptual Framework

An increase and improvement in market channels has direct relation with the use of information and communication technology (ICT). Sometimes the level of the use of ICT

is used to describe the market performance in the business. By saying so, impacts of the use of ICT in rice marketing are supposed to be reflected by the use of ICT which will result in cost reduction, reduce distance marketing problems, improved marketing channels etc. Most of the important variable in marketing is information, and ICT is one of the useful tools for providing information to the farmers and traders in such a way that the information is provided in a very low cost. However, farmers may choose to use ICT or not to use. As such, use of ICT in rice marketing is influenced by several factors such as; sex, age, years of educational attainment, marketing channels, cost of marketing functions in the markets and Access to Information and Communication Technologies. In a situation in which the use of ICT has been adopted in the marketing system, there have been always positive impacts on accessing market information and finally the livelihood of the farmer as it is shown in the figure below.

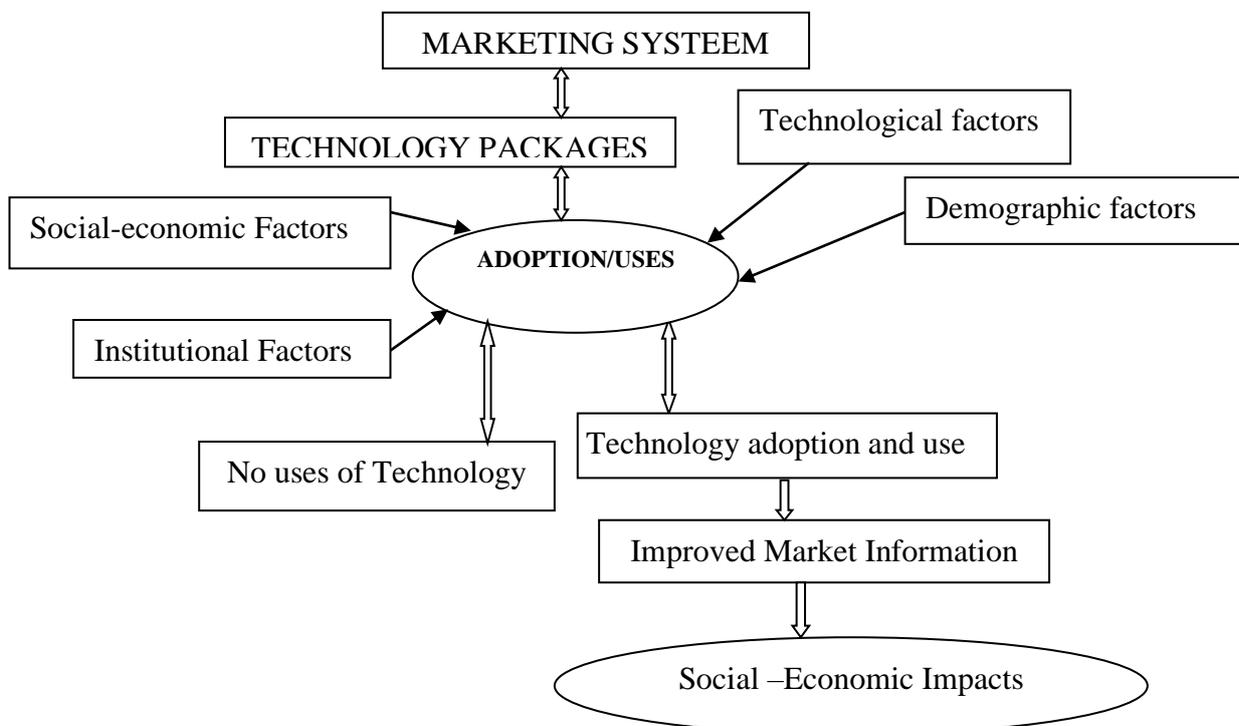


Figure 1: Conceptual framework showing factors influencing the use of ICT in rice marketing (Adopted and modified from Nassoro, 2006 and Kisusu, 2003)

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Description of the Study Area

The study was carried out in May 2018 in Kilombero district which is one of the seven districts of Morogoro region. Morogoro region is the second largest producer of rice in Tanzania after Mbeya region, driven by Kilombero district (RLDC, 2009). Kilombero district was selected for this study because of the availability of many agricultural activities especially rice production also the district has good mobile-network coverage in many locations.

3.2 Research Design

This study employed a cross-sectional method design, which entails the nature of the study. It was cross-section due to the nature of the study, whereby data was collected from a sample population, at a specific point in time (Urassa and Mvena, 2015).

3.3 Sampling Methods and Data Collection

A multi-stage sampling technique was used in selecting the respondents in Kilombero district. First stage involved purposive selection of Kilombero district and divisions. The second stage involved random selection of four wards within the district; the third stage involved a random selection of two villages from each Ward marking a total of six villages. Respondents were selected at the last stage, where the household who produced rice in the selected villages constitute a sampling frame, from which, fifteen households were randomly selected from each village using a simple random sampling technique making one hundred and twenty (120) respondents (Kisusi and Sife, 2015).

3.4 Data Analysis and Analytical Tools

The data were analyzed using descriptive and inferential statistics. The descriptive statistics; frequency distribution, means, cross tabulation and percentages were used to summarize the socio economic characteristics of the rice farmers and identifying the ICT source of information accessed by the farmers. Also descriptive analysis and Logistic regression (Odds ratio results) were used to show the extent use of ICT in rice marketing by assessing the extent of use by assessment scale from very high uses to very low by looking on the mean and ranking accordingly (Tomar *et al.*, 2016). The logit regression model was used to estimate the determinant of ICT uses on accessing market information in rice marketing (Eboh, 1998).

Logit model

Determinant factor influencing the use of ICT in rice marketing was analyzed by the logit model. This model has been widely employed to determine factors affecting the use of technology in several social-economic studies (Katungi *et al.*, 2011).

Logistic regression was used in this study because it is the appropriate regression analysis to conduct when the dependent variable is dichotomous (binary) that is (Y_0 and Y_1) as it is in this study.

The logit model is expressed implicitly as;

$$p = 1/[1 + \exp(-(\beta_0 + \beta_1 X_1 + \dots + \beta_k x_{ik}))] \dots \dots \dots (1)$$

P_i = the probability that there is improvement in the market structures and conduct of marketers, β_0 = Constant term, β_i = Coefficient to be estimated, X_k = for $K=1 \dots \dots 9$, which are independent variables and i = i th observation. The model will be linearized as the right hand side a logit transformation was applied by taking logarithm of both sides as:

$$\text{Log P}(Y_i) = \beta_0 + \sum \beta_{ik} X_{ik} + u \dots \dots \dots (2)$$

Where; $Y_i = (1 \text{ using ICT } 0 \text{ not Using ITC})$ and β_0 is a constant term and $\beta_i = \text{coefficient}$ to be estimated and $X_{ik} = \text{Explanatory variables}$.

Whereby: $X_1 = \text{the sex of farmer}$, $X_2 = \text{age of farmer}$, $X_3 = \text{years of educational attainment}$, $X_4 = \text{annual income of farmer}$, $X_5 = \text{source of market information}$, $X_6 = \text{awareness of the farmer}$, $X_7 = \text{regulatory bodies or institutions}$, $X_8 = \text{Accessibility}$, $X_9 = \text{cost of marketing functions in the markets}$, $X_{10} = \text{where do farmer sells their rice}$, $X_{11} = \text{source of power}$, $U = \text{independent error term}$.

Table 1: List of explanatory variables, measure of variables and their expected signs

Variables	Measure of variables	Expected sign
Social-economic and demographic characteristics		
Sex	Dummy (1=Male, 0=Otherwise)	+/-
Marital status	Dummy (1=Married, 0=Otherwise)	+/-
Education level	Dummy(1= informal education 2= primary education, 3= secondary education, 4=above secondary education)	+/-
Age	No. of years of individual since birth	+
Income level	Annual income of individual in Tsh.	+
Product and Market Characteristics		
Regulatory bodies and Institutions	Institutions available	+
Cost of markets functions	Costs	+
Source of market information	What source are used	+
Awareness and accessibility		
Awareness about ICT	Dummy (1=Yes, 0=Otherwise)	+
Accessibility	The Signals and if available	+/-
Source of power supply	Dummy (1=Available, 0=Otherwise)	+/-

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Social Economic Characteristics for Rice Farmers in Kilombero District

4.1.1 Age distribution

The majority of respondents as shown in Table 2; 63.3 % were aged between 21 and 40 years followed by the age group between 41 and 60 years 34.2%. There were no respondents of the age below 20 years old as this in most cases are students who are schooling at different levels of education; primary, secondary or tertiary. Only 2.5% of respondents were aged above 61 years. This shows that most of the rice farmers in Kilombero are mid aged farmers, and they are many compared to other groups of age, young farmers are ease and capable to adopt changes compared to other groups. Previous evidence shows that the young farmers are most likely and willing to spend more time to obtain information on improved technology compared to other age groups (Adeogun *et al.*, 2010).

4.1.2 Sex of the respondents

The result in Table 2 indicates that most of the farmers 58.3% were male and only 41.7% were female. This could be because most male were the ones interviewed in this study as heads of household. This is common phenomenon in African tradition where a husband is in the most cases a household head, and it is not common for women to own production resources like land and capital. So this makes male farmers more likely to have access and use the use of ICT's compared to female farmers. But also in Table 2, results show that there is high rate of divorce as it is 20.8% that make the deference to be very low between number of male famers and female farmers (16.6%).

4.1.3 Marital status of respondents

The study reveals that majority (60.8%) of the rice farmers in Kilombero were married (Table 2). Correspondingly, 13.3% of the respondents were single and widowed and divorced were 5.1% and 20.8%. Therefore, the study revealed that high percent of respondents were married; this could be because the majorities were above 21 years aged. This indicates that most of these respondents engage in farming activities so as to fulfill their obligation of ensure availability of food and increase their income for other necessary needs in their families.

4.1.4 Education of respondents

The survey result in Table 2 indicates that most of the farmers 79.2%, reported to have attained primary education while 14.2% and 1.6% attained secondary and higher education respectively. Only 5% had not attained any formal education. This indicates that, apart from having literate people in the study area also comprises of rice farmers who are not educated. The respondents that have attained primary and other higher levels of education understand the importance of market information in trading their rice together with the use of ICT in accessing that information, while those with no formal education mainly use experience in trading their rice which may hinder farmers' access to ICT for efficient marketing (Aman *et al.*, 1989 and Ayoola *et al.*, 2015).

4.1.5 Rice farming experience

It was found that most of the rice farmers are less than 10 years and 11 to 20 years of experience which is 33.3% each as showed in Table 2. Followed by 18.3% and 13.3% of farmers who have 21 to 30 and 31 to 40 years of experience respectively, and only 1.8% of the rice farmers are over 40 years of experience. This shows that most of rice farmers have less experience in rice farming so they need more information about rice farming and

market situation to guide them in farming practice, communication among farmers and searching for market especially by using ICT.

4.1.6 Farm size

The survey results from study show that majority of respondents about 57.5% were cultivating an area of less than 3 acres of rice production and 39.2% of rice farmers own 4-7 acres, with few (3.3%) rice farmers who own more than 7 acres, as shown in Table 2. This indicates that most farmers in Kilombero are small scale farmers. That means small scale farmers as for large scale can easily decide to use ICT source of information (Ayoola *et al.*, 2015).

Table 2: Social Economic Characteristics of Rice Farmers in Kilombero district

Variables	Frequency	Percentage
Age distribution		
21-40	76	63.3
41-60	41	34.2
Above 61	3	2.5
Total	120	100
Sex		
Male	70	58.3
Female	50	41.7
Total	120	100
Marital Status		
Single	16	13.3
Married	73	60.8
Widow	6	5.1
Divorced	25	20.8
Total	120	100
Level of education		
Primary	95	79.2
Secondary	17	14.2
Higher learning	2	1.6
No formal education	6	5.0
Total	120	100
Farmer experience		
Less than 10 Years	40	33.3
11 -20	40	33.3
21-30	22	18.3
31-40	16	13.3
Over 40 Years	2	1.8
Total	120	100
Farm size		
< 3 Hectares	69	57.5
3-7 Hectares	47	39.2
> 7 Hectares	4	3.3
Total	120	100

4.2 Problems encountered in Production and Farmer's Suggestions

Results from table 3 shows that the major production problem in the survey area was high rate of pest and disease, which was mention by 41.1% of the total respondents. Lack of

inputs associated with untimely delivery together with very high inputs price reported by 33.3% of the total respondents. It was further noted that unfavorable weather and poor extension services reported as the problems encountered in their production by 10.6% and 5.8% of total respondents respectively. In addition, 9.2% of the total respondent said lack of capital was the problem which could be source of many other problems. Also, when farmers were asked on what could be the solution in order to improve production, 44.7% indicated that inputs should be provided in a right time and at affordable price, 19.3% of total respondents indicated that there should be government or private organization that provide loans or credit to the farmers with low interest rate. About 19.3% indicated that market for the produce should be improved by creating local market and good price should be settled for the produce, 8% of the rice farmers suggested introducing irrigation scheme and only 8.7% of the total respondent said the extension services should be improved (Table 3).

Previous studies by Defoer *et al.* (2002) and Balasubramanian *et al.* (2007) reported similar constraints in rice production that is poor supply and management of inputs, yield instability due to weeds, pest and diseases, and deteriorating irrigation infrastructure. While Evenson and Golin (2003) also pointed out that ration of researchers to extension workers is much lower in African countries due to lack of profitable technologies.

Table 3: Problems encountered in Production and what should be done to improve production

Variables	Frequency	Percentage
Problems		
Lack of adequate capital	12	9.2
Poor extension services	10	5.8
Lack and high inputs	33	33.3
Pest and disease	49	41.1
Unfavorable weather	16	10.6
Total	120	100
Solutions		
Provision of inputs in time at affordable price	61	44.7
Loans provision with low interest rate	23	19.3
Introducing irrigation scheme	6	8.0
Improve market for the produce	23	19.3
Improve extension services	7	8.7
Total	120	100

4.3 Problems Related to Marketing in Kilombero District

It was found in Table 4 that out of 120 smallholder farmers who were interviewed 27.9% were faced with the problem of failure to access market price information. Lack of price information makes farmers to sell their rice in a low price especially to the middlemen, followed by 24.2% of the total respondent who reported that there are no formal institutions whether government or private one that used to help farmers with service of selling their produce by providing them information or market at a good price. Also results show that 14.6%, 12.9% of the total respondents were suffering from the problem of having few customers to buy their produce around the local market and lack of transport facilities to transport their rice to other markets respectively. Only 11.6% of the total respondents were suffering from market distance problem. Similar problems were reported by Munyua (2000), Katengeza *et al.* (2011) and MVIWATA (2014).

About 6.3% of the rice farmers reported that some buyers came with very large quantity scale to measure their rice like “*Ndoo ya Mozambique*” and overfilled bags, similar result reported by Togolay (2010). Only 2.5% reported that there is low demand for their produce in the study area.

Table 4: Problems related to marketing in Kilombero district

Problems	Frequency	Percentage
Lack of price information	111	27.9
No formal institutional	96	24.2
Few customers around the market	58	14.6
Lack of transport facilities	51	12.9
Market is very far	46	11.6
Quantity Scale	25	6.3
Low demand	10	2.5
Total	397*	100

*Multiple responses

4.4 Factors that Farmers Consider when Deciding to Sell their Rice

Results show that 94.2% of rice farmers in the study area always consider the price offered before they decide to sell their produce (Table 5). This shows that price information to them is very important factor because most of the time farmers are the price taker due to lack of information on price of the produce from other places, as it was also reported by Kamugisha (2006) and Nyange *et al.* (2002). This means middlemen have greater power of negotiating the price and can secure means of transport and market information. Only 1.7% of the respondents considered available marketing channel as the factor to make decision for selling their produce, which also means that if the farmer could use ICT source of information, they could be able to get correct price information and market channel available, similar results reported by Abraham (2007). The 4.2% of the rice farmers indicated that there are other factors rather than price information and market

channel available, and 90% of them they said that, they will decide to sell their produce due to the needs and family problems like school fees and health problems, while 10% indicated that budget and goals are the factors they consider before making decision to sell their produce.

Table 5: Factors that famer consider when deciding to sell their rice

Variables	Frequency	Percent
Major factors		
The price offered/information	113	94.2
Marketing channel available	2	1.7
Other factors	5	4.2
Total	120	100.0
Minor factors		
Family issues and needs	4	90
Budget and goals	1	10
Total	5	100.0

4.5 To Whom Farmers Sell their Rice

The study reveals that most of the small holder rice farmers in the study area (79.2%) sell their produce to middlemen (Table 6). These results show that smallholder farmers in Kilombero depend on middlemen who visit their home to buy the produce and getting market information from them too. Similar results were reported by MVIWATA (2014). Results also indicate that 18.3% of the total respondents sell their produce to rice traders and 2.5% sells to other buyers including small local industrial processors.

Table 6: To whom farmers sell their rice

Buyers	Frequency	Percent
Middlemen	95	79.2
Rice traders	22	18.3
Others	3	2.5
Total	120	100.0

4.6 ICT and Agricultural Market Information

4.6.1 Farmer's access to ICT sources of information

It was shown that 83.3% of the farmers had access to ICT sources of information, while 16.7% had no access (Table 7). This implies that most of the farmers can access at least one ICT source of information that could help them in accessing market information by not depending to the middlemen as they always do. For the market information to be shared to the farmers in easy way, less cost and timely, the farmers should have access to ICT sources of information (Abraham, 2007 and Tomar *et al.*, 2015).

4.6.2 Existing ICT source of information

One of the objectives (objective number one) of this study was to identify the existing ICT's sources of information related to agricultural market information for smallholder rice farmers. In order to address this objective and corresponding research questions, respondents were asked multiple responses questions about the existing ICT's sources of information accessed by the farmers in order to establish insight regarding ICT's source of information exploited by smallholders in Kilombero, in relation to rice market information sharing. The study found that the leading ICT's sources of information for most respondents (50.7%) accessed by the farmers for sharing market information was mobile phone (Table 7). This source of information involves calling friends, relatives or rice traders for the sake of knowing market information, using the system like Tigo kilimo, Vodacom club and MVIWATA system of market information and also using internet in social media for the purpose of accessing market information. Similar results reported by Urassa and Mvena (2015) and Kisusi and Sife (2015).

Radios were also among the existing source of information where about one third of the total respondents (31%) have access to radio, in which farmers used to listen news

concerning agricultural information. About 12% of the respondents reported that they have access to TV and only 6.3% reported to have access to internet (Table 7).

Table 7: Farmer's access to ICT's sources of information and Existing ICT source of information

Variables	Frequency	Percent
Access to ICT		
Yes	100	83.3
No	20	16.7
Total	120	100.0
ICT sources of information		
Mobile	103	50.7
Radio	63	31.0
TV	24	12.0
Internet	13	6.3
Total	203*	100

*Multiple responses

4.6.3 Access to ICT services in relation to age of the farmer

The chi-square test which is 1.706 shows that the observed differences are not significant, since p value > 0.426 is higher than 0.05 levels of significance (Table 8). Hence, there is no real evidence that the percentage of age doesn't vary from farmers who have access to ICT services in the study area.

Table 8: Access to ICT services in relation to age of the farmer

Variable		Age group		
		21-40	41-60	Above 61
Access to ICT services	Yes	61	36	3
	No	15	5	0
Total		76	41	3
Chi-square = 1.706				
P-value = 0.426				

4.6.4 Access to ICT services in relation to marital status of the farmer

Chi-square test results in Table 9 shows that there is a significant difference ($p = 0.001$) between access to ICT services and marital status of the farmers in the study area. Those farmers who have access to ICT services were mainly married ones compared to the other group. This indicates those married groups are easily having access to ICT because they support each other as a group in terms of income, effort and responsibilities.

Table 9: Access to ICT services in relation to marital status of the farmer

Variable		Marital status				Total
		Single	Married	Widow	Divorced	
Access to ICT services	Yes	14	67	5	14	100
	No	2	6	1	11	20
Total		16	73	6	25	120

Chi-square = 17.399
P-value = 0.001

4.6.5 Access to ICT services in relation to gender of the farmer

The results on Table 10 shows a chi-square test of sex and the access to ICT services that there is significant difference ($p = 0.005$) between the ability in accessing ICT services by men and women. This is an indication that men are likely to have higher probability of accessing ICT than women.

Table 10: Access to ICT services in relation to gender

Variable		Gender		Total
		Male	Female	
Access to ICT services	Yes	64	36	100
	No	6	14	20
Total		70	50	120

Chi-square = 7.927
P-value = 0.005

4.6.6 Access to ICT services in relation to education level of the farmer

Chi-Square statistic (0.797) and ($p = 0.85$) in Table 11 the null hypothesis is not rejected, since $p > 0.05$. Level of education seems not to be related to accessing ICT services, hence, there is no real evidence that the level of education doesn't vary from among number of farmers who have access to ICT services in accessing market information.

Table 11: Access to ICT services in relation to education level of the farmer

Variables		Level of education			Total	
		Primary	Secondary	Higher learning		No formal education
Access to ICT services	Yes	78	15	2	5	100
	No	17	2	0	1	20
Total		95	17	2	6	120
Chi-square = 0.797						
P-value = 0.850						

4.6.7 Access to ICT services in relation to income level of the farmer

Chi square test results in Table 12 shows that there is a significant difference ($p = 0.0044$) between farmers' income and the ability of the farmer to access ICT services. This indicates that if the farmer has high level of income, the probability of accessing ICT services for the purpose of getting market information compared to the lower income earners.

Table 12: Access to ICT services in relation to income level of the farmer

Variables	Farmers income								Total	
	0-199999	200000-499999	500000-799999	800000-1099999	1100000-1399999	1400000-1799999	1800000-2499999	More than 2500000		
Access to ICT services										
Yes	38	26	12	3	7	6	2	6	100	
No	6	7	3	2	0	0	0	0	18	
Total	44	33	15	5	7	6	2	6	118	
Chi square = 54.088										
P-value = 0.0044										

4.7 Reasons for their Choice on the Specific ICT Source of Information

Among 83.3% of the farmers who have access to ICT sources of information (Table 7), mobile phone reported to be most ICT sources of information that is used by the farmers (50.7%) compared to other sources (Table 7) and it's for some reasons. The important reason was ranked first, followed by other reasons as ranked and presented in Table 13. Most of the farmers argued that they choose to use a specific source of information by the fact that, first they should be aware of the source, it should be affordable (cheap), its accessibility in the place, should use less time and lastly the accuracy on the information it provides by the specific source of information.

Table 13: Reasons for their choice on the specific ICT source of information

Reasons for choice	Mean	Ranked most reason
Awareness	1.118	1
Cost	1.273	2
Accessibility	1.300	3
Time used	1.545	4
Accuracy	1.691	5

4.8 ICT Users in Accessing Market Information and Technique Used

The results in Table 14 show that only 45% of the rice farmers were using ICT sources of information as part of their market strategies in accessing market information, and more than half of the respondents they don't use (55%). This shows that most of the farmers are not aware and the only technique they always use in face to face as it was also reported by Urassa and Mvena, (2015) as the leading channel for most smallholder farmers to access market information was face to face mode of communication.

Also, the study found that among the users of ICT in accessing market information, the most used technique reported to be Phone calling and Text (51%) where farmers tend to

call and send a text to a friend, relative or traders who believe that it will provide reliable market information. Farmer who listen to radio for getting market information were 29.2%, followed by 8.3% of the famers who watch TV for the purpose of accessing market information. Most of the farmers seem to be not aware of the system that used to provide market information such as Tigo Kilimo, Vodacom Club and MVIWATA system as the results shows only 7.3% of the total respondent used these systems as technique in accessing market information, followed by only 4.2% who were reported to use social media. It is for the same reasons as presented in Table 13, that, first they should be aware of the technique, it should be affordable (cheap), its accessibility in the place, use less time and lastly the accuracy on the information it provides by the specific source of information.

Table 14: ICT users in accessing market information and technique used

Variables	Frequency	Percent
Using ICT		
Yes	54	45.0
No	66	55.0
Total	120	100.0
Which technique		
Phone call or Text	49	51.0
Watching TV	8	8.3
Listening to radio	28	29.2
Tigo Kilimo/Vodacom Club/Mviwata	7	7.3
Social media	4	4.2
Total	96*	100.0

*Multiple responses

4.9 Factors Influencing the Use of ICT's in Accessing Agriculture Market

Information

This study determined the factors influencing the use of ICTs in accessing agricultural marketing information, the second objective. A logit regression model was used to

estimate the results, the results of the logit model is presented in Table 15. Based on the results in Table 15, the statistic LR is 70.93 in which the likelihood ratio chi-square of 70.9 with a p-value of 0.0000 which tells us that the model as a whole fits significantly better than an empty model or model with no predictors. The Prob > Chi-square test is (0.0000<0.005), this is the p-value which is compared to a critical value 0.05 to determine if the overall model is statistically significant. In this case, the model is statistically significant because the p-value is less than 0.0000.

The results of the logit model indicate that sex of the farmers, education level, farmers' income level, awareness of the farmers about ICT sources of information and access to ICT sources of information are positively significant factors influencing the farmers to use ICTs. The gender of the household affects decision to use ICT sources of information, the male farmers has higher probability of using ICT than female famers. Another household characteristic that influences the use of ICT is education, the odds ratio is 0.3 which means that for educated farmers, the probability of using ICT's in accessing market information is 30% higher than that of the farmers who have a low education level or not educated at all. This shows that education plays an important role in increasing knowledge and the ability to receive new method, (Vidadie and Agustono, 2015). Contrary to expectations, age of the farmer and farmer's experience do not significantly influence farmer's decision to use ICTs. Although young aged farmers are more likely to use ICTs compared to old aged farmers as the same to experienced farmers and less experienced farmers, as reported by Ayoola *et al.* (2015).

Farmer's income has significant impacts on farmer's decision to use ICTs that is farmers with higher level of income can afford to own the ICTs source of information and be able to cover all cost of operations in accessing market information than those with low income

levels. Again contrary to expectations, regulatory institutions, source of power, where do farmers sell their rice and their source of market information do not significantly influence farmer's decision to use ICT's. While it's obvious that farmers who make contact to extension agents, specialist and other private institutions like Tigo, Vodacom and MVIWATA are more likely to be influenced to use ICTs, together with farmers with access to power supply, (Vidadie and Agustono, 2015).

Access to ICTs has positive coefficient (2.045) and significant at five percent level (Table 15) implying that the accessibility and availability of market information increased with greater access to ICTs. The using of ICTs has been shown to enhance information flow among users (Katengeza *et al.*, 2011) reported that increasing number of developing country smallholder farmers have recently embraced the mobile phone technology in order to enhance their access to agricultural markets. The mobile phone offers smallholder farmers the potential to increase market participation through access to information on available markets and prevailing market prices. Awareness has positive effect on the use of ICT's whereas farmers who had awareness on the use of ICT's are more likely to decide to use of ICT's in accessing market information, because having awareness help farmers to know and understand the use of ICT's, hence increase in awareness on the use of ICT's, increase the probability of adoption of ICT's as presented on Table 15 that awareness have positive coefficient of 2.168 at 5% significant level.

Table 15: Logit results on Factors influencing the use of ICT's in accessing agriculture market information and Extent of use (Odds)

Variables	Coefficients	Std. Err	P>z	Odds
Age	-0.045	0.1	0.376	1
Sex	-3.244	0.8	0*	0.1
Education	-1.451	0.6	0.015*	0.3
Farmers experience	0.478	0.5	0.337	1.4
Farmers Income	0.000	0	0*	1
Regulatory institutions	0.475	1	0.634	2.1
Awareness	2.168	1.1	0.045*	8.8
Source of power	-1.203	0.7	0.101	0.4
Access to ICT	2.045	0.8	0.006*	8.3
Where to sell	-1.005	0.7	0.134	0.3
Source of market information	0.208	0.3	0.422	1.3
Constant term	2.31	2.3	0.307	
No. of observation	120			
Log likelihood	- 47.1125			
LR Chi2 (11)	70.93			
Prob>chi-square	0.0000			
Pseudo R2	0.4295			

Note: * indicate significance level of 5%

4.10 Extent of the Use of ICT in Accessing Market Information

The study also was to assess the extent of the use of ICT in accessing market information by the smallholder rice farmers, third objective. In order to address this objective, the odds ratio in logistic regression (Table 15) showed the extent of using ICT. Odds ratio from the logit regression results shows that, sex had a positive effect on the extent of using ICT's in accessing market information at 10% level of significance ($p=0.000$). This implies that male have higher probability of using ICT's than female. Also Education is likely to have 30% extent to use of ICT's, Farmer's income is likely to 100% extent to use ICT's at $P=0.015$ and $P=0.000$ respectively. Awareness is nearly 8.8 times likely to use ICT's and Access to ICT's is nearly 8.3 times likely than other factors adjusted for use of ICT's as presented in Table 15.

Also the farmers were asked to assess the extent of using ICT in the following components; reducing length of marketing channels, support opening up new market, market information availability, and cost reduction, save time and money transfer and storage, on how high or low, the assessment of the use of ICT source of information will have an impact on their marketing. Results found that most of the farmers tend to highly use ICT tools especially mobile phone for money transfer and storage as it was ranked as the first, followed by time saving that farmers may use ICT because it saves time, cost reduction, to get available market information, support opening up new market and lastly in rank was reducing length of marketing channel (Table 16). This shows that farmers of the study area didn't highly use ICT sources of information in seeking market information. Similar results reported by Tomar *et al.* (2016), as seeking market information belongs to rather low extent of use, this may be due to lack of awareness and knowledge to the farmers about ICTs source of information and its usage in seeking market information.

Table 16: Assessment scale on the use of ICT

Assessment of ICT use	Mean	Rank	Assessment Scale
Reducing length of marketing channels	2.667	6	Very Low
Support opening up new market	2.608	5	Low
Market information search	2.283	4	Rather Low
Cost reduction	2.083	3	Medium
Save time	2.050	2	Rather high
Money transfer and storage	1.958	1	Very high

4.11 Challenges Encountered by Sampled Farmers When Accessing Market

Information

Table 17 shows challenges encountered by farmers, majority of the farmers reported that they were faced by the challenge of weak networks in the study area and very poor access of the mobile networks; this was ranked as the first great challenge followed by income

level as the second challenge. Farmers also complained on the poor electricity supply (third in rank) although most of the villages where survey was conducted there was Hydroelectric Power (HEP) supply but yet it's not well supplied to the smallholder farmers and not cost friendly to low income earners due to high initial cost of installment. If electricity is lacking mobile phone owners' face difficult to charge their phone batteries at home, also they can't watch TV. Other findings have similar reported that lack of electricity in rural areas is a major factor for using ICT devices hence contribute to information asymmetry (Urassa and Mvena, 2015, Mwakaje, 2010).

The survey noted that owned and using ICT sources of information is somehow expensive involves, paying electricity bills, buying airtimes and bundles and buying those devices that support accessing information. Also the number five challenge in rank was that, some of ICTs source of information doesn't meet needs of information that the farmer needs at the specific time, followed by the problem of having incorrect information and most of the time outdated information.

Table 17: Challenges encountered by sampled farmers when accessing market information

Challenge	Mean	Overall rank
Outdated information	1.958	7
Incorrect information	1.933	6
Doesn't meet needs of information	1.900	5
Cost	1.875	4
Access to electricity	1.875	3
Income problem	1.875	2
Poor access and weak network	1.867	1

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The study aimed at assessing the factors influencing the use of ICT in accessing market information by small rice farmers in Kilombero specifically; to identify the ICT sources of information accessed by the rice farmers, to analyze determinant factors on the use of ICT among rice farmers (mobile phone, radio, TV and internet), and to assess the extent of use of ICT by farmers in accessing rice market information. The findings show that majority of the respondents in the study areas have access to ICT's source of information (83.3%), while only 45% reported to use ICT's in accessing market information among all farmers who had access to ICT's. This implies that farmers are not aware on the use of ICT's in accessing market information for their produce. This is due to the fact that most of the farmer's sources of information are the middlemen and their fellow farmers, 43.3% and 35% respectively.

The results also identified that mobile phone is leading ICT's source of information used by the farmers (50.7%), where the most techniques used was phone calling and text messages (51%). This implies that the use of mobile phone technology ensures rapid access to market information for rice smallholder farmers hence facilitating timely decision making and less cost during marketing process. However, the most challenge facing the farmers while accessing market information was reported to be poor access and weak networks in the study area where outdated information was the last. Moreover, the logit results showed positive significant on the influence factors; gender of the farmers, education level, farmers income level, awareness of the farmers about ICT sources of information and access to ICT sources of information and the decision of the farmers in

using ICT's for the purpose of accessing market information. From these findings it is concluded that the mobile phone is the most ICT's source of information that is used in rural areas, Secondly, most of the smallholder farmers in Kilombero are not aware of the ICT's that they can benefit from using it in accessing market information rather than depending to middlemen and fellow farmers.

5.2 Recommendations

With regards to the findings of this study, the main problems related to using ICT's source of information were poor access and weak network together with poor electric supply. It is therefore recommended that government in relation with private sectors should promote availability of strong network signals in rural areas and also it should provide rural areas with the availability of reliable source of power. Also the government should enhance and facilitate the use of mobile phone as it was reported that is most used source of information among others by encourage a liberal policy for affordable prices for modern ICT's product, especially mobile phones and cost airtimes. Programs that increase farmers' incomes and provide free education for poor people should be continued and/or considered by the government; such programs have a great impact not only on rural development but also for supporting the use and adoption of agricultural innovation, technologies farming and marketing among smallholder farmers.

In addition, most of the farmers were not aware on the use of ICT's in accessing market information, therefore the government and other agricultural stakeholders should find a way that farmers will be trained and informed on the new technologies that could help them accessing market information. Also government should establish farmer's information unit at the ward and village level to facilitate easy access to reliable information together with opening up new market in rural area where farmers will be selling the produce within the area.

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APPENDICES

Appendix 1: Questionnaire

Section A: PERSONAL INFORMATION (Household Head)

A.	B.	C.	D.	E.	F.	G.	H.
Date	Ward	Village	Age (Years)	Sex	Marital status	Level of education	Main occupation
<p>Assessment scale</p> <p><i>E= 1-Male, 2-Female</i></p> <p><i>F = 1-Single, 2- Married, 3-Widow, 4- Divorced</i></p> <p><i>G= 1-Primary, 2-Secondary, 3-Higher learning, 4-No formal education</i></p> <p><i>H= 1-Self employed, 2-Farming, 3-Unemployed, 4-Employed</i></p>							

Section B: RICE PRODUCTION

- QnB1. When did you start cultivating rice?
- QnB2. How big is your rice farm?(hectars)
- QnB3. What is your approximate annual production of rice? (last season)
(Sacks)
- QnB4. What are the major problems facing you in your rice production?
- i.
 - ii.
 - iii.
 - iv.
 - v.
- QnB5. What future plans do you have concerning rice production?
1. To expand production
 2. To reduce production []
 3. To continue producing at the same level
 4. Others (specify).....

QnB6. What should be done to improve rice production?

.....

.....

.....

.....

.....

Section C: MARKETING OF RICE

QnC1. What is the distance from the market.....? (in km)

QnC2. What factor do you consider when deciding to sell your rice?

1. The price offered/information
2. Marketing channel available []
3. Market distance
4. Other market information (Mention).....

QnC3. To whom do you sell your rice?

1. Middlemen
2. Rice traders
3. Cooperative unions []
4. Others.....

QnC4. Do you find difficult to sell your rice?

1. Yes
2. No []

QnC5. What are the Costs of marketing functions in the market?

1. The market is very far from home
2. Few customers around the local market
3. Low demand
4. Lack of transport facilities
5. Lack of price information
6. No formal institutional

QnC5. Do you normally know market information in advance before taking your consignment to the market?

- 1. Yes
- 2. No []

QnC6. How do you get market information?

- 1. From other traders
- 2. Form farmers
- 3. By using ICT
- 4. Visit to the market
- 5. Others (specify)

Section D: INFORMATION COMMUNICATION TECHNOLOGIES (ICT) USES

QnD1. Do you have access to Information and Communication Technologies (ICT) services?

- 1. Yes
- 2. No []

QnD2. Which of the following form?

- 1. mobile
- 2. Radio
- 3. TV
- 4. Internet

QnD3. What are the reasons for your choice in (v) above?

- 1.
- 2.
- 3.
- 4.

QnD4. How often do you use ICT?

- 1. Always
- 2. Once per month
- 3. Once per week
- 4. Others.....(Specify)

QnD5. Do you use the ICT technique methods as part of your market strategies?

1. Yes
2. No []

QnD6. Would you have used the ICT, if you knew its importance?

1. Yes
2. No []

If Yes, Explain why?

1.
2.
3.
4.

QnD7. What is your annual income from selling rice before and after ICT marketing?

1. Tshs..... (Before ICT)
2. Tshs (After ICT)

QnD8. How high or low, the assessment of the use of ICT marketing methods will have an impact in marketing strategies in the following measures?

Assessment scale: 1=Very high 2=Rather high 3=Medium 4=Rather low 5=Low

	1	2	3	4	5
Cost reduction					
Market Information availability					
Support opening up new market					
Save time					
Reducing length of the marketing channels					
Money transfer and storage					

QnD9. Extent of use of ICT by the farmer for seeking market information

Dimension	ICT tools	Frequency		
		Regularly	Occasionally	Never
Market news and market intelligence	Mobile phone			
	Internet			
	Radio			
	TV			
Market infrastructure like ware house and cold storage facilities	Mobile phone			
	Internet			
	Radio			
	TV			
Transport facilities	Mobile phone			
	Internet			
	Radio			
	TV			

QnD10. What are the most seriously problems you face in using ICT in marketing of rice?

(Please specify the following)

Problem	Causes	Possible solution

QnD10. Among the above mentioned problems please mention the most important one for which immediately solution should be found.....

QnD11. In your opinions, what are the opportunities that exist in the rice sub sector if famers would use ICT in getting marketing information?

- i.
- ii.
- iii.

QnD12. In your opinions, what are the major constrains for the famers to use ICT?

- i.
- ii.
- iii.
- iv.

Section E: **RICE MARKETING CHANNEL AND MARGIN**

QnE1. Rice price and margin per bag in alternative market

Cost item	Market channel and Market		
	Village to Village	Village to District	Village to Regional/DSM
Buying price			
Selling price			
Parking materials			
Transport cost			
Market levy			
Broker's commission			
Other cost			

QnE2. Do you find any usefulness of using ICT in your marketing margin?/ Doest ICT has an impact on your marketing margin?

- 1. Yes
- 2. No []

QnE3. If, Yes, what are those (Mention)

- i.
- ii.
- iii.
- iv.

THANK YOU