ASSESSMENT OF FACTORS INFLUENCING THE USE OF MOBILE PHONES IN COMMUNICATING AGRICULTURAL INFORMATION: A CASE OF KILOLO DISTRICT

BY

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ABSTRACT

This study sought to investigate factors that influence the use of mobile phones in the communication of agricultural information in Kilolo district. The study examined the use of mobile phones as a means for achieving agricultural development. The study population comprised all farmers regardless their mobile phone ownership. The study adapted a cross sectional study design and a multistage simple random sampling technique, where, 384 respondents were selected. Data were mainly collected using an interview schedule. The results revealed that majority of respondents used mobile phones and had positive attitude on the contribution of mobile phone in their farming business. The study had three hypotheses to be tested: mobile phones ownership have no statistical significant influence in communicating agricultural information; different types of agricultural information have no statistical significant influence on mobile phones use in communicating agricultural information and; respondents' socio-economic factors have no statistical significant influence on mobile phones use in communicating agricultural information. The study results indicated that mobile phones offered an attractive solution to farmers' informational needs. Factors specified to have an influence on mobile phone use in the communication of agricultural information included: mobile phone ownership, type of agricultural information, farming system practiced, network coverage, respondents' demographic characteristics, and time of mobile phone ownership. As such, all the three hypotheses were rejected. The study concluded that the use of mobile phone to communicate agriculture information depend on mobile phone ownership, type of agricultural information to be communicated and individuals' socio-economic factors.

The study therefore recommended that many farmers be encouraged and supported so that they become access to and use mobile phones in their farming business.

DECLARATION

I **SIWEL YOHAKIM NYAMBA** do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is my own original work and that it has neither been submitted nor being concurrently submitted for degree award to any other institution**.**

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LIST OF ABBREVIATIONS AND ACRONYMS

ANOVA	Analysis of variance
FGDs	Focus Group Discussions
GSM	Global System for Mobile Communication
GDP	Gross Domestic Product
HESLB	Higher Education Students Loan Board
ICTs	Information Communication Technologies
ITU	International Telecommunication Unit
LAC	Latin America and Caribbean
MoEVT	Ministry of Education and Vocational Training
NGOs	Non- Governmental Organizations
SMS	Subject Matter Specialist
SPSS	Statistical Package for Social Science
TCRA	Tanzania Communications Regulatory Authority
TTCL	Tanzania Tele-communication Limited
URT	United Republic of Tanzania

CHAPTER ONE

INTRODUCTION

1.1 Background

Passing on information to farmers is a basic fundamental role of any agricultural extension services to effect learning process and social change (Demiryürek, 2008). In fact, the importance of information for effective functioning of any enterprise has been a central concern of economic theory for some time. Since Stigler's seminal work on the "Economics of Information" (Stigler, 1961), literature have emerged to explain how asymmetric information and costly search can explain equilibrium price dispersion for homogeneous goods. The linkages between costly search for information and market efficiency are important for the welfare of any business (Jensen, 2007). Information can be generated, processed, transformed and shared through complex processes of coding and decoding, generally known as communication (Röling, 1988). However, the generation of new information and knowledge need new information and communication channels. Therefore, better selection of information and communication channels, ensures the effectiveness of extension programs in agriculture.

Within agricultural sector, with appearance of sustainable agricultural systems, information is becoming a major input for agricultural production because sustainable agriculture is more information-intensive rather than technology intensive. Agricultural information can be seen as an important factor which interacts with the other production factors such as land, labour, capital and managerial ability. The productivity of these other factors can arguably be improved by the relevance, reliability and usefulness of information being provided. Farmers need to access

information about new technologies before they can consider adopting them and thus look up to research and extension agents as sources of new technologies. However, the traditional approach of providing agricultural information through extension services is overstretched and under-resourced.

As ICTs diffusion started to grow in many developing countries, its application in agricultural and rural development began to draw the attention of both researchers and policy makers. Working with and improving these information and communication systems ensure better delivery of agricultural services (Aker, 2008). Appropriate forecasts and their effective communication to farmers in time have a prospective future for increasing productivity in agriculture (Cecchini, 2003). An effective and efficient delivery system of essential information and technology services facilitate farmers in critical role of decision-making towards improved agricultural production, processing, trading, and marketing.

Most rural areas in developing countries have information asymmetry problem, they live in information-deserted areas (Esselaar *et al.*, 2001). Most rural areas in developing countries have information asymmetry problem, they live in information-deserted areas. Traditional search mechanisms such as face to face, the use of letters and radios are similarly low. As such, farmers' level of awareness regarding agricultural information, for example, is low hence poor decisions on the use of scarce resources and farming technologies (Minot, 2005).

In such context, new information search technologies can have important implications for agents' search behavior and hence market performance. Also,

according to the Tanzania Communications Regulatory Authority (TCRA, 2007), Information Communication Technologies (ICTs) have the potential to provide solution to the existing information asymmetry in various lagging sectors, agriculture in particular. After the green revolution in the mid-sixties, there has been no major technological innovation, which could give a fresh impetus to agricultural productivity. Insufficient extension services and poor access to information further widen the gap in the adoption of technology and lead to poor productivity levels. Therefore, precision agriculture is heavily dependent on an effective and efficient information dissemination system. Thus, investing in tele-communication technology is continued to be the best hope for developing countries to accelerate their development process (Goodman, 2005).

Mobile phones are one of the most exciting forms of ICTs, particularly in the context of developing nations (Overa, 2006). An assumption is that, mobile phones can enhance economic development. In some parts of the world, especially in the developed countries, however, mobile phone is an ubiquitous technology of urban-rural socio-economic speed, and it is considered as a development tool to “leapfrog” legacy infrastructure and innovate more quickly than older industrial forms. Mobile phones are speeding up ways in which farmers get, exchange, and manipulate information. They rework the way farmers interact with markets and cities. Increasingly, they enable farmers to focus, search, and extract useful and up-to-date market information from social and business networks (Ilahiane, 2007). This means mobile phone technologies are already today a serious medium for communication, truly available for an enormous number of people. With mobile phones farmers are

also able to make tentative decisions much more easily than without (Goodman, 2005).

Mobile phones are, therefore, becoming increasingly important to agro-based entrepreneurs as an infrastructure service for improving efficiency of agriculture markets, promoting investment, and contributing to empowerment, as an economic sector where agro-based entrepreneurs can make big profits, and pay taxes, as a development tool where mobile phones have increased the efficiency of service delivery to the agro-based entrepreneurs or opened opportunities for new services providing agriculture information through SMS and as a household expenditure that maintains social capital and contributes to economic management (Nigel, 2004).

Other literature show that, a developing country with an average of 10 or more mobile phones per 100 people between 1996 and 2003 would have enjoyed per capita Gross Domestic Product growth of 0.59% higher than an otherwise identical country with a mobile density of less than 10 phones per 100 people (Verheye, 2000). Moreover, for high-income countries, mobile telephones also provide a significant growth dividend Sweden, for example, had an average mobile penetration rate of 64 per 100 inhabitants during the 1996 to 2003 period, the highest penetration of mobiles observed. In that same period, Canada had a 26 per 100 average mobile penetration rates. Existing micro- and macro-level evidence suggests that mobile phones can improve consumer and producer welfare in developing countries (Jensen 2007; Aker 2008; Klonner and Nolen, 2009). However, the effect of mobile phones on changes in GDP and growth, especially in sub-Saharan Africa, is still relatively unexamined. Roller and Waverman (2001) assessed the impact of telecommunications

infrastructure on economic development in 21 OECD countries and found that a 10 percent increase in the telecommunications penetration rate increased economic growth by 1.5 percent. A similar analysis conducted in developing countries by Waverman *et al.* (2006) found that 10 percent increase in mobile penetration levels was associated with a 0.6 percent increase in growth rates.

Given its functionality, mobile phone penetration rate has been extraordinary high in both rural and urban areas, contrally to what Roller and Waverman found in their 1970 to 1990 analysis where mobile phones were seen not important, today, when we consider telephone networks, the importance of mobiles stands out, especially when we examine the 102 members of the ITU that had low phone penetration in 1995. Today the situation of mobile phones ownership is that, at the beginning of 21st century the average number of mobile phones per 100 inhabitants in Asia, Africa and Latin America and Caribbean (LAC) has risen by 100-400% in the span of just five years (Overa, 2006). Such massive growth in number is commendable by itself, and if accompanied by the predictable positive economic impact, the results could be unprecedented, International Telecommunication Union (ITU, 2006).

The compound annualized aggregate growth rate (CAGR) in handset numbers by Africans was pegged at a healthy 58 percent, a figure that clearly propelled the African cellular market to outperform all others worldwide (Jensen, 2007). The next fastest growing region has been Asia with a CAGR of just under 30 percent, while the Americas have also grown at more than 20 percent per annum. TCRA shows that the Tanzanian tele-density is inching close to 20 million users, http://www.dailynews-tsn.com/press.html site visited on 27/9/2010. In Tanzania, mobile phone penetration

is growing at a considerable rate, especially in urban areas. According to the Ministry of Finance and Economic Affairs, the overall mobile subscriber base grew from 15 million people in 2009 to 20.7 million in 2010 (TCRA, 2010). These growth figures are remarkably high, and point to the value that mobile telecommunications presumably bring in the development processes. The question, however, is to what extent has this ICT revolution helped rural farmers in Tanzania to access market information for their farm products?

1.2 Problem Statement and Justification

Information and communication issues have been key topics for agricultural education and extension for decades. The complexities of the agricultural production function imply that farmers need information on a variety of topics and at a variety of stages. Farmers have different types of information needs during each stage, ranging from weather forecasts, pest attacks, inputs, improved cultivation practices, pest and disease management and prices. Farmers can obtain information from a number of sources, including, among others, their own trial and error and from members of their social network. While, traditional economic theory assumes that searching for such information is costless, in developing countries, in reality, information is neither symmetric nor costless. This is partly due to the cost of obtaining that information via personal travel, radio, newspaper, which can be relatively expensive in the context of limited infrastructure and vast distances. According to Poole *et al*. (2000), old information and communications technologies such as radio and television have been and continue to be important tools in the attempt to link farmers more closely with

market demands, yet market information systems continue to be a weak point in rural development.

The 21st century is characterized by the rapid growth of information and communication technologies (ICTs) and their assimilation into all aspects of the global political economy. Proficiency in the use of such ICT tools is of real value in this emerging information economy, and many governments have pursued the policy of enhancing their peoples' ICT's capacities and capabilities as a means of attaining economic growth under difficult global circumstances. The developments of 'new' information technologies (such as satellite radio and television, internet-based media and cellular telephone) have created additional media for overcoming the information gap.

Despite this large-scale, heavy infusion and investment in ICT in developing countries, Tanzania in particular, information poverty has not yet been well addressed, especially for the rural poor farmers. Aminuzzaman *et al*. (2003) used the notion of ''information poverty'' to denote a situation in which ''inadequate telecommunications infrastructure which led to limitations on the choices available to individuals because high costs of telecommunications makes it too costly to seek out information about alternative courses of action'. One major evidence being that farmers and small entrepreneurs generally have no reliable way of knowing prices and other agricultural related information before they travel to the markets due to poor communication facilities. As such, farmers' participation in market and transport management has been so poor that most of the time they are being forced to

sell their products to local middlemen at low prices (Sood, 2006). Under such circumstances, experts speak out that this deprivation on part of the farmers may greatly be reduced if they would have been empowered with information (Minot, 2005).

In light of the above, the Government of Tanzania has taken a number of steps to come up with different media platforms through which farmers could access information including radios, televisions, prints, and person to person communication. However, progress has been so small probably because the technologies used have been so expensive that information capture has been problematic (Molony, 2008). For instance, Waverman *et al*. (2006) have highlighted the shortcomings of traditional methods of providing information to rural farmers and or rural community who are generally illiterate and relatively remote from formal sources of information like extension stations, radios, televisions, prints and libraries. Some of these shortcomings included: irrelevance of the delivered information, poor coverage, lack of avenues to improve performance, failure to ensure accountability, and lack of focus on location specific needs of regions, disadvantaged areas and target group requirements. The rationale of this study was therefore, to investigate mobile phones ability to address this information asymmetry in agriculture.

1.3 Objectives of the Study

1.3.1 General objective

The overall objective of the study was to investigate factors influencing the use of mobile phones in communicating agricultural information in Kilolo District in Iringa region, Tanzania.

1.3.2 Specific objectives

(i) To determine the extent of ownership of mobile phones by farmers in the study area.

(ii) To assess the type of agricultural information that farmers send and or receive using mobile phones.

(iii) To identify socio-economic factors influencing the use of mobile phones in the communication of agricultural information by farmers in the study area.

1.4 Study Hypotheses

Based on the above objectives the following hypotheses were tested:

Ho_1: There is no statistically significant difference of the influence of mobile phone ownership in the use of mobile phones to communicate agricultural information.

Ho_2: There is no statistically significant difference of the influence of the type of agricultural information to be communicated on the use of mobile phone(s) in communicating agricultural information.

Ho_3**:** There is no statistical significant influence of Socio-economic factors on the use of mobile phones in communicating of agricultural information.

1.5 Research Questions

The study generally aimed at finding out what factors affect the realization of full agricultural enhancing potential of mobile phones? Specifically, the study aimed at addressing the following questions:

(i) In what ways do farmers make use of mobile phone technologies to meet their agricultural information needs?

(ii) How the uses of the mobile phones enable farmers to confront the challenges they face in their farming business?

(iii) What are the attitudes of farmers toward the use of mobile phone technology?

CHAPTER TWO

LITERATURE REVIEW

2.1 An Overview of Mobile Phones Use

The past decade has witnessed a revolution in the use of ICT in Developing countries. Many people and offices as well as rural farmers own ICT facilities such as personal computers and mobile phones. The largest increase in the use of ICT has been in mobile telephony where subscriptions in developing countries increased from about 30% of the world total in 2000 to more than 50% in 2004 and to almost 70% in 2007 (Cieslikowsk et al., 2009). Mobile phones in less developed economies are playing the same crucial role that fixed telephony played in the richer economies in the 1970s and 1980s. Mobile phones substitute for fixed lines in poor countries, but complement fixed lines in rich countries, implying that they have a stronger growth impact in poor countries. Many countries with under-developed fixed-line networks have achieved rapid mobile telephony growth with much less investment than fixed-line networks would have needed (Waverman *et al*., 2006).

2.2 Mobile Phones' Contribution to Economic Development

The rapid adoption of mobile phones has generated a great deal of speculation and optimism regarding its effect on economic development in Africa. Policymakers, newspapers and mobile phone companies have all touted the poverty-eradicating potential of mobile phones (Corbett, 2008). An article in the *Economist* (2008) reported: "A device that was a yuppie toy not so long ago has now become a potent

force for economic development in the world's poorest countries." Do such sentiments and slogans reflect the reality of the consequences of the mobile phone for economic development in Africa?

Over the past 10 years, there has been a remarkable progress in the use of ICT in African agriculture; especially in the area of farmers' access to market information, though little studies have been done to explore how mobile phones impact livelihoods of farmers (Gabre, 2001). Farmers Information Services at both national and regional levels are a promising new field of research and application in the emerging field of agriculture. Mobile phones without doubt are amongst the main instruments that can help agriculture community especially to ease the communication process, so agriculture community must be encouraged to utilize it wisely. There is an assumption that owning a mobile phone has an influence in the economic boundary of the business owner as it gathers and or disseminates information about the business (Donner, 2006). This in turn makes the owner get easy in touch with other business partners (Jensen, 2007). There are some evidences of this belief, especially the well-known stories of the farmers checking price, finding suppliers or bidder customers through mobile phones (Bauer *et al*., 2005)

2.3 Benefits of Mobile Phone

Five potential mechanisms have been identified to address the ways through which mobile phones can provide economic benefits to consumers and producers in Sub-Saharan Africa. First, mobile phones can improve access to and use of information, thereby reducing search costs, improving coordination among agents and increasing market efficiency. Second, this increased communication could improve firms'

productive efficiency by allowing them to better manage their supply chains. Third, mobile phones create new jobs to address demand for mobile-related services, thereby providing income generating opportunities in rural and urban areas. Fourth, mobile phones can facilitate communication among social networks in response to shocks, thereby reducing households' exposure to risk. Finally, mobile phone-based applications and development projects have the potential to facilitate the delivery of financial, agricultural, health and educational services.

As pointed out in chapter one, this study is meant to determine the extent of mobile phone ownership and the type of information send or received by farmers via mobile phones then identify factors influencing mobile phone use by farmers in Kilolo District. According to Orlikowski (1992), as pointed out in structuration model; the interaction between technology, institutional properties and human agents affect human's' position within a socioeconomic structure. In the model, technology is seen as product and medium of human action and that, an institutional condition of interaction with technology determines the consequences of interaction.

2.4 Mobile Phones Ownership and Distribution

Most regions in Asia and Sub-Saharan Africa show varying levels of mobile telephony ownership. Digital wireless phones have great potential to bridge the gap between the "haves" and the "have-nots", given their accessibility, affordability, and fast infrastructure implementation. A study done in Tanzanian community found that 28% of people said they could access a fixed line in the community, compared to 97% who could access a mobile one (Goodman, 2005).The same study concluded

that income was an important but not limiting factor to ownership and use of mobiles. Ownership was less skewed towards the sections that have higher income levels.

2.5 Impacts of Mobile Phones on Agriculture

The important route to reduce poverty in rural areas is considered to be the enhancement of market participation by rural farmers, as it can increase net returns to agricultural production (Verheye, 2000). However, many farmers in Sub-Saharan Africa remain subsistence farmers whose production activities are conducted mainly for home consumption (Hudson, 2006). The reasons for remaining subsistence among others include lack of information and high cost to participate in marketing. A better access to agricultural information is expected to improve farm productivity, reduce cost and or encourage market participation by farmers.

Jensen (2007) and Aker (2008) both exploit the staggered introduction of mobile phone coverage to estimate the impact of mobile phones on agricultural markets in developing countries. Examining the effect of mobile phones on the fisheries sector in Kerala, India, Jensen finds that the expansion of mobile phone coverage leads to a significant reduction in the dispersion of fish prices across markets, as well as a decline in waste. He showed that this led to important welfare improvements for both fishermen and consumers; fishermen's profits increased by three percent, consumer prices declined by four percent and consumer surplus increased by six percent. With improved access to information via mobile phones, fishermen were better able to take advantage of spatial arbitrage opportunities, thereby improving locative efficiency. Examining the impact of mobile phones on grain markets in Niger, Aker (2008)

found that the introduction of mobile phones reduces dispersion of grain prices across markets by ten percent. The effect is stronger for those market pairs with higher transport costs, namely; those farther apart and linked by poor quality roads.

Mobile phones are being integrated into existing agricultural trading business chiefly because of the crucial role they play in improving the exchange of supply and demand of information between farmers and buyers (Verheye, 2000). The information obtained via mobile phones is useful in freeing a farmer from sending his produce to the market blindly, by allowing them to know whether to divert his crops elsewhere for minimum profit more locally instead of increasing loss (Aker, 2008). Aker's study on the use of cell phones on grain market performance in Niger found that the primary effect of cell phones was a reduction of information search costs.

2.6 Factors influencing Mobile Phone Use in Agriculture

The low rates of adoption of agricultural technologies in developing countries have been well-documented, and there is widespread theoretical and empirical literature attempting to identify the determinants of agricultural technology adoption in different contexts (Brynjolfsson and Hitt, 1995; Duncombe and Heeks, 2001; Conley and Udry, 2010). There has been some general consensus on the determinants or constraints to technology adoption, particularly in the agricultural context. This includes levels of education, wealth, risk preferences, expected returns, tastes and access to information (Djankov *et al*., 2001).

The growth of mobile phone coverage across Africa has shown a strong positive correlation with population density, but other factors matter as well, for instance;

using a spatially disaggregated dataset of mobile phone coverage and geographic characteristics, Buys *et al.* (2009) found that the probability of having a mobile phone tower in a particular location is strongly and positively associated with potential demand factors, such as population density and per capita income, as well as the competitiveness of the mobile phone sector within the country. They also found that factors associated with higher costs namely, higher elevation, steeper slopes, and distance from a main road and major urban centers are negatively associated with mobile phone coverage. In fact, the same might have effect on the use of mobile phone in communication of agricultural information in such areas.

According to Samuel *et al*. (2005), Factors that affect adoption and utilization of agricultural technology include; technological or innovation factors, institutional factors, individual factors and the nature of agricultural information to be communicated (Rashid, 2007). Technological factors include issues like relative advantages of the innovation, its complexity, compatibility, cost and the image surrounding it as viewed by the customers. Institutional factors include the size of the firm, the quality of the existing information systems, and intensity of the information being processed, urgency of information, the level of specialization of the firm as well as the level of support by management. On the other hand, individual factors affecting innovation adoption and use incorporate the decision makers' innovativeness as well as their knowledge of technology. Other individual factors include; gender, age and literacy level (Rashid, 2007).

2.7 Conceptual Framework of the Study

In the analysis of ICTs, it clearly appears that the use and or appropriation of any technology by a society is closely linked to the technological, individual and institutional factors (Davis, 1989). This study therefore sought to investigate factors influencing the use of mobile phones in communicating agricultural information. The study has built a foundation on “structuration theory” the focus of the theory is the development of relationship over time between structure and interaction. The relationship between independent and dependent variables of the study is as illustrated in the attached conceptual framework figure below,

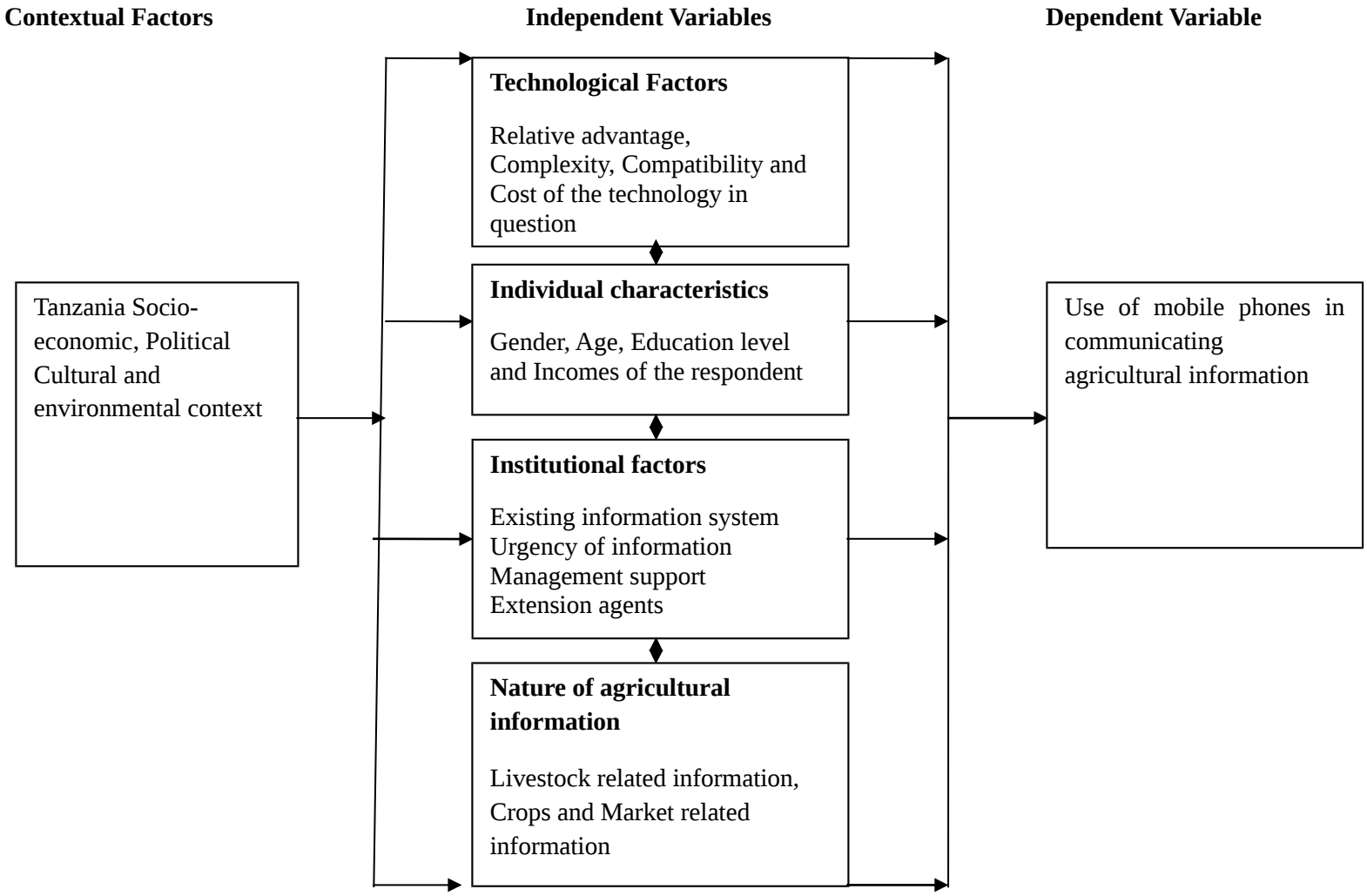

Figure 1: Conceptual framework of factors influencing the use of mobile phones in communication of agricultural information

CHAPTER THREE

METHODOLOGY

3.1 Description of the Study Area

This study was conducted in Kilolo district, which is one of the seven districts of Iringa region of Tanzania. Its geographical coordinates are 8° 0' 0" South, 35° 51' 0" East, and borders Morogoro region to the north and east, Mfindi district to the South and Iringa rural district to the West. Administratively the district is divided into three divisions, 12 Wards, 83 villages, 415 hamlets and 42 002 households. The three divisions of the district are Kilolo, Mazombe and Mahenge. Kilolo division has eight wards, including; Bomalang'ombe, Dabaga, Idete, Mtitu, Ng'uruwe, Ihimbo, Ukumbi and Ukwega. The District is favourable for agricultural production of crops like sunflower, maize, tomatoes, Irish potatoes, beans, simsim, and trees for timber.

3.2 Research Design

A cross-sectional survey design was adopted, according to Babbie (1994), cross-sectional research design allows for collection of information at one point in time, from a selected sample of respondents. The design is considered favourable with limited time and fiscal resources for data collection.

3.3 Sampling Procedures

3.3.1 Sampling technique(s)

The study population involved all farmers in Kilolo District regardless their mobile phones ownership status with an assumption that even those who didn't own mobile

phone could manage access and use mobile phone(s). A multistage sampling method was used in selecting respondents. The first stage involved purposive selection of one division (Kilolo) and four wards (Dabaga, Mtitu, Ng'uruwe and Ukumbi) out of the eight wards, the reason being that, the four wards experiences better mobile phones network than the other four wards. A simple random sampling technique was then used to get eight villages out 31 villages then 48 respondents from each village were selected. Every farmer in the selected village was assigned a unique number before being randomly selected using a table of random numbers. Respondents were further stratified basing on the type of farming activities they practice, literacy level, sex, and age. Purposive sampling was used in selecting key informants for focus group discussions (FGDs) from the different activities.

3.3.2 Sample Size

According to Cochran (1963), sample size for a study with an unknown population can be determined by using the formula given below;

$$no = \frac{Z^2 pq}{e^2}$$

Where: *no* is the sample size needed if population is unknown, *Z* to the level of confidence, *p* is the estimated proportion of the attribute that is present in a population, q is 1-p, e is the desired level of precision, (in this case level of confidence=95 thus Z= 1.96, p= 0.5, q=0.5, e=5%). Thus; $no = \frac{1.96x1.96x0.5x0.5}{0.05x0.05}$ =384. Therefore, the sample size for the study was 384 respondents.

3.4 Data Collection

3.4.1 Testing the validity and reliability of the instrument

Kirk and Miller (1986) point out that there are two basic goals in questionnaire design; first obtaining information relevant to the purposes of the survey and second collecting such information with maximal validity and reliability.

3.4.1.1 Validity

Validity refers to the degree to which a study accurately reflects or assesses the specific concept that the researcher is attempting to measure. Kirk and Miller (1986), identifies five sources of evidence to support construct validity: including content, response process, internal structure, relations to other variables, and consequences. The construction of the interview schedule for this study strictly considered all the above threats to validity. To ensure the instrument elicit appropriate, meaningful and useful data, the instrument was validated through discussions with supervisor, peers and other experts in agricultural education and extension department of Sokoine University of Agriculture, their comments were then used to improve the instrument accordingly.

3.4.1.2 Reliability test

Reliability refers to the extent to which an experiment, test, or any measuring procedure yields the same results on repeated trials. A measure is reliable to the degree that it supplies consistent results. Thus, an instrument for this study was pre-tested to ensure its reliability. A pilot study was conducted to ten people in the study

area through a split half method to work out Spearman-Brown Split Half Reliability Coefficient ($\mathbf{r_{sb}}$). Under this method, the instrument was divided in some random manner into two halves of five people each. The assumption was that; if the sum scale were reliable, the expectation was that the two halves would have a split half reliability coefficient (r_{sb}) range from o.7 to 1.0. The actual equation for Split Half reliability is; $r_{sb} = 2r_{xy} / (1+r_{xy})$, whereby; r_{sb} is the split-half reliability coefficient; rxy refers to the correlation between the two halves of the scale or test. The result from the test revealed that the test had a split half reliability coefficient of 0.74, hence, assent with Spearman-Brown Split Half Reliability that the instrument was reliable for the study.

3.4.2 Primary data

The study employed multiple data collection tools, including interview schedules, checklist for key informants and focus group discussions. Key informants and FGDs helped to explore some aspects about the use of mobile phones that enabled to gain an understanding about the level of use and the factors influencing the use of mobile phones by farmers in Kilolo District.

3.4.3 Secondary data

This included information from previous studies on mobile phone use and appropriation including books, journals, websites and other researches works from libraries and offices hence, helped to come up with information regarding mobile phone use.

3.5 Data Processing, Analysis and Interpretation

Kothari (1985) defines data analysis as the computation of certain indices or measures along with the searching for patterns of relations that exists among the data. In this study, data collected were statistically analyzed using computer soft ware programs, for instance; Statistical Package for Social Sciences (SPSS) version 16, whereby descriptive analysis was done to yield percentages, means, and frequencies. Cross tabulation, Chi-square and regression helped to establish the nature of relationship between variables.

3.5.1 Summary of data analysis

Hypothesis	Independent variable(s)	Dependent variable	Statistical analysis method(s)
Ho_1: There is no statistical significant influence of mobile phone ownership in the communication agricultural information.	**Farmer characteristics** • Age • Sex • Education level • Income • Mobile phone ownership status	Use of mobile phones in communicating agricultural information	Frequencies, Percentages, Chi-square, ANOVA
Ho_2: There is no statistical significant influence of the type of agricultural information to be communicated on the use of mobile phone(s) in communication of agricultural information.	**Type of farming system** • Growing crops i.e. input supply • Keeping animals i.e. type and number of animal kept **Income generating activities** • Timber business • Masonry • Carpentry • Local brewer **Information communicated** • Better prices • Input supply • Management practices • Weather information	Use of mobile phones in communicating agricultural information	Frequencies, Percentages, Chi-square, Regression, ANOVA
Ho_3: There is no statistical significant influence of Socio-economic factors on the use of mobile phones in the communication of agricultural	**Socio-economic factors** • Income • Market availability • Credit availability • Extension service	Use of mobile phones in communicating agricultural information	Frequencies, Percentages, Chi-square, Regression, ANOVA

information.	• Research

3.5.2 Generalization of the study findings

The study was conducted in only eight villages out of 83 villages of kilolo Distict in Iringa region. However, the findings can be generalized beyond the eight villages involved in the study provided they have similar situation to such areas. It is, therefore, considered that the implication from the study will be applicable to other rural areas in Kilolo district, Iringa region and elsewhere in Tanzania with similar situation.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Overview

This chapter presents the study findings. It is divided into 11 sections. The first section presents respondents' demographic characteristics, followed by section two, which presents and describes mobile phone ownership and distribution amongst respondents. Section three and four describes various types of agricultural information send or received and agricultural stakeholders who were contacted by farmers via mobile phones, respectively. Section five describes the advantages of using mobile phones in communicating agricultural information.

Section six and seven describes factors that influenced the use of mobile phone in communicating agricultural information. Further, section eight provides regression analysis of factors influencing the use of mobile phones in communicating agricultural information. Other sections are nine and ten which covers on hypothesis test and the description of ANOVA aiming at determining the relationship between different variables on the use of mobile phones in communicating agricultural information. Section eleven discuss on problems encountered when using mobile phones in communicating agricultural information.

4.2 Socio-Demographic Characteristics of Respondents

According to Souter *et al.* (2005), in his three countries study (India, Mozambique, Tanzania), telecommunications were found to have a significant correlation with socio-economic characteristics of individuals. In this study, of the 384 respondents, 200 (52.1%) were females, while 184 (47.9) were males. And of all the 384 respondents, 271 (70.6%) were married, 25 (6.5%) never married, 56 (14.6%) widowed while 32 (8.3%) were divorced, implying that large percentage of the respondents were married. In addition, of the 384 respondents, 306 (79.7%) owned mobile phones, while 78 (20.3%) did not.

Further, of the 384 respondents, 262 (68.2%) were young, aged between 20-45 years old, while 122 (31.8%) were aged above 45 years old. As such, the study revealed that, over two thirds of the respondents were young, implying that probably they would highly use mobile phones in communicating agricultural information compared to old people. Likewise, according to Sounders *et al.*, 1983 and Thompson, 2001 majority of ICTs users tends to be young adults. Moreover, of the 384 respondents, 306 (79.7%) reported that they had attained primary education, while 45 (11.7%) had not attended any formal education, and 33 (8.6%) were secondary school leavers.

Table 1: Respondents' Socio-demographic Characteristics (n=384)

Characteristics	Frequency	percent
Respondents' sex		
Male	184	47.7
Female	200	52.3
Respondents' age		
Young (≤ 45 years)	262	68.2
Old (> 45 years)	122	31.8
Respondents' marital status		
Never married	25	6.5
Married	271	70.6
Divorced	32	8.3
Widow	30	7.8
Widower	26	6.8
Respondents' education level		
No formal education	45	11.7
Primary education	306	79.7
Secondary education	33	8.6
Mobile phone ownership		
Have mobile phone	306	79.7
Doesn't have mobile phone	78	20.3

4.3 Mobile Phones Ownership and Distribution

As illustrated in Table 1 above, of the 384 respondents interviewed, 306 (79.7%) owned mobile phones. This mobile phone penetration rate (79.7%) is far higher compared to that of the entire Tanzania nation during the last quarter of the year 2009 as pointed out by Samuel *et al.* (2005) where the rate was only (39.0%). Table 2 below indicates the distribution of mobile phones ownership by respondents' socio-demographic characteristics such as education level, marital status, sex, income and age. Other factors were; the type of farming activities that respondents practiced, agricultural information respondents commonly communicated with other stakeholders, and income generating activities other than farming respondents undertook.

Table 2: Respondents' mobile phone ownership and distribution (n=384)

	Own mobile phone	Do not own mobile phone	Chi-square test

Variables	n	%	n	%	χ^2-value	P-value
Education level						
No formal education	36	9.4	9	2.3	72.000	0.644^{ns}
Primary	238	62.0	68	17.7		
Secondary	33	8.3	0	0.0		
Marital status						
Never married	23	6.0	2	0.0	24.460	0.000*
Married	221	57.5	50	13.0		
Divorced	28	7.3	4	1.0		
Widowed	14	3.6	16	4.2		
Widower	20	5.2	6	1.6		
Average daily income						
Less than a dollar a day	247	64.5	78	20.3	17.769	0.000*
More than a dollar a day	59	15.3	0	0.0		
Sex of respondents						
Male	157	40.9	27	7.0	20.612	0.000*
Female	149	38.8	51	13.3		
Age of respondents						
Young	216	56.3	46	12.0	20.612	0.008*
Old	90	23.4	32	8.3		
Farming system practiced						
Keeping animals	13	3.4	2	0.0	6.939	0.458^{ns}
Growing crops	166	43.2	38	10.0		
Mixed farming	127	33.1	38	10.0		
Agricultural information sent or received						
Better prices	163	42.5	40	10.4	1.562	0.000*
Input supply	122	31.8	18	4.7		
Management practices	10	3.1	12	3.1		
Weather information	8	2.1	0	0.0		
Income generating activities						
Timber business	12	3.1	0	0.0	20.612	0.004*
Masonry	14	3.6	5	1.3		
Carpentry	12	3.1	2	0.0		
Local brewer	30	7.8	7	1.8		
Shop/grocery	9	2.3	2	0.0		
Food and drinks	13	3.4	2	0.0		

Note: *Significant at 0.05, ^{ns} not significant at 0.05.

As illustrated in Table 2, of the 306 respondents who owned mobile phones, 238 (62%), 33 (8.5%), 36 (9.4%) reported to had attained primary, secondary and no formal education respectively. The study result indicated that all respondents who had

attained secondary education owned mobile phones. This could be interpreted that education is a factor for owning mobile phones. However, a chi-square test revealed that respondents' education levels had no statistical significant influence on mobile phone ownership at $\chi^2 = 72.0$ and $\rho > 0.05$. This insignificant influence of education levels on mobile phones ownership and use could probably be due to high proportion of the respondents, for instance 238 (62%) being of the same level of education (primary level). So, the result seems to disagree with Bertolini (2002) findings that primary education had stronger influence on mobile phone ownership.

Also, the study results in Table 2 illustrates that, of the 384 respondents, 306 (79.4%) who owned mobile phones, 221 (57.5%), 28 (7.3%), 23 (6.0%), 20 (5.2%) and 14 (3.6%) were married, divorced, never married widowers and widows, respectively. Most of respondents were married, and a chi-square test results revealed that there was a statistical significant difference at $\chi^2 = 24.46$ and $\rho < 0.01$ implying that marital status influenced mobile phone ownership and use.

Furthermore, Table 2 shows that, of the 306 respondents who owned mobile phones, over half, 247 (57.5%) indicated that they had incomes less than a dollar per day, while 59 (15.3%) got incomes greater than a dollar per day. As such, the study revealed that, mobile phone ownership and use was also common to respondents with low incomes, however, a chi-square test revealed that there was a high statistical significant influence incomes on mobile phone ownership at $\chi^2 = 17.769$ and $\rho < 0.01$. Therefore, these findings tallied with earlier studies which showed a positive correlation between incomes and ICTs adoption, for instance, Chowdhury and Wolt (2003) found that respondents with high incomes in developing countries were more

likely to own mobile phones than those with low incomes. Similarly, Sounders *et al.* (1983) observed that mobile phones tend to be used more intensively by individuals who are operating above subsistence level, and is used in place where a large proportion of populations are engaged in market-oriented activities above the subsistence level.

Furthermore, results on Table 2 indicated that, of the 384 respondents, 157 (40.9%) males and 149 (38.8%) females owned mobile phones. As such, the ownership of mobile phones in the study area was a bit more skewed to males than to females. Does it mean that women are less able to fully receive the benefits of mobile phones compared to males? The answer could be yes. Nielinger (2003) found that sex was a key determinant of ownership and utilization of information enhancing technologies in Kasulu, Magu, and Sengerema Districts in Tanzania. According to Njehia (1994) and Sounders et al. (1983) gender was found to be a limiting factor to access and use of ICTs. Their findings portrayed that, women tend to use telecommunication significantly less than men in most developing countries, because of socio-cultural restrictions. A chi- square test of this revealed that there was a statistical significant difference at $\chi^2 = 20.612$ and $\rho < 0.01$.

As of age, of the 384 respondents, majority, 306 (79.7%) reported that they owned mobile phones, and of these, 216 (56.3%) were young respondents. A chi-square test revealed that age of respondents had a statistical significant influence on mobile phone ownership at $\chi^2 = 20.612$ and $\rho < 0.008$. Thus, the findings correspond with Alampay (2003) who found that, age of an individual was a factor in accessing and using ICTs. In addition, Sounders *et al.* (1983) showed that, majority of ICTs users

tended to be young adults. The interesting question here could be why young people? The answer to this question could be probably because most of the young people have extra incomes for buying and using technologies such as mobile phones. Bertolini (2001) found that older individuals had lower economic and social interactions thus resulting into low intensity of telephone service use.

Regarding mobile phones ownership in relation to the respondents' type of farming activities practiced, of the 384 respondents, 166 (43.2%), 127 (33.1%) and 13 (3.4%) grew crops, kept livestock and or practiced mixed farming, respectively. A χ^2-test revealed that the type of farming activity of respondents had no statistical significance influence on mobile phone ownership at $\chi^2 = 6.939$ and $\rho < 0.458$. Further, Table 2 summarizes responses from respondents on the type of agricultural information that they commonly communicated with different stakeholders using mobile phones. Of the 303 respondents who were involved in crop farming, 163 (42.5%) reported that, they used mobile phones to communicate information pertaining to prices of various agricultural produce. Furthermore, 122 (31.8%), ten (3.1%), eight (2.1%) reported that they used mobile phones to communicate information on input supplies, agricultural management practices and weather information. A chi-square test revealed that there was a high statistical significant different of mobile phones use in the communication agricultural information at $\chi^2 = 1.562$ and $\rho < 0.01$.

Furthermore, Table 2 indicates that there were some differences on the level of mobile phone ownership based on income generating activities that respondents overtook in addition to farming activities. Of the 384 respondents, 120 (31.25%)

mentioned that apart from farming activities were also engaged in non-farm activities such as, selling timber, building, carpentry and selling local brew. Yet others sold foods and or soft drinks in shops and groceries. Of the 120 respondents, 30 (7.8%) made and sold local brew, while 14 (3.6%), 13 (3.4%), 12 (3.1%) and nine (2.3%) were masonry, carpentry, timber dealers, selling food/soft drinks and sellers of shop or grocery, respectively.

4.4 Agricultural Information frequently sent or received

Table 3 summarizes respondents' opinions on the type of agricultural information commonly communicated with different stakeholders using mobile phones. Of the 384 respondents, majority, 303 (79.5%) said that mobile phones had enhanced their ability to access different agricultural information. In addition, Focus Group Discussion (FGDs) and Key Informants (KI) reported that they used mobile phones to discuss prices with buyers and crosscheck prices for their produce, instead of relying on middlemen or a few buyers prevailing on the locality. Mobile phones were further reported as being used to make decisions on the best time to sell crops and livestock, because farmers could get instant information on prices.

These findings therefore portray that mobile phone use enabled farmers in the study area to access information on better market and prices for their produce and so be able to overcome the problem emanating from relying on middlemen. Previous studies (Molony, 2008) have indicated that farmers have often complained about the low prices for their produce. Farmers felt that they are being cheated by middlemen who rarely reveal market prices. Focus group discussions with various participants further indicated that farmers communicated a range of agricultural information,

specifically on better prices, input supplies, better management practices and weather information which together helped them to make better choices on where and when to buy or sell their agricultural inputs and outputs, respectively.

Table 3 shows the types of agricultural information that respondents communicated via mobile phones in the study areas. Of the 384 respondents, over half, 163 (42.5%) indicated that they used mobile phones to get information on markets and better prices for their agricultural produce, which eventually helped them to make sound decisions. However, few, 122 (31.8%) respondents mentioned that they used mobile phones to communicate information on input supplies. Likewise, other respondents, ten (3.1%), and four (2.1%) reported that used mobile phones to communicate information on recommended managerial practices and weather, respectively.

Table 3: Agricultural information frequently sent or received (n=384)

Information on;	Frequency	Percent
Market and prices for agricultural produces	163	42.5
Input supplies	122	31.8
Recommended agricultural managerial practices	10	3.1
Weather	8	2.1
Total	**303**	**79.5**

4.5 Agricultural stakeholders that respondents contacted via mobile phones

Table 4 shows that, of the 384 respondents, 271 (70.7%) mentioned that they used mobile phones to call extension officers to seek help on different farming information. Of all respondents, 242 (63.0%), said that they rarely used mobile phones to call extension agents while 29 (7.6%) often used. A chi-square test revealed that respondents' use of mobile phones to call extension agents on agricultural issues

had a statistical significant influence in communicating agricultural information at χ^2 = 47.816 and $\rho < 0.01$.

Again, Table 4 shows that of the 384 respondents, 293 (76.3%) indicated that they used mobile phones to call marketing agents on prices of different agricultural produce. Of these, 258 (67.2%), said that they rarely used mobile phones to contact marketing agents while 35 (9.1%) said they often called them. A chi-square test revealed that respondents' use of mobile phones to call marketing agents on prices of agricultural produce had a statistical significant influence in communicating agricultural information at χ^2 = 48.790 and $\rho < 0.01$. The study findings conforms with those of Lohano *et al*. (1998) who found that, available information on prevailing market prices for agricultural produce strengthened farmers' position when bargaining with traders, also led farmers to check on prices they received *vis-à-vis* the prevailing market prices.

Table 4: Agricultural stakeholders contacted via mobile phones and the type of information commonly exchanged (n=384)

Variable	Frequency of use					Chi-square test	
	Often		Rarely			χ^2-value	ρ-value
	n	(%)	n	(%)	Total (%)		
Called extension agents	29	7.6	242	63.0	271 (70.6)	47.816	0.000*
Called marketing agents on prices	35	9.1	258	67.2	293 (76.3)	48.790	0.000*

Called buyers on agricultural prices	54	14.1	240	62.5	294 (77.4)	17.257	0.002*
Called input suppliers	36	9.4	261	68.0	297 (75.6)	39.468	0.000*
Called fellow farmers on social issues	70	18.2	253	65.8	323 (84.0)	49.453	0.000*
Called fellow farmers on farming issues	47	12.2	245	58.3	292 (70.5)	16.413	0.037*

Key: Often refers to the situation whereby the respondent used mobile phone to send or receive agricultural information (3-6 days per week), whereas, rarely refers to the use mobile phones to communicate agricultural information (at a rate of 1-2 days per week), *-statistically significant at $p<0.05$.

Further, result on Table 4 indicated that, of the 384 respondents, 294 (76.5%) indicated that they used mobile phones to call buyers of agricultural produce on prices of different commodities. Of these, 240 (62.5%), said that they rarely used mobile phones to call buyers of agricultural produce while 54 (14.1%) said they often used them. A chi-square test revealed that respondents' use of mobile phones to call buyers of agricultural produce to ask for prices had a statistical significant influence at $\chi^2 = 17.257$ and $\rho < 0.002$. Also, study results on Table 4 indicated that, of the 384 respondents, 297 (77.4%) indicated that they used mobile phones to call input suppliers on the availability of agricultural inputs. Of these, 261 (68.0%) said that they rarely used while 36 (9.4%) said that they often used them. A chi-square test revealed that respondents' use of mobile phones to call input suppliers on availability of agricultural inputs had a statistical significant influence at $\chi^2 = 39.468$ and $\rho < 0.01$.

Furthermore**,** results on table 4 shows that, of the 384 respondents, 323 (84.0%) mentioned that they used mobile phones to call their fellow farmers to talk about social issues. of these, about two thirds, 253 (65.8%) said that they rarely used mobile phones to call fellow farmers on family issues while a few, 70 (18.2%) said that they

often used mobile phones to call them. A chi-square test revealed that respondents' use of mobile phones to call fellow farmers on social issues had a statistical significant influence at $\chi^2 = 49.453$ and $\rho < 0.01$. Souter *et al*. (2005) and Donner (2004) found that there was great use of mobile phones to call for social issues and emergencies, rather than for economic issues such as calling suppliers or buyers. In addition, 292 (70.5%) respondents reported that they used mobile phones to call fellow farmers on farming issues. Of these, over half, 245 (58.3%) said that they rarely used mobile phones to call their fellow farmers to ask about farming issues while 47 (12.2%) said that they often used mobile phones for such purpose. A chi-square test revealed that respondents' use of mobile phones to call fellow farmers on farming issues had a statistical significant influence in communicating agricultural information at $\chi^2 = 16.413$ and $\rho < 0.037$.

Table 5 summarizes respondents' views on other sources of agricultural information other than mobile phones and type of information each source conveyed to farmers. The study found that, other sources of agricultural information included; radios, progressive farmers, extension agents and researchers. Of these 384 respondents, 178 (46.3%) said that they got agricultural information from progressive farmers, while 111 (38.6%) reported that they got it from extension agents. Furthermore, 51 (13.2%) of the respondents said that they got agricultural information from radios, the use of radio to communicate agricultural information was beneficial only if there were radio stations that had programs on agriculture and rural development (Soriano, 2007).

Table 5: Sources of agricultural information in addition to using mobile phones (n=384)

Information Source(s)	Information on better prices		Information on input supply		Information on recommended managerial practices		Information about weather		Total	
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Progressive farmers	131	34.1	33	8.6	4	1	10	2.6	**178**	**46.3**
Extension staff	78	30.3	32	8.3	0	0	1	0	**111**	**39.6**
Radio	37	9.6	8	2.1	4	1	2	0.5	**51**	**13.2**
Researchers	4	1.0	0	0	0	0	0	0	**4**	**1**

4.6 Advantages of using mobile phones

Mobile phones confer diverse advantages as a communication link in isolated circumstances because of its distinct feature of mobility**.** They serve as a two way communication mode and provide access to agricultural information service in fields. In this study for example, respondents listed a number of virtues associated with the use of mobile phones. For instance, focus group discussions with traders and middlemen showed that mobile phones improved their ability to deal with truck breakdowns and also the ability to shift crops once on the way in response to the changing market conditions. Ashraf *et al.* (2005) and de Silva (2008) asserts that mobile phones can facilitate a greater export orientation in agricultural practices and marketing, potentially bringing higher incomes for farmers. Respondent's views on what they thought were the advantages of using mobile phones in communicating agricultural information. Table 6, show that over half, 202 (52.6%) of the respondents reported that, mobile phones helped them to easily obtain agricultural information they needed. According to Kleih *et al. (*2004) cost savings, combined with quick access to information and instant communication with trade partners, opens new market possibilities.

Table 6: Advantages of using mobile phone in communicating agricultural information (n=384)

Variables	Frequency	Percent
Helps to easily get agricultural information once needed	202	52.6
Saving time in dealing with related parties	21	5.5
Promotes interpersonal relationships	16	4.2
Assist in obtaining agricultural information quickly	18	4.7
Helps to exchange information anytime the need arose	22	5.7
Increase income of the people in the community	8	2.1
Allow more contacts amongst farmers	12	3.1
Enhance strong social cohesion	2	0.5
Easy contact with customers/suppliers	2	0.5

In addition, the study result revealed other minor benefits associated with mobile phone use. For instance, of the 384 respondents, few, 22 (5.7%), 21(5.5%), and 18 (4.7) mentioned that, mobile phones made easier exchange of information, saved time in dealing with others, and assisted to obtain quick agricultural information, respectively. Furthermore, respondents pointed out other merits to include promoting interpersonal relationships, allowing more contacts amongst farmers, increasing incomes of the community members and enhancing easy contacts with customers. These findings are in line with those of Bertolini (2004) who found that people in Tanzania rural areas can benefit from provision of telephone services. Generally, mobile phones enabled farmers to have a more reliable and faster means of sending information and greater ability to keep track of consignments in transit goods and on arrival at the market. So, the study findings were more or less in line with what Jagun *et al.* (2007) found, that with mobile phones it means less time and money is

spent on travel, not just by reducing travel related risks but apparently, by even providing a substitute for unreliable alternatives such as transport.

4.7 Factors influencing the use of mobile phone in communicating agricultural information

Factors that respondents identified to influence use of mobile phones in communicating agricultural information included sex of respondents, their education levels, average daily incomes, mobile phone ownership duration of mobile phone ownership, type of farming practiced, type of agricultural information needed, and network coverage. Table 7 illustrates the results.

Table 7: Factors influencing the use of mobile phones in communicating agricultural information (n=384)

Variables	Used mobile phones to communicate agricultural information		Did not use mobile phones to communicate agricultural information		Chi-square test	
	n	%	n	%	χ^2-value	ρ -value
Respondent's education level						
No formal education	36	9.4	9	2.3	3.278	0.194^{ns}
Primary education	237	61.7	69	18.0		
Secondary education	30	7.8	3	0.0		
Average daily income						

Less than a dollar per day	247	80.7	78	20.3	18.636	0.000*
greater than a dollar per day	59	19.3	0	0.0		
Mobile phone ownership						
Owned mobile phones	293	76.3	13	3.4	2.568	0.000*
Did not own mobile phone	10	2.6	68	17.7		
Time of mobile phone ownership						
Less than 12 months	17	4.4	76	20.0	58.793	0.000*
12-24 months	62	16.2	8	2.0		
25-36 months	105	27.3	0	0		
More than 36 months	108	28.1	4	1.0		
Type of farming activities involved						
Grow crops	163	42.4	41	10.7	1.036	$0.596^{n.s}$
Keep animals	13	3.4	2	0.0		
Mixed farming	127	33.1	38	9.9		
Agricultural information needed						
Better prices	163	42.5	40	10.4	28.171	0.000*
Input supply	122	31.8	19	5.0		
Management practice	10	3.1	13	3.7		
Weather information	8	2.1	0	0.0		
Network coverage/availability						
Poor	3	0.0	0	0.0	2.674	0.000*
Average	26	7.8	0	0.0		
Good	263	68.5	11	2.9		
Very good	3	0.0	4	1.0		
I don't know	8	2.0	66	17.2		

Note= ***-Significant at 0.05, $^{n.s}$ not statistically significant at 0.05, χ^2 **-chi value**

Of the 384 respondents, 303 (79.0%) indicated that they used mobile phones to communicate agricultural information, of these, 237 (61.7%) indicated to had attained primary education, while 30 (7.8%) had attained secondary education. An interesting finding from the study was that, all respondents with secondary education level owned mobile phones. Such results perhaps showed that education was a factor for owning and using mobile phones. However, as indicated in the chi square results (χ^2 = 3.278, and ρ < 0.194) literacy levels of respondents had no statistical significant

influence on mobile phone use in communicating agricultural information. These results contradict what Alampay (2003) found, that “education determines the level of both access and use of ICT”, according to him, people with tertiary level of education could have higher access and use of public telephones and cellular phones than those of lower levels.

Furthermore, of the 306 respondents who owned mobile phones, 247 (76.3%) mentioned to earning income less than a dollar per day, while 59 (19.3%) indicated to getting incomes greater than a dollar per day. A chi-square test of the study revealed that respondents’ average daily income had a high statistical significant influence on mobile phones use in communicating agricultural information ($\chi^2 = 18.636$, and $\rho < 0.01$). Although mobile phone ownership was also common among respondents with low incomes, the study results found that use of mobile phones to communicate agricultural information was highly influenced by income levels. Such findings match with earlier studies which showed a positive correlation between incomes and mobile phone technology adoption (Chowdhury and Wolt, 2003; Sounders *et al.,* 1983).

Results on Table 1 show that, of the 384 respondents interviewed, 306 respondents owned mobile phones which was (79.7%) of the mobile phone penetration rate far higher compared to that of the entire nation of 39 percent during the last quarter of 2009 (Samuel *et al.,* 2005). Normally, mobile phone penetration rates are subject to significant measurement error, leading to potential bias in the coefficient estimates (Samuel *et al*., 2005), thus, such figures are subject to further scrutiny. A chi- square test results revealed that mobile phone ownership had a statistical significant

influence on mobile phone ownership and use to communicate agricultural information at (χ^2 = 2.568 and $\rho < 0.01$).

Of the 384 respondents, 306 (79.7%) reported that they used mobile phones to communicate agricultural information. Again, data on Table 8 indicate that there were differences in the rate of mobile phones ownership based on the type of agricultural information that respondents needed. For instance, less than half of the respondents, 163 (42.5%) reported that they used mobile phones to get information concerning better prices of agricultural produce. On the other hand, 122 (31.8%), 10 (3.1%) and eight (2.1%) reported that they used mobile phones to seek agricultural inputs, ask for managerial practices and weather information, respectively.

As shown on Table 7, the type of agricultural information that respondents communicated had an influence on mobile phones use in communicating agricultural information. A chi- square test results revealed that the two variables had a statistical significant influence on mobile phone use to communicate agricultural information at (χ^2 = 28.171 and $\rho < 0.01$).This provided evidence to reject the two null hypotheses which stated that mobile phone ownership had no influence on the use of mobile phone in communication of agricultural information. Hence, mobile phone ownership influenced the communicating agricultural information. Of the 384 respondents, 302 (78.6%) indicated that they used mobile phones in communicating agricultural information, and of these, more than half had owned mobile phones for over two years. Table 7 shows that, 105 (27.3%) and 108 (28.1%) of the respondents indicated that they owned mobile phones for 25-36 months and over 36 months, respectively. On the other hand, few respondents, 62 (16.2%) and 17 (4.4%) indicated to owning

mobile phones for less than two years, with a period of ownership between 12-24 months. A chi- square test results revealed that duration of mobile phone ownership had a statistical significant influence on mobile phone use to communicate agricultural information at ($\chi^2 = 58.793$ and $\rho < 0.01$).

Table 7 also summarizes the distribution of respondents' farming activities. Of the 384 respondents, 303(78.9%), indicated they were solely involved in farming activities. Of the 303 who farmed, 163 (42.5%) indicated to growing crops while 127 (33.1%) and 13 (3.4%) mentioned that they were mixed farmers and livestock keepers, respectively. However, such differences were found insignificant, as revealed by a chi-square test at $\chi^2 = 1.036$ and $\rho > 0.596$ revealed this shows that the types of farming activities had no statistical significance influence on mobile phone use to communicate agricultural information.

4.8 Other factors that influence the use of mobile phone in communicating agricultural information

In addition to factors illustrated on Table 7 above, other factors named to have an influence on the use of mobile phones in communicating agricultural information are shown in Table 8 below.

Table 8: Other factors affecting the use of mobile phone in communicating agricultural information (n=384)

Variable	Does the farmer use mobile phones to communicate agricultural information?	Chi-square test

	YES		NO		χ^2-value	ρ -value
	n	(%)	n	(%)		
Type of crop grown						
Maize	263	68.5	66	17.7	18.155	0.001*
Beans	3	1.0	0	0.0		
Wheat	6	1.6		0.1		
Peas	8	2.1	0	0		
Tomatoes	17	4.4	0	0		
Total	**297**	**77.6**	**66**	**17.8**		
Type of animal kept						
Cattle	76	19.8	8	2.1	44.272	0.000*
Goats	18	4.7	2	0		
Sheep	0	0.0	4	1		
Pigs	16	4.2	2	0		
Poultry	34	8.9	22	5.7		
Total	**144**	**37.6**	**38**	**8.8**		
Service provider						
Vodacom	209	54.4	11	2.9	4.666	0.198^{ns}
Tigo	19	5.0	0	0		
Airtel	67	17.5	0	0		
Zantel	4	1.0	0	0		

Note= *-Significant at 0.05, $^{n.s}$ not statistically significant at 0.05, $\chi 2_{\text{-chi square value.}}$

Data on Table 8 indicate that, 263 (68.5%) of the respondents indicated that they grew maize while 17 (4.6%), eight (2.1%), six (1.6%) and three (1.0%) mentioned that they produced beans, wheat, peas and tomatoes, respectively. Furthermore, results on Table 8 indicate that in spite of respondents growing beans, peas and tomatoes on small plots, they all used mobile phones to communicate agricultural information. The study findings revealed that the type of crop that respondents grew had statistical significant influence on the use of mobile phone in communicating agricultural information at $\chi^2 = 18.155$ and $\rho < 0.01$.

Furthermore, results on Table 8 indicates that of the 182(46.4%) respondents who kept animals, 144 (37.6%) of them owned mobile phones, and of these, (19.8%) kept cattle. This implied that, respondents who kept cattle owned and used mobile phones

in communicating agricultural information by large proportion than other categories. A chi-square test revealed that the type of animal kept, had a statistical significant influence on the use of mobile phone in communicating agricultural information at $\chi^2 = 44.272$ and $\rho < 0.01$.

In Tanzania, there are five major mobile-phone operators; including Airtel (formerly Celtel/Zain), Tigo, TTCL, Vodacom and Zantel, with coverage in almost every part of the country, TCRA (2007). According to Buys *et al*. (2009) the probability of having a mobile phone tower in a particular location is strongly and positively associated with potential demand factors, such as population density per capita income and the competitiveness of mobile phones sector within the country. Respondents were asked to mention the type of service providers they subscribed. Of the 384 respondents, over half, 209 (54.9%) mentioned that their main service provider was Vodacom followed by Airtel 67 (17%), Tigo, 19 (5%) and Zantel 4 (1%). On the same view TCRA (2008) found that the annual number of Tanzanians subscribing to a telephone line had grown at an average rate of 48 percent, with 45 percent, 26 percent, 13 percent and 6 percent for Vodacom, Airtel, Tigo and Zantel, respectivelly. The reasons for respondents to prefer Vodacom (SIM) in the study area could be due to the operator having been in the area for a long time compared to others. However, as seen on Table 7, subscribing to another service provider, had no statistical significant influence on the use of mobile phone in communicating agricultural information at $\chi^2 = 4.666$ and $\rho > 0.198$.

4.9 Regression analysis of factors influencing the use of mobile phone in communicating agricultural information

A regression analysis was run to determine the significance of determinant factors for using mobile phone which included respondents' age, sex, marital status, income and types of agricultural information to be communicated (Table 9). As shown on Table 9 above, with exception of sex, all other variables were found significant at (ρ <0.01). This suggests that, these variables had an influence on access to agricultural information via mobile phones. Regarding sex, on average women tend to be more marginalized than men, and are therefore less likely to make frequent use of mobile phones (Souter *et al.*, 2005), However, there was no significant difference in using mobile phones to communicate agricultural information due sex. This lack of significant impact of sex on mobile phone use to communicate agricultural information could be explained by the fact that the ratio of male to female on regard to mobile phone ownership is so narrow, as illustrated on Table 2 where the ownership of mobile phones was 40.9 and 38.8 percent for males-females, respectively.

Table 9: Regression estimates for the efficiency of selected variable on mobile phones use

χ_i	β	**Standardized Coefficients**	**Un-standardized Coefficients**	**T-value**	ρ-value	**95% confident interval**	
		SD_β	Std error (b*)			Lower bound	Upper bound
Age	-0.364	-1.067	0.088	-4.122	0.000*	-0.537	-0.190
Sex	-0.013	-0.016	0.027	-0.466	0.641$^{n.s}$	0.066	0.041
Marital status	0.034	0.069	0.014	2.425	0.016*	0.006	0.062
Income	0.200	0.191	0.065	3.080	0.002*	0.072	0.328
Type of agric. info (i.e. prices, inputs, and			0.025				0.137

weather)	0.088	0.170		3.470	0.001*	0.038

R^2 = 0.646, Dependent variable: Use of mobile phone to communicate agricultural information, Predictor variables (χ_i): Respondents' age, sex, marital status, income and agricultural information to be communicated, *-Significant at 0.05, $^{n.s}$ not statistically significant at 0.05, χ^2-chi value.

4.10 Hypotheses testing

Ho$_1$: *There is no statistically significant difference of the influence of mobile phone ownership in the use of mobile phones to communicate agricultural information.*

As shown on Table 9 above, a t-test on equality of variances was conducted to test the influence of mobile phones ownership on the use of mobile phones in communicating agricultural information. Age, sex, incomes and marital status were the positive predictor variables that strongly influenced the contribution of mobile phones in communicating agricultural information. As such the result led to reject the Null hypothesis ($H0_1$). The standardized regression coefficients indicated that, age, sex, income and types of agricultural information to be communicated influenced the use of mobile phones by -1.067, -0.016, 0.319, and 0.191 and 0.170 units, respectively. The predictor variables were found to be statistically significant at F (5, 1129) and ρ < 0.01.

Ho$_2$: *There is no statistically significant difference of the influence of the type of agricultural information to be communicated on the use of mobile phone(s) in communicating agricultural information.*

To establish whether there were any significant differences in the use of mobile phones to communicate agricultural information as influenced by the types of agricultural information communicated, a t-test was run to verify. As shown on Table 9 above, the type of agricultural information being communicated had a high influence on the use of mobile phones in communicating agricultural information at $\rho < 0.01$, therefore, the results gave evidence to rejects the Null hypothesis (Ho_2), since the conclusion that the types agricultural information, for instance, information on better prices, input supply, managerial practices and weather information influenced the use of mobile phone in communicating agricultural information.

The result on Table 9 further indicates that, age, sex, and incomes were the positive predictor variables that strongly influenced the contribution of mobile phones in communicating agricultural information. The standardized regression coefficients indicated that, age, sex, income and types of agricultural information to be communicated influenced the use of mobile phones by -1.067, -0.016, 0.319, and 0.191 and 0.170 units, respectively. The predictor variables were found to be statistically significant at F (5, 1129) and $\rho < 0.01$. Income levels and types of agricultural information to be communicated were the highest predictors of the use of mobile phones to communicate agricultural information. Their β value 0.2 and 0.088 while their p- values were 0.002 and 0.001 for income levels and type of information, respectively. Therefore, these predictors were found statistically significant.

Another predictor variable was age, with standardized regression (SDβ) of -1.067, β value of -0.364 and p-value of 0.000. The predicted coefficient of age was negative

but statistically significant at ρ < 0.01. Having a negative relationship implied that more young people used mobile phone to communicate agricultural information than old people. Therefore, age was found to have an influence on mobile phones use to communicate agricultural information, and was found statistically significant at ρ < 0.01 (Table 9).

4.11 A one-way analysis of variance (ANOVA)-test

For the purpose of showing differences on contribution of selected independent variables on mobile phone ownership and use in communicating agricultural information, a one-way analysis of variance (ANOVA) and an independent T-test were carried out, the results were as illustrated on Table 10 below.

Table 10: ANOVA results on influence of selected independent variables on mobile phone use

Variable	Test for Equality of Variances (ANOVA)		T-test for Equality of Means			
	F-value	P-value	t-test	μ	σ	ρ -value
Age of respondent	9.838	0.002	1.971	1.2941	0.45639	0.049*
Sex of respondent	30.424	0.000	2.651	1.4869	0.50065	0.008*
Marital status	14.198	0.000	2.996	2.3039	0.92104	0.003*
Education level	0.262	0.609	1.570	1.9869	0.47200	0.117^{ns}
Average monthly income	127.973	0.000	4.305	1.1928	0.39515	0.000*
Time period of mp owned	0.190	0.663	1.221	3.0066	0.94866	0.223^{ns}

Note: R^2 =0.622 *****Significant at 0.05, ^{ns} not significant at 0.05, ANOVA-Test for Equality of Variances, T-test for Equality of Means, μ- Means, σ- Standard deviation

Ho$_3$: *There is no statistical significant influence of Socio-economic factors on the use of mobile phones in communicating of agricultural information.*

An ANOVA test was used to determine if there were statistically significant differences in level of use of mobile phones to communicate agricultural information as influenced by socio-economic factors. The results in Table 10 rejected the Null hypothesis (H_3) as some of the elements considered under socio-economic factors, such as age, sex, marital status and income highly influenced the use of mobile phones in communicating agricultural information and proved to be statistically significant at $\rho \leq 0.01$. However, education levels and period of mobile phone ownership had little influence on mobile phone use to communicate agricultural information.

Results on Table 10 further indicated that, variables like age of respondents, sex, marital status and average incomes showed a statistical significant influence on mobile phone ownership and use at ($F=9.838$ $\rho=0.002$), ($F=30.424$, $\rho < 0.05$), ($F=14.198$, $\rho < 0.05$) and ($F=127.973$, $\rho < 0.05$) for age, sex, marital and average income, respectively. Thus, the study findings showed that, mobile phones could address the digital divide between literates and illiterates in terms of technology communication as lowly educated equally had mobile phones.

However, as seen on Table 10, respondents' education level and time of mobile phone ownership had no statistical significant effect on mobile phone use at ($F=0.262$, $\rho=0.609$, and at ($F=0.190$, $\rho=0.663$) for education levels and time of mobile phone ownership, respectively. Such study findings contradicted with those of Harker and Akkeren (2002) and Rice and Katz (2003) who found that people with higher

education had more positive perceptions on mobile phones use compared to those with lower education.

As for sex, the independent t-test indicated that, there was no significant influence of sex on mobile phone ownership and use. This study finding is in line with Frimpong (2009) and Singh and Ryan (1999) who found that, there were no differences in mobile phone usage between males and females bin ICTs use. One conclusion they drawn from their studies was that women who were generally categorized as not being technology friendly are currently at least overcoming that. This applied not only to women in relatively well-endowed areas, but also to those in under-served areas. This is a good starting point for agencies to initiate gender-specific projects that will promote mobile phone usage among women and reduce the gap between males and females in mobile phone usage.

4.12 Problems of using mobile phones in communicating agricultural information

Of the 384 respondents, 113 (29.4%) reported that mobile phones were too expensive to buy and run. Lack of electric power for charging mobile phones was mentioned by 102 (26.6%) of respondents, while 79 (20.6%) said that there was poor network. Other studies, for instance, (Samuel *et al.*, 2005; URT, 2010) also suggested a positive correlation between mobile phones ownership and access to electricity. Likewise, Gollakota (2008) argued that, despite the positive effects associated with the use of ICTs tools for enhancing livelihood opportunities, electric power and cost are hindering factor. Respondents also pointed other hindrance factors contributing to failure to use of mobile phone to communicate agricultural information, which

included failure to have mobile phone, poverty, illiteracy and lack of awareness of whom to call for a particular need.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

This chapter presents the conclusion and recommendations based on the findings of the study. The overall objective of this study was to investigate factors influencing the use of mobile phones in the communication of agricultural information by different agricultural stakeholders in the study area. The study sought to investigate the level of ownership and use of mobile phones by farmers in Kilolo district while at the same time looking for factors that affects the use of mobile phones in communicating agricultural information. The study was conducted in eight villages of Kilolo district specifically in Kilolo division. The eight villages included; Ilamba, Kidabaga, Kitowo, Lukani, Lulanzi, Mtitu, Ng'uruwe, and Ukumbi. Four wards out of eight were involved including Dabaga, Mtitu, Ng'uruwe and Ukumbi.

Multiple data collection tools were used, including interview schedules, checklist for key informants and focus group discussions. The study employed a cross sectional survey design whereby data were collected at a single point in time to a selected sample of respondents from the population of all farmers in Kilolo division. The collected data were analyzed using Statistical Package for Social Science (SPSS) computer programme from which descriptive statistics ware carried to yield percentages and frequencies. Cross tabulation, Chi-square and linear regression were also run to find out the nature of relationship between variables.

The study found that both demographic and socio-economic variables, including things like respondents' age, sex, income, education level and marital status had a positive influence on mobile phone ownership and use by farmers in the study area. As such, the study evidently rejected the three null hypotheses and accepted their alternative hypotheses. Therefore, ownership of mobile phones, type of agricultural information and socio-economic factors were found to have significant influence on the use of mobile phones in the communication of agricultural information. A number of factors were named to have an influence on mobile phone use in the communication of agricultural information, apart from mobile phone ownership and the type of agricultural information, other factors included; the type of farming system practiced, network coverage, respondents' demographic characteristics, and time of mobile phone ownership.

A range of constraints with regard to mobile phone access and use in communication of agricultural information were cited during the survey. The major problems rose included; lack of mobile phones, illiteracy, poor mobile phone network service coverage, poverty and failure to have specific people whom they should call incase a need arises. Other constraints included lack of electrical power for charging mobile phone batteries, complexity of the technology and the technology being too expensive to buy.

5.1 Conclusions

The study found that, asymmetry information generates uncertainties in markets which eventually limit the economic potential of market participants. The findings from this study have shown that mobile phones provided rural farmers with fast and easy modes of communication thereby increasing their ability to access agricultural information. Also, mobile phones seemed to help rural traders and farmers to secure better markets and prices; save time and money; and promptly communicate their agricultural information.

Furthermore, the study found that, mobile phones offered an attractive solution to many rural poor individuals and communities, due to its general accessibility and collective ownership models. The use of mobile phone therefore seemed to make market information available to farmers and so improved their position in the value chain by increasing their knowledge and become able to make better informed decisions and hence increase their bargaining power against local middlemen. In such a way, mobile phones were said to have a great contribution to reduced information costs, simply because, as participants communicate verbally, they do sharply, cheaply and without geographical limitation.

The study findings again indicated clearly that mobile phone technology was highly accessible to people in the study area. However, respondents' characteristics such as age, gender, daily income, and education level were found to be the key determinants of ownership and use of mobile phone in the study area. In fact, identifying the

determinants of the level and rate of mobile phone use paved a way and insights into future demands for mobile based services.

In terms of access to agricultural information through mobile phones, it was evident that, people in the study area took the advantages of increased number of mobile phone to access information related to their farming activities. They used mobile phones to contact various agricultural stakeholders to meet both technical and agricultural market information. As such, their projections for food markets, weather and other information that could be useful in their context had been easy and thus improved their life standards. Based on the observed penetration rate (79%), it seemed that, mobile phone technology adoption to rural Tanzania is high enough for one to accompany it with a predictable positive economic impact. Thus, there was no doubt that mobile phones have a key influence in the world economy, agricultural sector in particular.

However, the use of mobile phones in communicating agricultural information found to be dependent on the type of information that is being shared. Furthermore, lack of electricity, extreme poverty and lack of knowledge on how to use the technology were the limiting factors to mobile phone ownership and use by farmers in the study area.

5.2 Recommendations

Based on the conclusions above, the study would recommend the following:

(i) The government, NGOs and other stakeholders should work together to help farmers be access to mobile phones ownership, for instance through loans. Likewise, education to farmers might be very necessary, since a discussion with key informant found that, provision of education to farmers concerning mobile phones use could increase better use of mobile phones in communicating agricultural information to Tanzania farmers in particular.

(ii) The government should provide mobile phones to Agricultural Extension Agents, and where possible to some outstanding farmers so as to accelerate the adoption of new technologies.

(iii) The use of mobile phone has a bright future to increase delivery of agricultural information; the government should reduce mobile tariffs, particularly through encouraging rigorous competition between mobile phone providers.

(iv) The government should introduce public phone booths for many farmers to be able to communicate agricultural information.

(v) Rural people need to be provided with education on the use, modes of application and benefits associated with mobile phones in the art of communicating agricultural information. As portrayed in the ANOVA and regression test, such teachings should consider bringing together farmers of different categories, focusing on age, income levels and sex as they were found to determine the digital divide amongst farmers.

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APPENDICES

APPENDIX I: Interview schedule

Dear Respondent,

My name is **Siwel Nyamba**, a Masters student at Sokoine University of Agriculture. I am conducting a study on mobile phone use by farmers. The purpose of the study is to identify factors that influence the use of mobile phone in communicating agricultural information. The ultimate goal being to develop an understanding of how mobile phones can enable information search and improve communication between agricultural actors or how the potential of mobile phone can be taped to enhance improvement of life quality, and economic standards of rural farmers in a Tanzanian rural context. Please note that the information you provide will strictly be treated with the utmost confidentiality.

Instructions to the interviewer:

- Please get consent before you start filling in the questionnaire***:*** start by asking whether or not the respondent is ready for the conversation. If **YES** proceed with the interview, if **NO** go to another interviewee.
- Make sure you introduce yourself and explain the purpose of the study.
- Ask each question the way it is written
- Ensure that the respondent answers all questions.
- Allow the respondent to give answers by gently probing him/her.
- Most questions require you to tick (√) the answer(s), only a few require short answers to be filled.

Enumerator's name…… **Questionnaire Number……**

A: Respondent's general information

Ward name……village name…….

B: socio-economic characteristics of the respondents

B1. What is your age (in years)……

B2. Sex of respondents**:** male ( ) female ( )

B3. Marital status: never married ( ) married ( ) divorced ( ) widow ( ) widower ( )

B4. What level of education have you attained? *Tick (√) the appropriate one*.

Never attended any formal schooling ( ) Primary education ( ) Secondary education (form I-VI) ( ) College or university ( )

Other(s) (specify)……

B5. On average, what is your income per month?
1. Less than 10,000 Tanzanian shillings ( ) 2. Between 10,000-20,000 Tanzanian shillings ( )
3. Between 21,000-30,000 Tanzanian shillings ( ) 4. Between 31,000-40,000 Tanzanian shillings ( )
5. Greater than 40, 000 Tanzanian shillings ( )
B6. Do you have a functional mobile phone? 1. YES ( ) 2. NO ( ) *tick (√) the appropriate*
B7. If answered yes in Qn1.6 above, for how long have you had a mobile phone? *Tick (√) the appropriate one*
Less than 12 months ( ) 12 - 24 months ( ) 25 - 36 months ( )
More than 36 months ( )
B8. How did you get it? 1. Bought myself ( ) 2. Somebody bought for me ( )
B9. What do you use your mobile phone for? *Tick (√) the appropriate one*.
1. To communicate agricultural information to and from various stakeholders ( )
2. To seek research information ( )
3. To communicate with fellow farmers ( )
4. To promote Interpersonal relationships ( )
Other(s) (specify)

……
B10. Which network service do you use? *Tick (√) the appropriate one*.
1. Vodacom ( ) 2. Airtel ( ) 3. Tigo ( ) 4. Zantel ( ) 4. TTCL ( )

B11. What is your experience with network quality/reception in your area?

1. Poor ( ) 2. Average ( ) 3. Good ( ) 4. Very Good ( )

C: Agricultural information sent or received

C1. What type of agricultural activities do you practice**?** *Tick only activities that you deal with*;

1. Keeping animals only ( ) 2. Growing crops only ( ) 3. Keeping animals and growing crops ( )

C2. If grow crops, please indicate in the table below the type of crop(s) and area size for each crop

SN	Type of crop(s)	Area cultivated (In acres)
1		
2		
3		
4		

C3. If keep animals, please indicate in the table below the type of animal(s) and number for each type

SN	Type of animal(s)	Number of animal(s)
1		
2		
3		
4		

C4. What other income generating activities are you involved with? *Tick (√) the appropriate*

1. Timber business ( ) 2. Masonry ( ) 3. Carpentry ( ) 4. Local brew sale ( )

Other(s) (specify)……
C5. What specific agricultural information do you need about your farming activities? *Tick only the information that you need;*
1. Information *for* better marketing of agricultural products ( )
2. Information about agricultural input supply ( )
3. Information about agricultural management practices ( )
4. Information about new agricultural technologies ( )
Other(s) (specify**)……**
C6. Do you use a mobile phone to communicate any of the said information in question C5 above? 1. YES ( ) 2. NO ( )
C7. If answered' NO' for question C6 above, what are the reasons for not using mobile phones to communicate agricultural information? *Tick (√) the appropriate*
1. Don't have phone ( ) 2. No one to communicate with ( ) 3. Not able to pay the cost of both purchase and use of mobile phone ( ) 4. Network problems ( )
5.Complexity of the mobile phone technology ( )
Other(s) please specify (if any)
……
C8. If answered "YES" in QnC6 above, which agricultural information do you communicate via mobile phones? *Tick only the information that you need;*
1. Information about better marketing of agricultural products ( ) 2. Information about agricultural input supply ( ) 3. Information about agricultural management practices ( ) 4. Information about new technologies ( )
Other(s), please, specify (if any) ……
.....

.....

C9. How often do you use the mobile phone for the following purposes on weekly basis? *Tick (√) the appropriate*.

Purpose(s)	Very often (every day)	Often (4-6 days)	Occasionally (2-3-days)	Rarely (1 day)	Never used
Send agricultural information to various agricultural stakeholders					
Seek research information					
Talk with fellow farmers about farming issues					
Talk with fellow farmers about social issues					
Talk with parents about family issues					
Talk with parents to enhance interpersonal relationships					
Call extension officer for a help on you farming business					
Talk to buyers of a particular agricultural product					
Talk to researchers about new agricultural technologies					
Talk to extension officers about how to carry out agricultural management practices					
Talk to input suppliers about the availability of certain agricultural inputs					
Talk to marketing agents about prices of a particular agricultural product at a certain time					
Talk to a friend to enhance interpersonal relationships					

C10. On average, how much money do you spend per week on agricultural-related calls from your mobile phone?

1. 00 Tshs ( ) 2. Less than 100 Tshs ( ) 3. 100-500 Tshs ( ) 4. 500-1000 Tshs ( )

5. Above 1000 Tshs ( )

C11. Who pays for the expenses?

1. Myself ( ) 2. My children ( ) 3. My employer ( ) 4. My parents ( )

Other(s)

specify……

C12. Apart from mobile phones, which of the following is also a source of your agricultural information? *Tick (√) the appropriate.*
Radio ( ) Books ( ) Progressive farmers ( ) Extension staff ( ) Researchers ( )

Newspapers ( )
Other(s), please specify (if any)
……

……

……

C13 What type of agricultural information does each source in C12 above convey to you?

Source	**Type of information it convey to you**
Radio	Information about new agricultural technologies ( )
	Information about the price of particular agricultural commodities ( )
	Information about better marketing ( )
	Information on some recommended management practices ( )
	Information about input supply and availability ( )
	Information about demand and supply situation of particular agricultural commodities ( )
Progressive	Information about new agricultural technologies ( )

farmers	
	Information about the price of particular agricultural commodities ( )
	Information about better marketing ( )
	Information on some recommended management practices ( )
	Information about input supply and availability ( )
	Information about demand and supply situation of particular agricultural commodities ( )
Extension staff	Information about new agricultural technologies ( )
	Information about the price of particular agricultural commodities ( )
	Information about better marketing ( )
	Information on some recommended management practices ( )
	Information about input supply and availability ( )
	Information about demand and supply situation of particular agricultural commodities ( )
Researchers	Information about new agricultural technologies ( )
	Information about the price of particular agricultural commodities ( )
	Information about better marketing ( )
	Information on some recommended management practices ( )
	Information about input supply and availability ( )
	Information about demand and supply situation of particular agricultural commodities ( )

C14. How do you rate the quality of the agricultural information communicated through mobile phone compared to other sources outlined in QnC12 above?

1. Poor ( ) 2. Average ( ) 3. Good ( ) 4. Very Good ( )

C15. How do you rate the timeliness of the information received through mobile phone compared to other sources outlined in QnC12 above? *Tick (√) the appropriate*.

1. Poor ( ) 2. Average ( ) 3. Good ( ) 4. Very Good ( )

C16. Which way(s) do you prefer to receive the agricultural information via mobile phone? *Tick (√) the appropriate option.*

1. Through Short text Messages (SMs) ( ) 2. Through Voice Calls ( ) 3. Through e-mail ( )

Others please specify (if any)

……

……..…….....

C17. Do you share the agricultural information you receive through your mobile phone with other farmers? 1. YES ( ) 2.NO ( )

C18. If answered YES in QnC15 above, what type of agricultural information do you exchange with other farmers?

1. Information for better marketing *(*) 2. Information about input supply ( )
3. Information about management practices ( ) 4. Information about new technologies ( )

Other(s) (specify)

……

……..……

C19 Do you think the use of mobile phone to communicate agricultural information has raised farmers' income? 1. YES ( ) 2.NO ( )

C20. How do you rate the use of your mobile phone in communicating agricultural information; *Tick (√) the appropriate one*.

1. Not important at all ( ) 2. Somewhat important ( ) 3. Important ( ) 4. Very important ( )

C21. What benefits/advantages do you get from using mobile phone in communicating agricultural information? *Tick (√) the appropriate one*.

1. Helps to easily send agricultural information anytime the need arose ( )
2. Reduces the need to travel ( )
3. Promotes interpersonal relationships ( )
4. Assist in obtaining agricultural information quickly ( )
5. Helps to exchange information anytime the need arose ( )
6. Increase income of the people in the community ( )

7. Allow more contacts amongst farmers ( )
8. Enhance strong social cohesion ( )
9. Easy contact with local customers/suppliers ( )
10 Easy to get in touch with fellow farmers ( )
Others please specify (if any)
……

……
C22. How do you rate the use of your mobile phone in communicating agricultural information; *Tick (√) the appropriate one*.

1. Not important at all ( ) 2. Somewhat important ( ) 3. Important ( ) 4. Very important ( )

D: Factors influencing the use of mobile phone in communicating agricultural information

D1. Do you face any problems with regard to mobile phone use in communicating agricultural information? YES ( ) NO ( )

D2. If 'YES' **(QnD1)** above, what are the problems**:** *Tick (√) the appropriate one*.

1. Failure to have cash for recharging air time ( )

2. Failure to have cash for buying handset ( )

3. Network problems ( )

4. Lack of power for charging battery ( )

5. Complexity of the mobile phone technology ( )

Other(s), please specify (if any)…….

APPENDIX II: Check list for focus group discussion

Ward…… **Village……**

1. Do farmers in this area use mobile phones to communicate agricultural information? YES ( ) NO ( )
2. If yes for Qn1 above, what type of agricultural information do farmers communicate using mobile phones?
   ……
   ……
   ……
3. What communication media do extension agents use to communicate agricultural information to farmers in this area?
   ……
   ……
4. What communication media outlined in Qn4 above, are much used compared to mobile phones in communicating agricultural information?
   ……
   ……
5. What are farmer' attitude on the use of mobile phones in communicating agricultural information?
   ……
   ……
6. What advantages do farmers get by communicating agricultural information using the mobile phones?
   ……
7. What disadvantages do farmers get by communicating agricultural information using mobile phones?

……

……

8. Do you think that the use of mobile phones in communicating agricultural information helps farmers to overcome their agricultural informational needs?
YES [ ] NO [ ], If YES how?
……

……

9. Do you think that the use of mobile phones in communicating agricultural information helps farmers to increase their income?
YES [ ] NO [ ] If YES how? If NO why? Give reasons
……

……

10. What factors that influence the use of mobile phone in communicating agricultural information?
……

……

11. How could mobile phones be better used to improve the communication of agricultural information in this area**?**
……

……

……

APPENDIX III: Questions for extension officers

Ward name……Village name……..…….

1. Do you use mobile phones to communicate agricultural information with farmers in this area? YES ( ) NO ( )

2. Do farmers in this area send or receive agricultural information from you via mobile phones? YES ( ) NO ( )

3. What type of agricultural information do you normally communicate with farmers?

Tick (√) the appropriate one.

(i) Information about new agricultural technologies ( )

(ii) Information about the price of particular agricultural commodities ( )

(iii) Information about better marketing ( )

(iv) Information on some recommended management practices ( )

(v) Information about input supply and availability ( )

(vi) Information about demand and supply situation of particular agricultural commodities

Other(s) please specify (if any)…….

4. Do farmers in this area send to you agricultural information via mobile phones?

YES ( ) NO ( )

5. On average, how many farmers out of ten, do you communicate agricultural information per day?.....

6. Do farmers like the use mobile phones in communicating agricultural information?

YES ( ) NO ( )

7. Do you think that the use of mobile phones in communicating agricultural information helps farmers to increase their income? YES ( ) NO ( )

8. Do you think that the use of mobile phones in communicating agricultural information helps farmers to overcome their agricultural informational needs?
YES ( ) NO ( )

9. Basing on the nature of their agricultural activities they practice, which group(s) commonly use mobile phone to communicate agricultural information than others?

Tick (√) the appropriate one
(i)Livestock keepers ( ) (ii) Crop Growers ( ) (iii) Mixed farmers ( )

10. What constraints do you face in communicating agricultural information with farmers via mobile phone? *Tick (√) the appropriate one*
1. Network problem ( ) 2. Lack of power for charging ( ) 3. Complexity of the mobile phone technology ( ) 4. Lack of cash for buying cellular phones ( )
Other(s) please specify (if any)
……

……
10. Apart from farmers, which other group of agricultural stakeholders do you communicate agricultural information via mobile phone? *Tick (√) the appropriate one*
Researchers ( ) 2. District officials ( ) 3. Other extension workers ( )
Other(s) please specify (if any)……
11. Apart from mobile phones, which of the following is also a source of your agricultural information? *Tick (√) the appropriate.*
Radio ( ) Progressive farmers ( ) Extension staff ( ) Researchers ( ) Newspapers
Other(s), please specify (if any)
……

……
12. Is the use of mobile phone in communicating agricultural information better for anything than the use of other sources of agricultural information named in Qn12 above? YES ( ) NO ( )
13. Do you have a daily budget for your mobile phone for agricultural information communication? YES ( ) NO ( )
14. If YES who pays for the expenses? Myself ( ) 2. My employer ( ) 3. Farmers( )
15. What advantages do farmers get by communicating agricultural information using the mobile phones? *Tick (√) the appropriate*
(i) Helps to easily send agricultural information anytime the need arose ( )
(ii) Reduces the need to travel ( )
(iii) Promotes interpersonal relationships ( )
(iv) Assist in obtaining agricultural information quickly ( )
(v) Helps to exchange information anytime the need arose ( )
(vi) Increases income of the people in the community ( )
(vii) Allow more contacts amongst farmers ( )
(viii)Easy contact with local customers/suppliers ( )
(ix)Easy to get in touch with fellow farmers ( )
Others, please, specify (if any)

……

……..

17. What factors that influence the use of mobile phone in communicating agricultural information? *Tick (√) the appropriate*

(i) Failure to have cash for recharging air time ( )

(ii) Failure to have cash for buying handset ( )

(iii) Network problems ( )

(iv) Lack of power for charging battery ( )

(v) Complexity of the mobile phone technology ( )

Other(s), please specify (if any)

……

……..…….

18. Do you have any comment on how mobile phones could better be used so as to make them effective in the communication of agricultural information?

YES ( ) NO ( ), if YES what are your comments?

……

……

……

……

APPENDIX IV: Checklist for district officials

Ward…….village name……respondent's title……..

1. What communication media do you use to communicate agricultural information to agricultural stakeholders in this area?

……

……

2. Do farmers in this area use mobile phones to receive some agricultural information from your office? YES ( ) NO ( )

3. Do you receive some agricultural research information via mobile phone?
YES ( ) NO ( )

4. If YES (in Qn3) from which source? *Tick (√) the appropriate*
Progressive farmers ( ) Extension staff ( ) Researchers ( ) regional officials ( )

5. What type of agricultural information do you normally communicate with farmers?

……

……

6. Do you think that the use of mobile phones in communicating agricultural information helps farmers to increase their income? YES ( ) NO ( )
If YES how? If NO, why?

……

7. Do you think farmers like to use mobile phone in communicating agricultural information? YES ( ) NO ( )

8. What are farmer' opinion on the use of mobile phones in communicating agricultural information?

……

……

9. What advantages do farmers get by communicating agricultural information using the mobile phones?

……

……

10. What disadvantages do farmers get by communicating agricultural information using mobile phones?

……

……

11. Do you think that the use of mobile phones in communicating agricultural information helps farmers to overcome their agricultural informational needs?

……

……

12. What are the factors that influence the use of mobile phone in communicating agricultural information?

……

……

16. How could mobile phones be better used to improve the communication of agricultural information in this area?

……

……

……