UNIVERSITY OF NAIROBI

ICT FRAMEWORK FOR ADOPTION IN THE DISSEMINATION OF AGRICULTURAL INFORMATION IN KENYA :(CASE STUDY OF AGRICULTURAL DEVELOPMENT CORPORATION)

BY

JACKSON CHEPYATOR KIPTUM

P56/73703/2012

A research project report submitted to the School of Computing and Informatics in partial fulfilment of the requirements for the award of Degree of Master of Science in Information Systems of the University of Nairobi.

2016

DECLARATION

This project is my original work and has not been presented for a degree in any other University or learning institution.

_____ Date_____

Jackson Chepyator Kiptum

Reg. No. P56/73703/2012

This project has been submitted for examination with my approval as university supervisor

_____ Date_____

Dr. Christopher Chepken

Lecturer, School of Computing & Informatics

University of Nairobi.

ACKNOWLEDGEMENT

First and foremost, I wish to thank the Almighty God for this achievement. My family for the support and encouragement.

My indebted gratitude goes to my Supervisor Dr. Christopher Chepken for his guidance, patience and advice throughout the project.

Finally to my colleagues for Constantly reminding me to complete the project.

ABSTRACT

The agricultural sector in Kenya is critical to the economy and it faces numerous challenges and constraints in the application and use of ICTs in the dissemination of agricultural information. Farmers are working in an information intensive environment and numerous studies have showed that information and communication technologies (ICTs) can play a vital role in the dissemination and transfer of agricultural information.

A descriptive research design was used in the study with a target of 120 respondents. The study used questionnaires as its main instrument with closed and open-ended questions. The researcher checked the completed questionnaires for completeness and consistency of the collected data. Coding and analysis of the collected data was done through SPSS(statistical package for social sciences) and the findings presented using tables, charts and graphs with the respective interpretation.

The purpose of this study was to investigate the role and contribution of ICTs as a means of disseminating relevant information and technological transfer to the Kenyan farmer. In particular, the research identified specific ICT tools (mobile, computer and radio) as the most appropriate alternatives used by various stakeholders in the dissemination of information in the agricultural sector. The research highlighted the challenges that confront farmers and a framework was proposed to effectively resolve farmers and stakeholders perennial challenges in information dissemination, storage and sharing of knowledge and experiences.

The objective of developing the framework was to establish a clear communication channel between farmers, extension agents, agricultural experts, research centers, and the community. While validating the framework, the findings showed that the relationship between all variables was mutual and information disseminated was based on farmers' needs and feedback. Internet was used as the ICT technology to transfer the agricultural information to the farming community, and that since some farmers were semi-illiterate, they did not have to use the internet directly but through extension agents.

In conclusion, despite the constraints and challenges encountered in the application and use of ICTs in the agricultural sector, the study established that a wide range of ICTs (computer, cell phone & radio) had been used and the framework proposed to facilitate information dissemination and sharing among agricultural researchers and the farmers in Kenya.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATION AND ACRONYMS

ICT	Information Communication Technology
GDP	Gross Domestic Product
MOA	Ministry of Agriculture
GoK	Government of Kenya
ADC	Agricultural Development Corporation
KNBS	Kenya National Bureau of Statistics
UNDP	United Nation Development Programme
FAO	Food and Agriculture Organisation
USAID	United States Agency for international Development
EAS	Extension and Advisory Services
SPSS	Statistical Package for Social Sciences
VOIP	Voice over Internet Protocol
GPS	Global Positioning Systems
M-ARD	Mobile application for Agriculture and Rural Development
CDROM	Compact Disk Read only Memory
VCD/DVD	Visual Compact Disk/Digital Video Disk
BBC	British Broadcasting Corporation
RFI	Radio France International
VOA	Voice of America

CHAPTER ONE

1.0 Introduction

The agricultural sector in Kenya contributes directly 26% of GDP and since it's the backbone of the economy, it provides raw materials to the manufacturing sector. Agricultural products account for 65% of Kenya's total export and 70% of the rural population depend on agriculture for their livelihoods. Although agriculture is critical to the economy, levels of production and productivity are very low and access to agricultural information is still a challenge. For example, the average yield for maize is 1.3 tonnes per hectare and milk production at less than 5 litres per cow per day.(ASDP, MOA 2011)

The policy framework for agricultural extension (Ministry of Agriculture, GoK, 2011) highlights the opportunity for information and communication technology (ICT) to improve the quality, accelerate the transfer and exchange of information to farmers, and ICT is consequently given a high priority, particularly as a tool for improving extension and delivery system of research findings.

Information has a central role in our current environment and agriculture is no exception: success in farming requires gaining, processing, using and evaluating a huge amount of information. Farmers are working in an information intensive environment and numerous studies have showed that ICTs can play a vital role in the dissemination and transfer of information to farmers in the farm level. (M. Csoto, 2011)

1.1 Why ICTs in information dissemination

ICTs generally refer to an expanding assembly of technologies that are used to handle information and aid communication. (UNDP, 2012)

The Common sources of agricultural information that have been used in Kenya are the radio, television, extension services, magazines, newspapers and face-to-face communication. It is believed that the modern sources of information have social, educational, economic, cultural and technical constraints which limit their effectiveness in disseminating agricultural information to farmers (Bashir, 2008)

The use of ICTs (mobile, computers and internet) in the dissemination of agricultural information have the following advantages over the traditional methods; its is a cheaper way in communicating relevant information to rural farmers, easy to use in the delivery of

education and training programmes ,it enables farmers access markets and agricultural credit and empower them to negotiate for better prices. (OKELLO et al.2010).

The benefits of ICTs are thought to be enjoyed by those who do not have first-hand access to them but go through intermediaries. ICTs are increasingly improving access to information, knowledge, skills and technology for farmers and their communities. However, it should be noted that for lCTs to improve the provision of agricultural information other inputs and/or conditions are necessary such as skill development, policy and regulatory framework, and conducive infrastructure. (Ajit, M. et al. 2014)

1.2 The Problem Statement

Agricultural researchers are involved in the creation and dissemination of new knowledge which is meant for solving practical problems faced by farmers and other stakeholders in the agricultural sector. Normally, this new knowledge may be passed to farmers through national extension service which is the main source of productivity information for farmers.

Despite being a huge enterprise, the Government's extension services do not reach poor small farmers because of the geographical spread and low motivation of the extension staff (UNDP, 2012)

The research system faces a number of problems like lack of strong research-extension-farmer linkages, inadequate funding and high turnover of research scientist. This is the reason why most farmers countrywide still grow the old crop varieties that were introduced by the missionaries and colonialists before independence. (Olila P. O. et al.2006)

Farmers have a long tradition of sharing knowledge through cooperatives or farmers learning groups and extension services, but there is a gap between the provision of agricultural research results and the application of the same in practical farming. The problem has often been the communication gap between researchers and extension personnel on the one hand and farmers on the other. The contention is that the communication gap lies not so much in language or cultural differences as in the methods employed for the dissemination of agricultural information. Thus, new ICT supported collaborative methods may be required to bridge the gap. (Hansen, J. at al. 2014)

Therefore, Access to ICTs is one of the most important enablers for smallholder farmers to improve productivity sustainably. Innovative mechanisms for technology transfer are

required to bring relevant tools, knowledge and know how to farmers. One of the biggest challenges facing Kenya and other developing nations which need to be addressed urgently is that agricultural technology, innovations and other research findings do not get to the farmers who need it most. (Nahm-Su, K. 2011).

This study investigated the role and contribution of ICTs as a means of disseminating relevant information and technological transfer to the Kenyan farmer. In particular, the study identified specific ICTs used by various stakeholders, determined the challenges and reviewed information dissemination processes and the extent of use of selected ICTs in creation, storage and sharing of agricultural knowledge. Finally proposed an ICT based framework for diffusing agricultural information in Kenya.

1.3 Research Objectives

General Objectives

The general objective of this study sought to determine parameters suitable for the establishment of ICT-based framework for adoption in the dissemination of agricultural information among farmers in Kenya. To achieve this, the following specific objectives were formulated;

Specific Objectives

i. To Identify agricultural information needs of farmers;

ii. To determine the constraints and challenges encountered in the dissemination of information in the agricultural sector;

iii. To investigate the extent to which information needs of farmers are being met through ICTs;

iv. To review the existing ICT-based frameworks used in the dissemination of information;

v. To propose an ICT based agricultural information dissemination framework and validate;

Research Questions

i. What are the information needs of the farmer?

ii. What constraints and challenges are encountered in the dissemination of information in the agricultural sector?

iii. To what extent has the access and utilization of ICTs succeeded in meeting farmers needs?

iv. Do the existing frameworks sufficiently address all the parameters needed in the dissemination of agricultural information to farmers?

v. What are the parameters/factors suitable for consideration in the delivery of agricultural information in Kenya?

1.4 Justification of the study

i. This research was undertaken to encourage farmers and other stakeholders to adopt new practices, to improve agricultural processes and dissemination agricultural information. At the long run farmers livelihoods maybe enhanced and agriculture will become more sustainable.

ii. Access to ICT Tools enabled extension workers to engage in the full knowledge management activity and be in the position to gather, store, and disseminate knowledge and information that are demanded by the farmers.

1.5 Limitations of the study

A limitation is an aspect of the study that the researcher knows may adversely affect the results of the study, but over which he/she has no direct control over (Orodho J. A, 2010). The study dealt with selected ICT channels; radio, TV, mobile phone, internet and computers used in disseminating agricultural information to farmers. Due to financial and time constraints, the study was limited to Agricultural Development Corporation (ADC), Kenya.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

The literature review will guide this research towards its completion by exploring the usage of ICT in agricultural information dissemination. The focus of this study is primarily on dissemination of information in the agricultural sector.

The agricultural sector accounts for 65% of Kenya‘s total exports and provides more than 70% of informal employment in the rural areas. Therefore, the agricultural sector is not only the driver of Kenya‘s economy but also the means of livelihood for the majority of Kenyan people (GoK, 2010).

There has been a gradual decline in the share of the GDP attributed to agriculture, from over 30% during the period 1964 - 1979 to 25% in 2000 - 2002. The agricultural sector directly contributed 22% and 23% of GDP in 2007 and 2008 respectively (KNBS, 2009).

In the agricultural sector, new information and knowledge fuel innovation and increase productivity and competitiveness. The ability of farmers to participate in and benefit from growth in the sector is linked to their ability to adopt new practices, solve problems and be involved in agricultural value additions. Farmers currently access information through a complex web of social networks that include other farmers, family members, extension agents and input supply dealers. Yet for many farmers, these networks lack the type of information that can help them to move confidently into more productive and competitive strategies. (USAID, 2013)

2.1 Providers of Agricultural Information

Sources of agricultural knowledge include scientific research and indigenous knowledge. ICTs play a critical role in facilitating rapid, efficient, and cost effective knowledge management. In a number of Sub-Saharan African countries, smallholder farmers get technology-related advice as well as location-specific market information on inputs and outputs through ICT kiosks (UNDP, 2013)

With the advent of new ICTs, especially computers, the Internet and cellular telephony, there is increased transformation of agriculture activities and practices through innovation that is largely enabled by information sharing and exchange between agricultural communities (Maru, 2008). The digital divide is not merely a problem of access to ICT, it is part of a larger developmental problem in which vast sections of the world's population are deprived of the capabilities necessary to use ICTs, acquire information and convert it into useful knowledge (Xiaolan, 2011).

The possibility that ICTs can extend the reach of existing information channels also means that they can be used to overcome barriers that currently limit farmer's access to information. Research has documented how farmers lack of access to land, information, credit and other productive resources has limited their potential, thereby reducing overall gains in agriculture (FAO, 2011).

2.2 Agricultural Development Corporation (ADC)

As a provider of quality seed to the Kenyan farmer, ADC is the main seed maize grower in Kenya with the help of the large land area it has in Trans-Nzoia County. The basic seed obtained from the Kenya Seed Company and other organizations is multiplied and passed back to Kenya Seed Company for processing. In so doing, it contributes towards poverty reduction efforts and to the National Food Security through the following mandates;

1. ADC plays a major role in the transfer of technology from the research institutions to the Kenyan farmer,
2. Through linkages with Agricultural institutions ,ADC has contributed to be a testing ground for technologies and research in which the findings are passed on to the farmer through training and field days,
3. ADC being a major producer of agricultural produce, Plays a major role in its support to industries processing agricultural goods.(www.adc.or.ke)

There are other institutions that collaborate and partner with ADC, like Kenya Agriculture Research Institute (KARI), Kenya Seed Company and Agricultural society of Kenya and many others from the private sector.

2.3 National Extensions Services

The National extension service plays a key role in disseminating knowledge, technologies, agricultural information, and in linking farmers with other stakeholders in the economy. The extension service is one of the critical change agents required in transforming subsistence farming to a modern and commercial agriculture to promote household food security, improve income and reduce poverty (Government of Kenya, 2010).

Agricultural extension has now become recognized as an essential mechanism for disseminating information and advice as an "input" into modern farming. Agricultural extension, which largely depends on information exchange between and among farmers and other stakeholders, is an area in which ICT can have significant impact. Researchers may relate directly with the farmers through ICTs. Extension workers, who are the direct link between farmers and other stakeholders in the agricultural knowledge and information system, are well positioned to make use of ICT to access expert knowledge or other types of information that could be beneficial to the farmers (Salau, 2008).

ICTs can supplement the efforts of extension and advisory services (EAS) providers in disseminating various kinds of information to large, dispersed audiences. ICTs offer the opportunity for rapid and cost effective dissemination of agricultural information to remote locations and to diverse populations. They make it possible to deliver near real-time information on weather, market prices, disease and pest outbreaks, and the availability of services, allowing farmers to make more informed decisions on what to grow and how to improve their agricultural practices. Content can be delivered in audio, visual and written formats to reach farmers with varying levels of education and literacy. (USAID, 2013)

However, ICTs will not make extension workers redundant, rather they will be able to concentrate on tasks and services where human interaction is essential in helping farmers individually and in small groups to diagnose problems, to interpret data and to apply their meaning. The future will call for more able, more independent, more client-oriented extension workers. The emphasis will be on the quality of interaction between agent and client rather than on the movement of "messages" through a hierarchical system, (ibid).

2.4 Factors that affect use of ICTs for agricultural extension

According to (UNDP, 2013), the use of ICTs for agricultural extension is growing in Asia and Africa especially with the recent expansion in the use of mobile phones. Mobile phones and other ICT devices have been used to largely provide agricultural information. Yet, if not supported with advice on improved agricultural practices and farmer education, agricultural information alone may not necessarily lead to innovations and the desired increased productivity. However, while use of the ICTs seems relatively easy once in place as opposed to human-based extension service, which requires deployment of large number of extension workers, doing so is not without constraints that can be summarized into three broad conditions; the policy environment, the rural setting, infrastructure and capacity problems and the ability of local communities to use ICTs to access information for their farming activities.

Agricultural extension workers cited the main barriers for technology uptake and agricultural performance as lack of appropriate incentives, low level of recognition, high transportation cost and inadequate budgets, inadequate technology training, lack of affordable system of communication with the farmers, and lack of training in communication skills and social mobilization techniques. The issues of reward/recognition of their profession/efforts were not being embraced by farmers and public extension workers. (Mahrukh Siraj, 2012)

2.5 Farmers Agricultural Information Needs

Studies on farmers information needs paint a mixed picture. Information needs differ significantly between countries and within countries for farmers producing different products. Farmers differ in their perceptions of the information they require and in their priorities when they come to access information. The primary message underlying these disparities appears to be that farmers require a package of information and that their needs and priorities change throughout the production cycle (World Bank, 2011).

According to FAO (2006), agricultural community require a wide variety of information such as availability of agricultural support services, government regulations, crop production and managements, disease outbreaks, adaptation of technologies by other farmers, wages rates and so on. The content of the information services should reflect farmers diverse circumstances and livelihoods. Therefore, information can be seen as the basic element in any development activity and it must be available and accessible to all farmers in order to bring the desired results.

The agricultural sector in developing countries is becoming increasingly knowledge intensive. Researchers at the global, regional, and national levels continue to generate new information. As agricultural systems become more complex, farmer's access to reliable, timely, and relevant information becomes more critical to their competitiveness. Information must be relevant and meaningful to farmers, in addition to being packaged and delivered in a way preferred by them (Asenso-Okyere & Govindarajan, 2012).

However, UNDP (2001) argued that despite the additional cost and time associated with generating localized content; this content could be more relevant and useful in meeting farmers information needs.

Research has shown that factors that influence farmers use of information include personal characteristics such as age, education and experience in farming; business characteristics such as market orientation of farming, farm size, type of farm enterprise, debt level and ownership of farm and geographical characteristics such as distance to market centres and distance to nearest technological hub (Kiplagat, 2004).

Mittal, Gandhi and Tripathi (2010) found out that, education and information dissemination are key components of supplying inputs through ICT. It is critical for farmers to have a rooted understanding of the potential long-term implications on productivity and profits of using better inputs in a timely manner. On a more practical level, farmers need information about how to source inputs and identify counterfeit supplies, which remains a significant productivity drain.

2.6 Agricultural Information Dissemination

According to (Mokwunye, 2010), effective communication in the dissemination of agricultural information from research institutions to the farmers is one of the key components in the transfer of agricultural technology. Ahmed (2003), found out that almost all farmers agree that the technologies provided are costly to adopt and even if the technologies were inexpensive, farmers have limited financial resources and there should be concerted efforts by the research institutions to make the necessary investments that would develop and sustain the capacity for technology dissemination and adoption.

In Kenya, ICTs such as the Internet and email are being adopted at the ministry of agriculture, district and provincial agricultural offices to improve communication of agricultural information. The Information Centre in the Ministry has been elevated to status

of a division with specific role of information acquisition, processing, packaging and distribution. The centre has been mandated to repackage agricultural information for extension workers and farmers. Extension materials are produced and distributed to extension workers across the country to assist them in disseminating agricultural information to farmers.(MOA, 2012)

Even though agricultural research has progressively improved production systems, useful findings from research have not always been delivered to the farmers who could benefit from these findings. However, useful information and suggestions have been circulated among researchers and academia rather than disseminated to farmers who should be the beneficiaries of these research results. Without new knowledge, farmers have been left with traditional agricultural approaches and oral recommendations from other farmers (Kalusopa, 2005).

ICTs especially mobile phones can speed the way farmers in rural areas of Kenya exchange and manipulate information. Global positioning systems (GPSs), radios, digital soil maps, and other ICTs give farmers information to use biophysical technologies appropriately for example, nitrogen sensors can help to determine the correct fertilizer dose. A variety of innovations that integrate ICTs into the dissemination of agricultural information to farmers have been developed at local, national and regional levels. (World Bank, 2011).

According to World Bank (2011), precision farming must also rely on an information dissemination process. Many rural areas in developing countries are isolated from sources of new agricultural information; not surprisingly, farmers in these areas use few modern technologies. ICT is beginning to play an important role in providing advisory services in real time to farmers.

2.7 Drivers of ICT in Agriculture

The ability of ICTs to bring refreshed momentum to agriculture appears even more compelling in light of rising investments in agricultural research and the private sector strong interest in the development and spread of ICTs and more particularly organizations committed to the agricultural development agenda (World Bank, 2011). According to (Ajit Maru at al., 2014) there are five key drivers of the use of ICT in agriculture namely;

(1) **low-cost and pervasive connectivity;** through a wide range of devices and platforms to access and use data, information and knowledge already contribute to increasingly knowledge-rich environments for agricultural sector. The use of mobile phones and other mobile devices as interfaces to connecting in these environments is now well documented.

(2) **Sensor sharing data linked to Decision Support Systems and Geographical**

Information systems; this enables monitoring of soils, weather, market and crop/livestock conditions and digital signatures and labels to track inputs and products from producer to consumer.

(3) **Increase in accessibility of data and information from public institutions, communities and individuals** are becoming visible, publicly accessible and re-useable at the click of a device, many a times which is mobile, removing the constraints of location and bringing greater inclusion in their use. This is leading to need for and development of intermediary skills and applications to enable effective harvesting, making sense and adds value from this data and information for agricultural systems.

(4) **Increasingly interconnected knowledge bases and diverse sets of tools and applications;** are available through digital clouds and made accessible and useable across different devices from any location are enabling collaboration across boundaries as never before. Different communities are starting to connect and share their knowledge with each other, along value chains and across disciplines in new forms of innovation chains with wider actors including farmers, processors and traders.

(5) **ICTs together with bio and nanotechnology, space technology and materials sciences** are now defining the core direction of agricultural science, research, innovation, technology and development and opening hitherto unexplored new directions.

(6) **The democratization of information;** including the open access movement and social media. These drivers are expected to continue shaping the prospects for using ICT effectively in developing-country agriculture.

2.8 ICT Channels for Information Dissemination

The common sources of agricultural information that have been used are the radio, television, extension service, magazines, newspapers and face-to-face communication. Lately, research institutions have embraced the modern sources of information such as the internet, especially online databases, journals and articles that have made information more readily accessible, accurate and timely. These modern sources have been used within research institutions and extension service units, but their effectiveness in availing information to farmers has been criticized. It is thought that the modern sources of information have social, educational, economic, cultural and technical constraints which limit their effectiveness in disseminating agricultural information to farmers (Bashir, 2008 and N. Musa et al.).

Farmers preference in information dissemination pathways and media is important in determining adoption of technologies and productivity (Mbugua, 2012). Agricultural researchers and extension workers previously used conventional communication channels to disseminate agricultural information to farmers and other stakeholders (Kiplagat, 2004). The channels have been used widely and they have been monologue and have not allowed much interaction Kiplagat asserts. New ways of communication are being adopted via ICTs such as the Internet, email, mobile phones, and electronic sources among others he says.

An ICT is any device, tool, or application that permits the exchange or collection of data through interaction or transmission (World Bank, 2011). Here we look at telephone and mobile phone, radio, television, internet, and VCD/DVD.

2.8.1 TV/Radio

Agricultural programmes are aired through the national and private radio stations. The farmers have diverse channels of accessing agricultural information. The radio stations are classified in the commercial and the free-to-air radio. The listeners are characterized along class, ethnicity, race and clutter. Indeed, a few stations such as Capital FM, Classic 105, KISS 100, and Citizen Radio are distinct in terms of audience. There are four international broadcasting stations such as the British Corporation (BBC), Radio China International (RCI), Voice of America (VOA) and Radio France International (RFI), all satellite-fed broadcast interlinked with FM broadcast. With the popularity of radio broadcast, it is also reported that the radio is not only one of the top four widely used ICT tools but its importance also has increased in improving rural agriculture. (Hassan et al., 2008; Munyua, Adera & Jensen, 2008).

There are about four main pay television channels such as Multi-Choice's DStv, Zuku, GoTV and more recently Star Times. Free-to-air television stations in Kenya are; KBC TV 47 channels, Family TV 3 channels, Citizen TV 11 channels, NTV 7 channels, KTN 9 channels, STV 6 channels, KISS TV 1 channel, SYR TV and EATN TV.

2.8.2 Telephones/Mobile phones

There are over 4 billion phone users in 2008 [ITU 2009], and close to 60% of subscribers live in developing countries [UNCTAD 2008]. Thus, many entities with a global development focus have turned to the mobile phone as a potential platform for delivering development services, in sectors spanning education, finance, health, agriculture, and governance [Donner, 2008].

According to (world bank, 2011),Mobile communications technology has quickly become the world's most common way of transmitting voice, data, and services in the developing world. Given this dramatic change, mobile applications (M-apps) in general and mobile applications for agricultural and rural development (M-ARD apps) in particular hold significant potential for advancing development. They could provide the most affordable ways for millions of people to access information, markets, finance, and governance systems previously unavailable to them.

M-apps are software designed to take advantage of mobile technology and can be developed for technology besides mobile phones. But mobile phones have many key advantages: affordability, wide ownership, voice communications, and instant and convenient service delivery. As a result, there has been a global explosion in the number of M-apps, facilitated by the rapid evolution of mobile networks and by the increasing functions and falling prices of mobile handsets. (World Bank, 2011)

M-Kilimo is a unique and innovative service aimed at providing agricultural information, advice and support over the phone to farmers. The Kenya Farmer's Helpline was launched in October 2009 by Airtel, with the objective of providing high quality and reliable information to farmers to enable them to make more informed decisions on land preparation, planting, pest management, harvesting, post-harvest and marketing of agriculture produce including climate and weather information, (http://www.m-kilimo.com/).

2.8.3 VCD/DVD

Munyua, Adera, & Jensen, (2008) found out that agricultural knowledge can be transferred through learning modules in offline Compact Disc Read-Only Memory (CD-ROM) format. Not only text information can be included in CD-ROM but also other types of data like pictures, audio and video clips. This helps to overcome the illiteracy problems hindering further learning by poor farmers in rural areas. In addition, it is a solution to the problem of agricultural knowledge dissemination in areas where there is no Internet connectivity or the connection is unreliable.

2.8.4 Networking and/or Internet

For geographically remote locations, connectivity through computer networks may be an appropriate way to provide information to farmers. For example, each village centre could communicate with the outside world, nearby villages, other countries or other continents, via several types of communication tools, such as dial-up telephone connections, wireless networks or a satellite communication system called very small aperture terminal (VSAT).

2.9 A review of Existing Agricultural ICT-based Frameworks

2.9.1 eSagu Project

By exploiting recent information technology revolution (mainly the database, web, image processing technology), the Indian Institute of Information Technology (IIIT), Hyderabad built a cost-effective and scalable agricultural expert advice dissemination system to disseminate agricultural advice to the farmers, both in a timely and personalized manner.

It is an academic research pilot project to study a hybrid technology intervention outcome in agriculture. Its motivation is to provide improvement to the existing agriculture extension methods. It is developed for ICT-based Agri-extension system to provide personalised, query-less, timely, cost effective and easy to develop services to farmers. Its solo prototype study is to see ICT enabled extension is possible or not. It was found out that it is and a single visit with an advice per week will solve farmer need (for cotton and chillies crops). Coordinator can cover 125 farms and expert can cover 500 farms in a week. It is found farmers are unable to pull the information from experts due to ignorance, illiteracy and confidence. (http://agriculture.iiit.net/agrids, http://www.esagu.in/esagu).

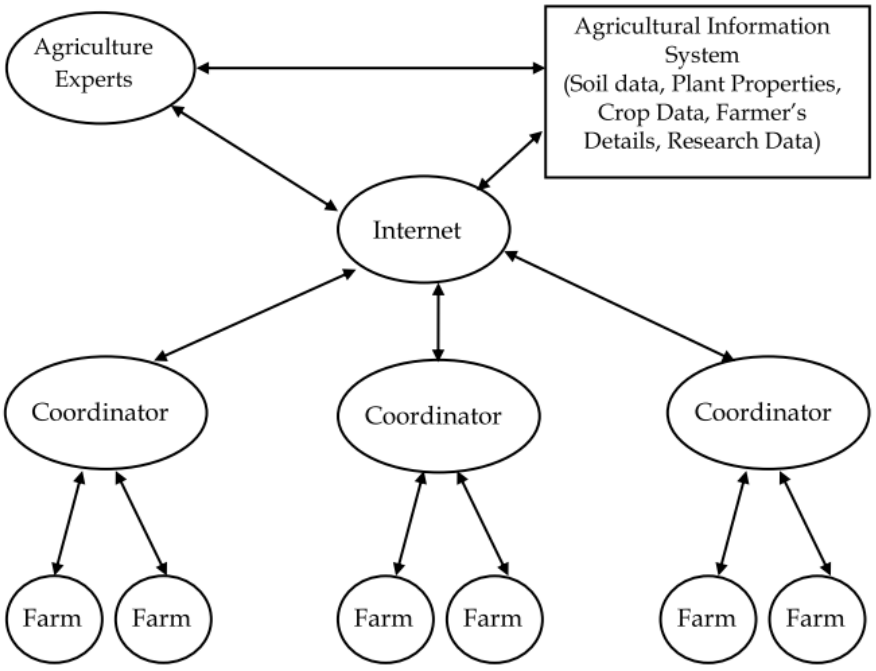


Figure 1: eSagu Framework (Reddy & Ankaiah, 2005).

2.9.2 MKrishi Project

MKrishi established in 2007 by Tata Consultancy Services as mobile-based Agro advisory system that empowers rural people to derive economic and social benefits from new upcoming wireless technologies in the areas relevant to their lives and livelihoods. It answers unique queries that farmers face and also provides up to date weather and pricing information through sms / voice message in local language. Using sensors, camera phones, GPS and cellular networks serves up environmental information to agriculture experts, who in turn provide tailored advice to farmers. The system is well developed for symptom based diagnostic approach as well plant disease forecasting models and advertisement based business model able to provide free service to poor farmers who are not able to subscribe to the services. Others are charged as per middle and premium charge basis not more than a dollar per month.

2.9.3 Technological Framework for the SOUNONG Search Engine

An ICT project, introduced in Anhui Province, China, has three main features: an Internet portal, information assistants, and information dissemination models. It targets specialized farmers cooperatives. The Institute of Intelligent Machines developed an Internet search engine called SOUNONG to aggregate information from the Internet and provide it to farmers cooperatives in a meaningful manner. SOUNONG coordinates with China‘s governmental agricultural websites. SOUNONG monitors over 7,000 websites per day, including nearly all of China‘s agricultural data. These sites contain information on prices of wholesale farm products, prices in 9,000+ markets, and prices for 20,000 types of agricultural products. Information is also retrieved from a number of databases, including those on climate, crop species, and pest and disease diagnostics.

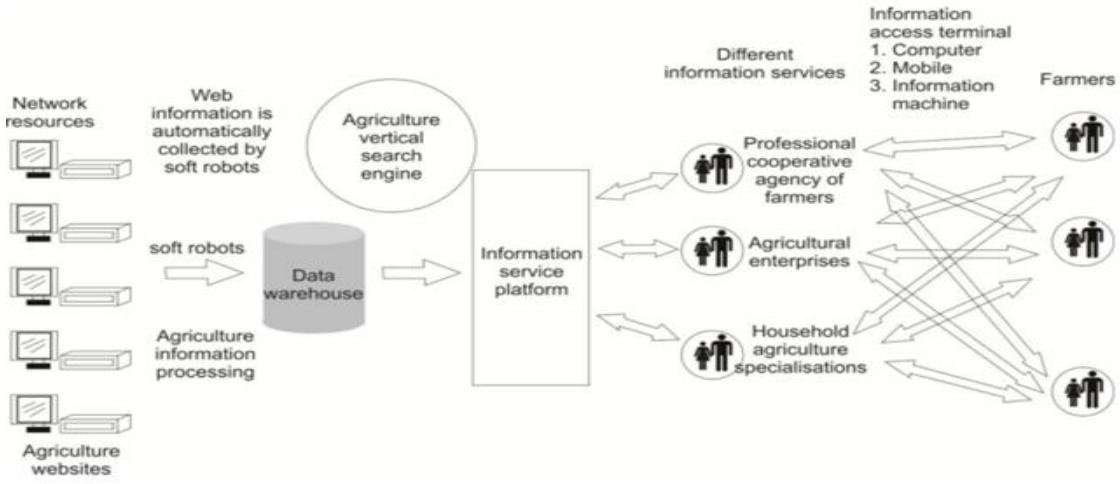


Figure 1.2: Technological Framework for the SOUNONG Search Engine (World Bank, 2011).

2.9.4 Information Dissemination for Farming Communities in Thailand

The framework aims at providing agricultural information to farmers on a large scale, which would lead to knowledge enhancement in the longer term. Thai farming community were found to be familiar with the use of mobile phones, as can be seen from the high percentage of mobile phone owners. As a result, coordinators to assist in sending and receiving information would be unnecessary in this framework (Tantisantisom, K. 2011)

It can be seen that the framework is a circulated flow, starting from the information dissemination system containing an agricultural information repository which delivers information in the user-requested formats, such as a typical SMS or short video clips. Then user satisfaction should be periodically evaluated to improve the system. User requests for information should be passed to the information administrator who is responsible for managing all the content in the agricultural information repository, including the dissemination schedules and lists. In the meantime, other farmer feedback related to technical manipulation of the system should be forwarded to the applications developer who deals with all system modifications.(K. Tantisantisom, 2011)

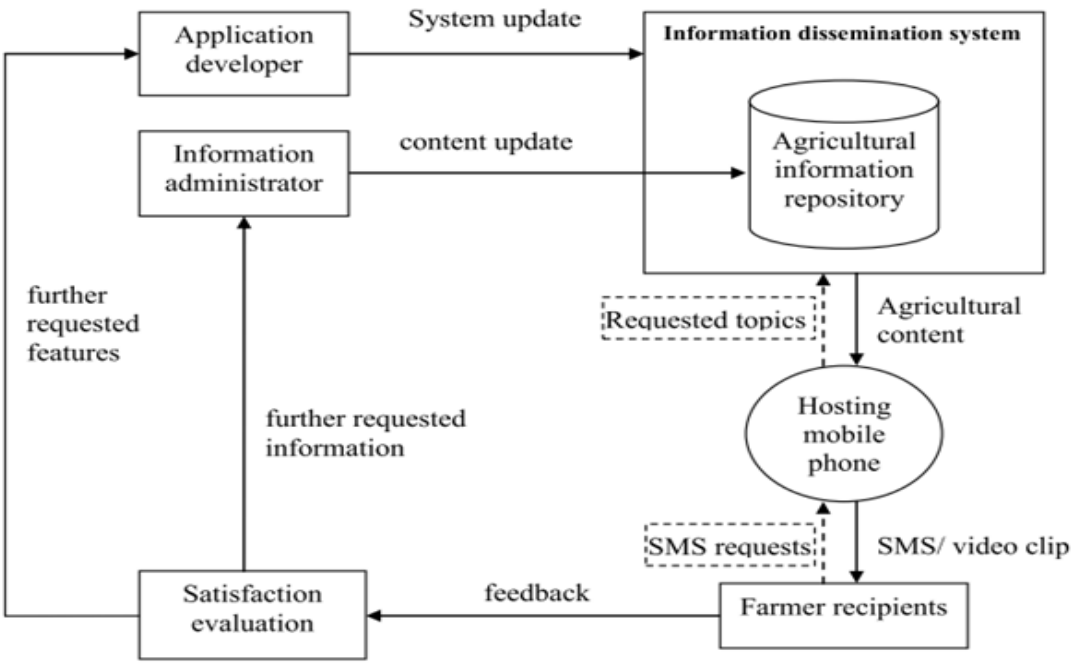


Figure 1.3: A Framework of information dissemination via mobile phone (Tantisantisom, K. 2011)

2.9.5 A Framework for Agriculture Information Dissemination System

A study by Ommani, (2005) designed Agricultural Information Dissemination System by Information Technology of Iran according to perception of extension agents who work for Management of Extension and Farming System of Khuzestan province. The objective of developing the framework was to establish communication between farmers, extension agents, agricultural experts, research centers, and community. The framework ensured that communication between all factors was mutual and information was based on farmers need. Internet was used as a facility to transfer the advanced agricultural information to the farming community, and that since some farmers were illiterate and only spoke a local language they did not have to use the system directly but through extension agent.

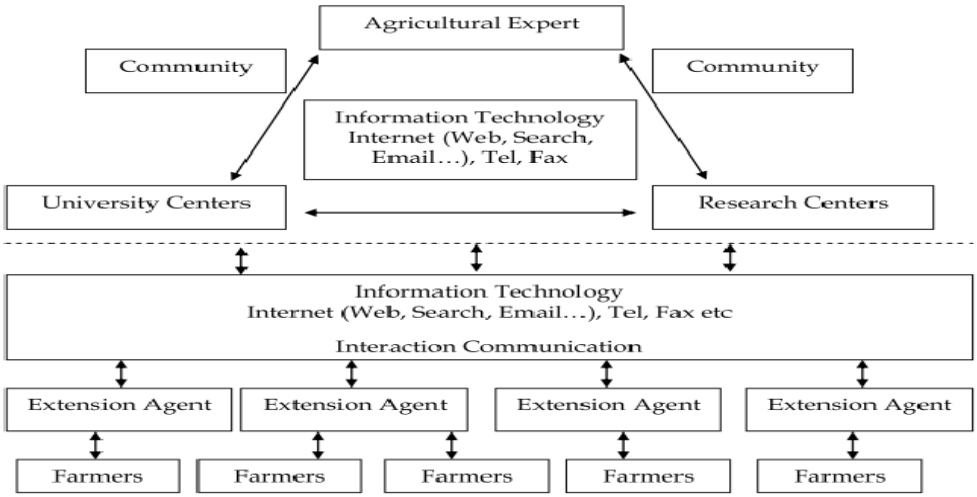


Figure 1.4: A Framework for Agriculture Information Dissemination System by Information Technology (Ommani, 2005).

2.10 Barriers to information dissemination

The agricultural barriers may be resolved by employing ICT tools to provide an information bridge between agricultural experts and farmers. For example, communication via mobile phones can reach farmers in distant areas where land line phones are limited. Video conference or voice over IP (VoIP), may be used to transfer information between an expert and groups of farmers in several areas. Such an approach could reduce the need for travelling to remote areas, the costs of travelling and the time spent with those farmers. (K. Tantisantison, 2011)

While the use of ICTs in extension services provides several key benefits in relation to traditional media, ICT projects come with a range of challenges including: technological dependence; lack of accessible telecommunication infrastructure in many rural and remote areas; capital cost of technologies, high cost of on-going access and support; inherent need for capacity building; integration issues with existing media and local communication methods and tradition and lack of involvement of all stakeholders in planning.(UNDP, 2012).

From the aforementioned review, the following major barriers were cited;

i. Fear of technology

A combination of unfamiliarity with technology and lack of self-efficacy intimidates many people lacking technology-operation skills from direct usage. The effort of acquiring the skills required to operate the device is also perceived as high. The easiest alternative, then, is to find a technologically skilled person.

ii. Lack of literacy and numeracy

Non-literacy limits the ability of some users to understand the features, functions, and outputs of technologies. Numeracy is an essential skill in number-based operations, such as dialling phone numbers and operating menus. This is further compounded by the skills required to operate technologies. For example, a user who is non-literate but numerate, and could read the time from a wall clock but not set the alarm.

iii. Habits of dependency

Pre-existing habits of dependency, not always regarding technology, transfer to device interactions. Factors such as age, lack of self-esteem, social order gave rise to dependencies on other community members. Local experts acted as enablers of information and communication access, through existing relationships.

iv. Cost of owning technology

The cost of ownership of a device was sometimes prohibitive, not just in terms of initial purchase, but also in maintenance, subscriptions, updating, or repairs.

v. security of the service

Security is paramount, it calls for secure storage systems, all sensitive data for farmers be well protected, unauthorized access should be eliminated and maintain a good data confidentiality.

2.11 Literature review Summary

An examination of the literature mentions factors that affect the successful usage of ICT tools for agricultural information dissemination to farmers as follows; literacy levels, income, ICT knowledge or skills, awareness toward ICT advantages, educational background, social class and gender, community cultures, particular information requirements, relationships between information users and providers and local languages. Other factors included availability of networks, infrastructure, financial support and roles of markets and intermediaries.

2.12 Theoretical framework

1.0 Introduction

Research on the adoption and diffusion of agricultural technologies has a long history in social sciences. “Diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system” (ROGERS 2003), where time is involved in the innovation-diffusion process, innovativeness, and an innovation’s rate of adoption. Thus, diffusion depends on four elements: the innovation, communication channels, time, and a social system in which diffusion takes place (ROGERS 2003).

1.1 Innovation,

Rogers (2003) defines an innovation as an idea, practice, or object that is perceived as new by an individual or other unit of adoption. Rogers and Scott (1999) observe that characteristics of an innovation, as perceived by the members of a social system, determine its rate of adoption. An innovation may have been invented a long time ago, but if individuals perceive it as new, then it may still be an innovation for them. Rogers (1999) identified the following attributes or characteristics determining an innovation's rate of adoption: Relative advantage; Compatibility; Complexity; Trial-ability and Observability. Although the explanations for adoption seem to vary between studies, many studies have confirmed that innovation diffusion follows a sigmoid diffusion path over time.

1.2 Communication channels

The second element of the diffusion of innovations process is communication channels. According to Rogers (2003), communication is “a process in which participants create and share information with one another in order to reach a mutual understanding”. This communication occurs through channels between sources. Rogers states that “a source is an individual or an institution that originates a message. A channel is the means by which a message gets from the source to the receiver”. Rogers states that diffusion is a specific kind of communication and includes these communication elements: an innovation, two individuals or other units of adoption, and a communication channel. Mass media and interpersonal communication are two communication channels. While mass media channels include a mass medium such as TV, radio, or newspaper, interpersonal channels consist of a two-way communication between two or more individuals. On the other hand, “diffusion is a very social process that involves interpersonal communication relationships” (Rogers, 2003).

1.3 Time

Rogers and Scott (1999) have identified time as the third key element in the diffusion of innovations theory. According to Rogers (2003), the time aspect is ignored in most behavioural research. He argues that including the time dimension in diffusion research illustrates one of its strengths. The innovation-diffusion process, adopter categorization, and rate of adoptions all include a time dimension. Lewis and Rimer (1997) explain the attribute of time as the duration an innovation can take to be adopted. They are of the view that some innovations require longer time while others may take shorter time.

1.4 The social system

The social system is the last element in the diffusion process. Rogers (2003) defined the social system as "a set of interrelated units engaged in joint problem solving to accomplish a common goal". Since diffusion of innovations takes place in the social system, it is influenced by the social structure of the social system. According to Rogers (2003), structure is "the patterned arrangements of the units in a system". He further claimed that the nature of the social system affects individuals' innovativeness, which is the main criterion for categorizing adopters. He observes that members or units of a social system may be individuals. Informal groups, organizations and subsystems. Although each unit of a social system can be distinguished from other units, all members co-operate to the extent of seeking to solve a common problem in order to reach a mutual goal. Diffusion processes can be examined considering adoption throughout the social system as well as the decision process for each individual in the social system.

1.5 Innovation-decision process

Rogers (2003) described the innovation-decision process as "an information-seeking and information-processing activity, where an individual is motivated to reduce uncertainty about the advantages and disadvantages of an innovation", The innovation-decision process involves five steps: knowledge, persuasion, decision, implementation, and confirmation. These stages typically follow each other in a time-ordered manner. This process is shown in Figure 2 below.

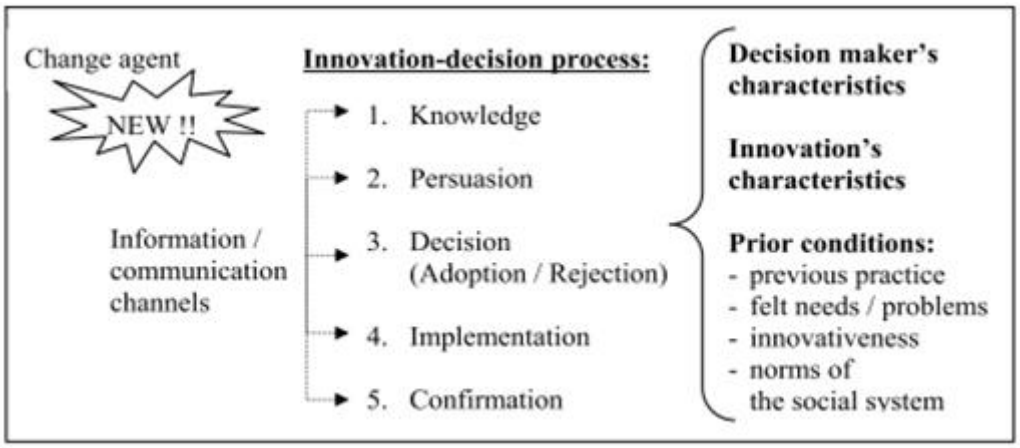


Figure 2:Inovation Decision process (Rogers 2003)

Figure 5 above, depicts that in every stage of the innovation-decision process, the farmer acquires information from various communication channels. The information channels accessed by the farmer and the behaviour throughout the process are greatly influenced by the decision maker's personal characteristics, the farmer's innovativeness, and the prior conditions of both the decision maker's situation and the social system.

1.6 Agricultural innovations

According to (Rogers 1995), "Many technologists believe that advantageous innovations will sell themselves, that the obvious benefits of a new idea will be widely realized by potential adopters, and that the innovation will therefore diffuse rapidly. Seldom is this the case. Most innovations, in fact, diffuse at a disappointingly slow rate"

Sonnino, A. et al. (2009), classified Agricultural innovations according to three parameters;

a) Innovations embodied in capital goods or products ("shielded" and "non-shielded") and innovations not embodied;

b) Innovations according to impact: New products; Yield increasing innovations; Cost-reducing innovations; Innovations that enhance product quality.

c) Innovations according to form: Mechanical, biological, chemical, biotechnical, and informational innovations

2.13 The Conceptual Framework

This study was guided by the diffusion of Innovation theory developed by Rogers (2003) which explains why farmers choose to adopt new ideas, the time needed and the rates of adoption which depend on the innovation itself and the characteristics of the receivers.

In the context of this research, an independent variable is the one that has control over what one could choose and manipulate to exert impact on the dependent variable. For example, the independent variables in this research were "ICTs Technologies", "Socio-economic characteristics", "Agricultural information providers (AIP)" and "challenges"; and the dependent variables were "contribution" and "the "Information access and utilization system (IAUS)". In other words, this research sought to establish the role of ICTs tools in the dissemination of agricultural information to the Kenyan farmers.

Though some Kenya farmers have access to ICTs, one still needed to establish what contributions ICTs made in the dissemination of agricultural information. When this was established, it became equally necessary to establish the factors that would lead to a state of low optimal use of ICTs. This was important in order to propose strategies for improvement.

The relationship between the variables of this study revolved around ICTs contribution to the development of both the rural areas and the farmer, through the dissemination of relevant agricultural information. "Contribution and challenges" and "proposed framework" are related key concepts pointing out gaps which needed answers to complete the circle of the conceptual framework.

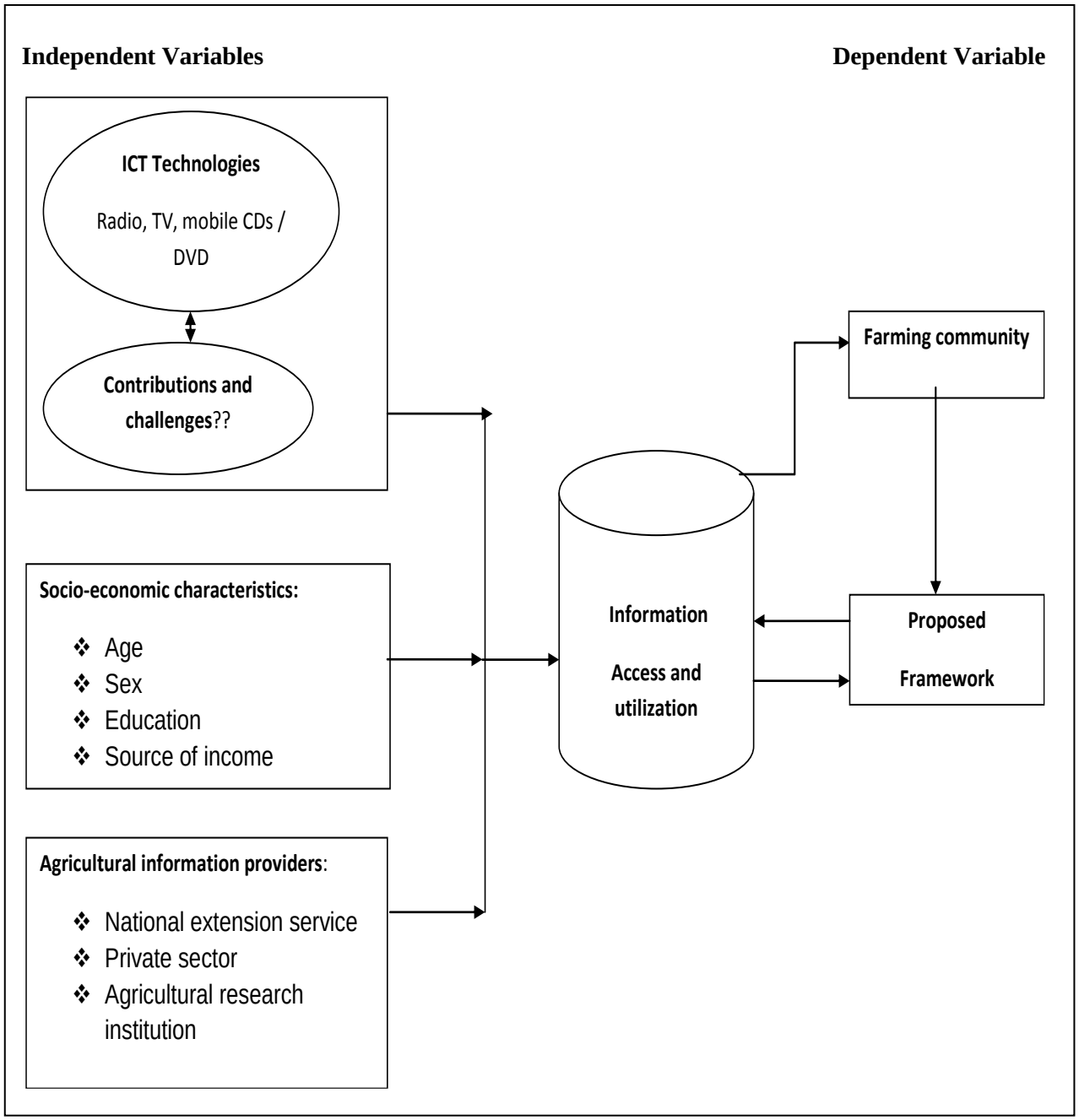


Figure 3: Conceptual framework,(author 2016)

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

This chapter presents the outline of the research methodology that was used in this study. This includes the study design, target population, sampling procedure, research instruments, data analysis and presentation. This research methodology was aimed at enabling the researcher obtain and process the data.

3.1 Research design

This was a descriptive research design in which the study investigated the role and contribution of ICTs as a means of disseminating relevant information to farmers in Kenya. Cooper and Schindler (2004) suggested that the purpose of the descriptive study survey is to observe, describe and document aspects of a situation as they naturally occur. Case study research can investigate either single or multiple cases (Yin, 2009). Thus, this design was used to obtain information about the variables from the respondents in their natural setting. This survey aided effective collection of data to support the study findings (Mugenda & Mugenda,2008)

3.2 Area of study

The study was carried out in Agricultural Development Corporation (ADC) in Kenya. ADC is a public entity within the ministry of Agriculture (MOA). ADC is located across 6 Counties across Kenya as shown by fig. 8. The case study focused on a particular unit and looked at the subject to be studied as a whole. The Case study enabled the researcher to do in-depth investigation of the problem at hand.

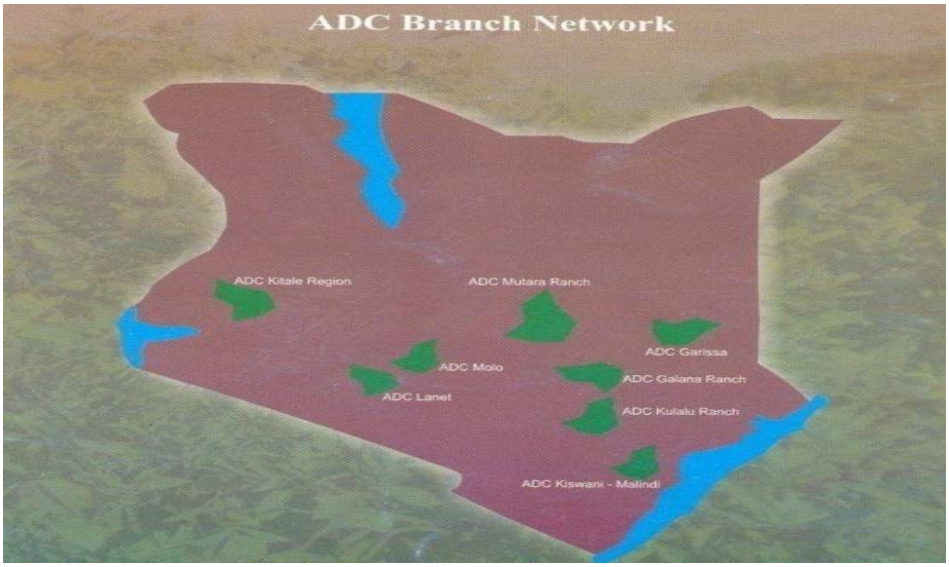


Figure 7: ADC Branch Network

3.3 Target population

In this study, the target population was well defined specific group of respondents who are working in the ADC farms and receive disseminated information from research institutions, Extension officers and directly apply the new agricultural information in their farms and provide feedback.

The target population of this study involved 340 employees of ADC, as per (ADC human resource register,2015).

3.4 Sampling Method

The research employed non probability-sampling methods in choosing participants. According to Bernard (2002), non-probability-sampling methods include quota, purposive, convenience and snowball sampling. Quota and purposive sampling are almost identical except that unlike quota sampling, in purposive sampling there is no overall sampling design that tells you how many of each type of informant you need for a study (Bernard, 2002). For this research, purposive sampling was used in selecting research participants and site.

In this type of sampling, subjects are chosen to be part of the sample with a specific purpose in mind. With judgmental sampling, the researcher believed that some subjects are better fit for the research compared to other individuals. The process involved nothing but purposely handpicking individuals from the population based on the authorities or the researcher's knowledge and judgment.

3.5 Sample size

Yamane (1967:886) provided a simplified formula to calculate sample sizes. This formula was used to calculate the sample sizes and taking 95% confidence level. A sample of 120 was taken for the purposes of this study as guided by ADC staff establishment. This figure was reached after consideration of the time available for data collection and financial resources of the self-sponsored researcher bearing in mind that questionnaires and observation were the main instruments of data collection.

Table 3.1:Sample size

Nakuru county/Laikipia county		**Transnzoia county**	
Farm/Unit	**No. of respondents**	**Farm/Unit**	**No. of respondents**
Mutara Ranch	10	Namandala	15
Lanet feedlot	10	Sabwani	15
Molo potato complex	10	olgatongo	10
sirikwa	5	Japata	10
Enchilli	10	Chorlim/A.I	10
Asante	5	Katuke/Suam	10
Total	**50**	**Total**	**70**
Overall Total	**120**		

3.6 Data Collection methods and Procedure

The main data collection instrument used by the researcher is the questionnaire. Data was collected using a semi-structured questionnaire served on respondents. The questionnaire had both open and closed questions to allow for varied responses.

3.6.1 Research Instruments

This study used a variety of instruments in data collection which include a questionnaire, observation and documentary review. The instruments are expected to provide precise and adequate data relevant to the objectives of the study.

3.6.2 Primary data collection

Primary data was gathered directly from respondents using a semi structured questionnaire. The questionnaire was categorized into four(4) sections as follows; section a: dealt with socio-economic information, section b:ICT channels for information dissemination, section c: challenges of disseminating information through ICT and section d: utilization of ICT tools in the agricultural sector.

The first part enabled the researcher to know the nature and type of the respondents, while the second part focused on the variables/parameters suitable for the dissemination of agricultural information.

3.6.3 Secondary Data Collection

Secondary data was collected from involved the systematic identification, location and analysis of documents containing information related to how agricultural information could be disseminated effectively through ICTs. Both published and unpublished information was be reviewed. The purpose of reviewing secondary data was to set a stage for the study and explore the challenges and successes of the various frameworks used for information transfer or dissemination.

The study area analysis was carried out through literature review, internet browsing, journals and magazines. The objective was to capture general information on the area in order to develop clear understanding and insight of the context of which data was collected. The information gathered on background of the study culminated into development of research tools, scoping of the entire work and also assisted in drawing recommendations and conclusions

3.7 Validity and Reliability of the study Instruments

The study sought to enlist both validity and reliability in the study instruments.

3.7.1 Validity of the Instrument

Validity refers to the degree to which evidence and theory support the interpretation of the test scores (Saunders, 2009). The researcher sought the help of a team of subject experts who assisted in reviewing the instrument to ensure that it bore both content and face validity. Construct validity was enlisted by developing the study research instrument in line with the reviewed literature.

3.7.2 Reliability of the Instrument

A pilot study was done to test for reliability of the research instruments. According to Mugenda and Mugenda (2003), 10% of the sample size is adequate for a pilot study. Based on this contention, piloting test was conducted with a sample of 17 respondents who did not form part of the sample size.

The reliability of the instrument was estimated after the pilot study using Cronbach's reliability coefficient. Frankael and Wallen (2008) assert that a reliability of at least 0.70 or higher is recommended for Social Science Research. Therefore if Cronbach's reliability coefficient is more than 0.7, the instrument is deemed reliable. From the findings, the study provided a Cronbach's Alpha coefficient of 0.762 which is more than 0.7. Thus, the study instrument was deemed reliable for the study

3.8 Data Analysis and Presentation

Data analysis is the whole process, which started immediately after data collection and ended at the point of interpretation and processing data. The researcher checked the completed questionnaires for completeness and accuracy before coding. The data was then coded carefully to facilitate analysis.

The data was analyzed using descriptive statistics aided by the SPSS (Statistical Package for Social Sciences). The analyzed data is presented in frequencies and percentages and presented using tables, charts and graphs with respective interpretation. Qualitative data collected was grouped into commonalities based on the research variables and analyzed by checking the developing convergent themes. Correlation and regression analyses were used to determine the nature and strength of the relationship that exists between variables.

CHAPTER FOUR

DATA ANALYSIS, RESULTS AND DISCUSSION

4.1 Introduction

The chapter examines data collected to help and assists in drawing relevant conclusions. The principal guiding factors in this section is study objectives highlighted in earlier in chapter one. The data was interpreted according to research objectives and research questions. Appropriate data analysis and presentation techniques are used thus all of the discussion in this chapter reflected the ideas given by the respondents. For the purpose of this study, classifications were made based on social economic profile, ICT Channels for information dissemination, challenges associated with the dissemination of information through ICT, data related to the utilization of ICT tools in agricultural sector and data and Information Dissemination

4.2 Response Rate

Data was collected from the administered hundred and twenty (120) questionnaires, 102 responded, which gave a response rate of 85 percent. According to Mugenda & Mugenda (2003), a response rate of more than 80% is sufficient for a study. It can be concluded that data obtained from those who responded was sufficient enough to answer research questions as shown by table 4.1;

Table 4.1: Response rate

Categories	Frequency	Percentage
Returned	102	85%
Not returned	18	15%
Total	120	100%

4.3.0 Level of Education

The study sought to determine the level of education of the respondents. The findings of the study are presented in figure 4.1.

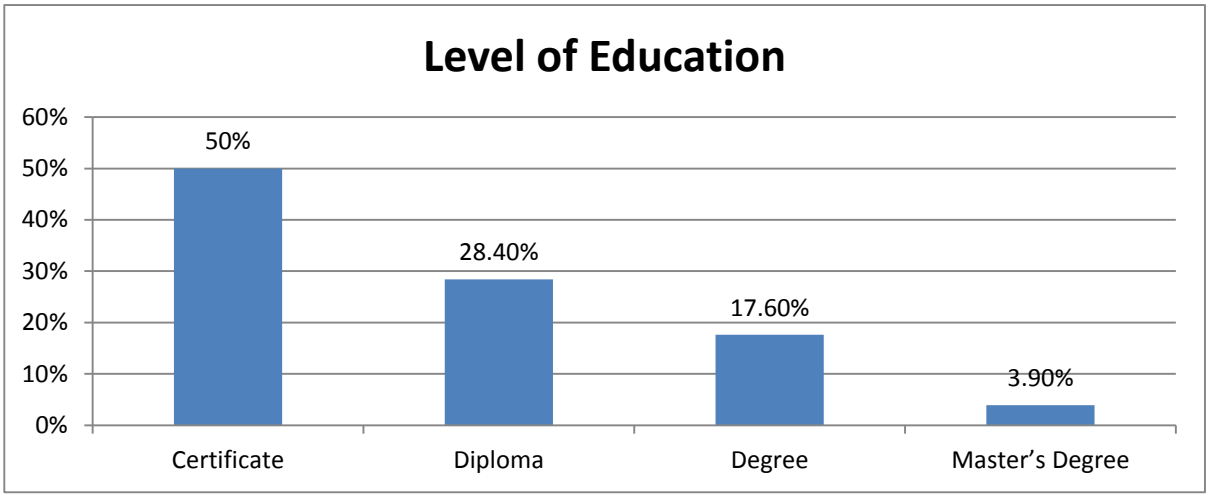


Figure 4.1: Level of Education

The study revealed 51 (50%) of the respondents attained certificate as their highest level of education, 29 (28.4%) of the respondents attained diploma while 18 (17.6%) attained degree. Only 4 (3.9%) of the respondents had attained master's degree level of education. The findings revealed that most respondents ADC farms have certificate level of education and hold substantial ability to comprehend matters of information dissemination through ICT channels.

4.3.1 Gender

In order to determine the gender of the respondents, they were asked to indicate their gender. The responses are shown in the figure 4.2.

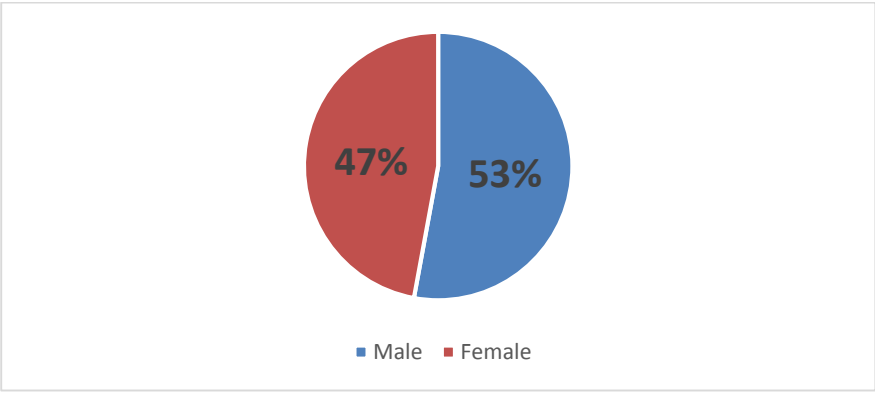


Figure 4.2: Gender

The study revealed that majority of respondents was male as shown by 53% response rate compared to 47% of their female counterparts. This margin is marginally big and could be attributed to the ration of male to female respondents in the area.

4.3.2 Age Range

The respondents were asked to state the age range in which they fell excluding months. The findings are illustrated in the figure 4.3.

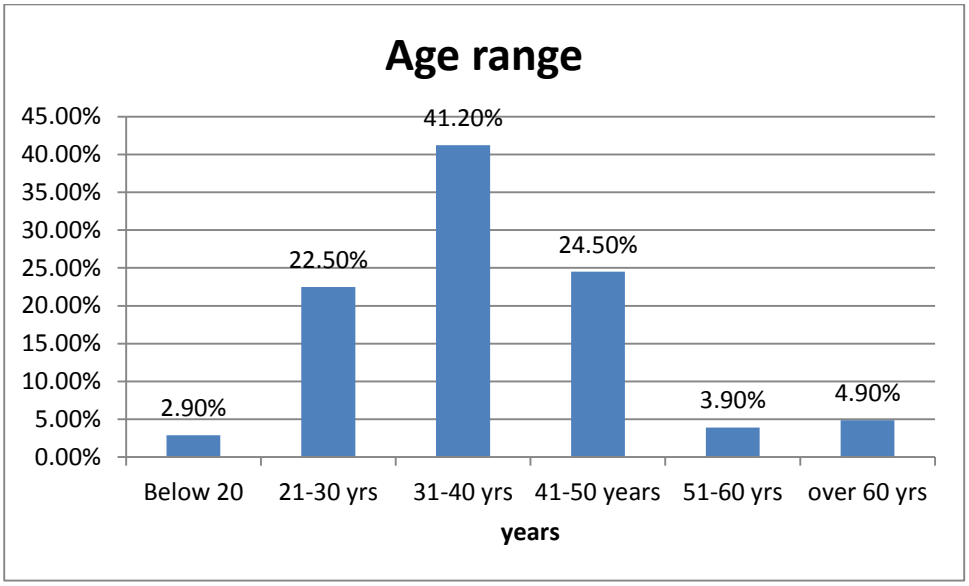


Figure 4.3: Age Range

From the findings, majority of the respondents 42 (41.2%) indicated that they were aged between 31-40 years, 25 (41.2%) of the respondents indicated that they were aged between 41-50 years while 23 (22.5%) of respondents indicated that they were aged between the age of 21-30 years. However, a small number of the respondents 5 (4.9%), 4 (3.9%) and 3 (2.9%) of the respondents indicated that they were aged over 60 years, 51-60 years and below 20 years respectively. This means that majority of the respondents were in their middle age. This is the age when the employees are at the peak of their career hence they are eager to implement new strategies which aim to improve their performance and to also contribute to the free flow of agricultural information in there settings using ICT.

4.3.3 Service Duration

The study requested the respondents to indicate how long they had served in the Corporation. figure 4.4 represents the findings.

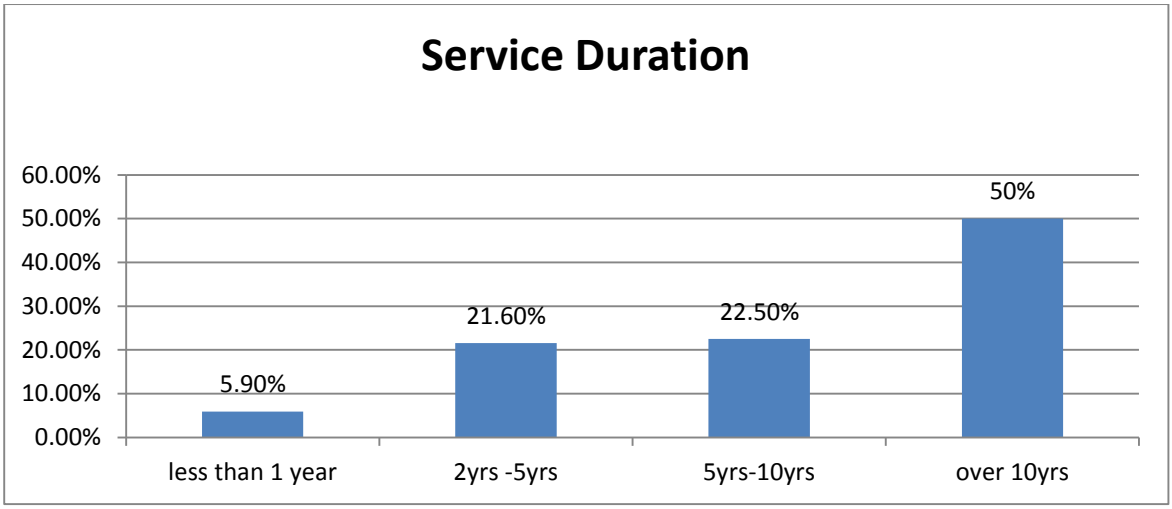


Figure 4.4: Service Duration

From the findings, majority of the respondents 51 (50%) stated that they had served in the ADC farms for over 10 years, 23 (22.5%) of the respondents stated that they had served in the farms for 5-10 years, 22 (21.6%) of the respondents stated that they had served in the organization for 2-5 years while 6 (5.9%) indicated that they had served for less than 1 year. The findings show that majority of the respondents at ADC farms have served in the organization for over 10 years and thus had experience on how to disseminate agricultural information in the farms.

4.3.4 Agriculture Practiced

The study sought to determine the type of agriculture the respondents practised. The figure 4.5 gives the responses.

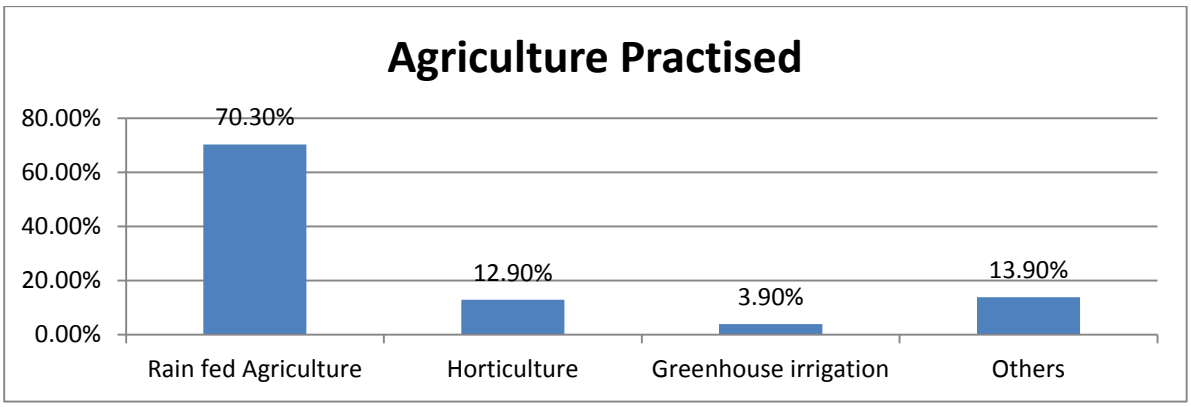


Figure 4.5: Agriculture Practiced

From the findings, majority of the respondents 71 (70.3%) indicated rain fed Agriculture as the type of agriculture they practised, 14 (13.9%) of the respondents indicated others, 13 (12.9%) of the respondents stated horticulture while 4 (3.9%) of the respondents indicated greenhouse irrigation. The findings showed that rain fed Agriculture was mostly practised by the respondents in the two counties.

4.3.5 Crops Grown

The study further sought to indicate the type of crops they grew. This information is represented in figure 4.6.

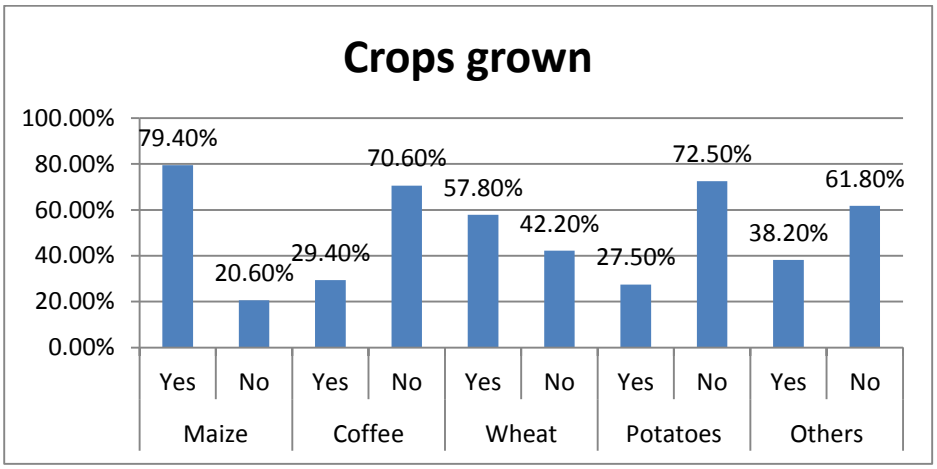


Figure 4.6: Crops Grown

From the findings, majority of the respondents 81 (79.4%) indicated that they grew maize while 59 (578%) did grow wheat, 28 (27.5%) of the respondents indicated that they grew potatoes, 30(29.4)%) grew coffee while 39 (38.2%) grew others. The findings show that the majority of the respondents majored in the growing of maize in the two counties.

4.4.0 ICT Channels for information dissemination

4.4.1 ICTs used

The respondents were asked to indicate ICTs tools used in the course of their work. The results are presented in the figure 4.8.

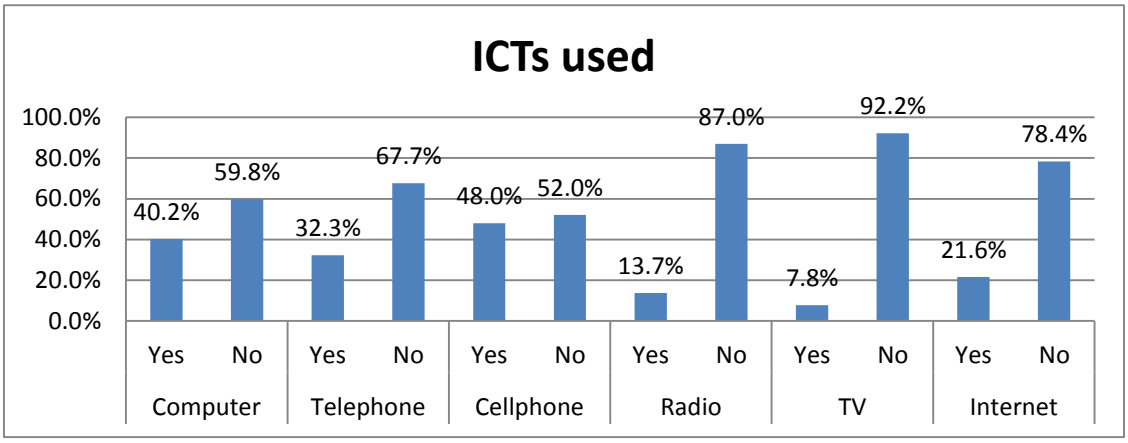


Figure 4.8: ICTs used

From the findings, majority of the respondents 94 (92.2%) indicated TV as ICTs not used in the course of their work, 89 (87%) stated radio as ICTs not used in the course of their work, 80 (78.4%) indicated internet as ICTs not used in the course of their work, 69 (67.7%) indicated telephone as ICTs not used in the course of their work, 61 (58.7%) indicated computer as ICTs not used in the course of their work while 53 (52%) indicated cell phone as ICTs not used in the course of their work. The findings indicated that the usage of ICT tools in ADC farms were below 50% as shown by the table above. The leading ICT tool which was been used was the cell phone at 48%, followed by computer at 40.2% and telephone at 32.3%.

4.4.2 ICT Tool Rating

The study asked the respondents to rate the ICT tools as best for disseminating information to the farmer based on their experience. The data collected was tabulated in figure 4.9.

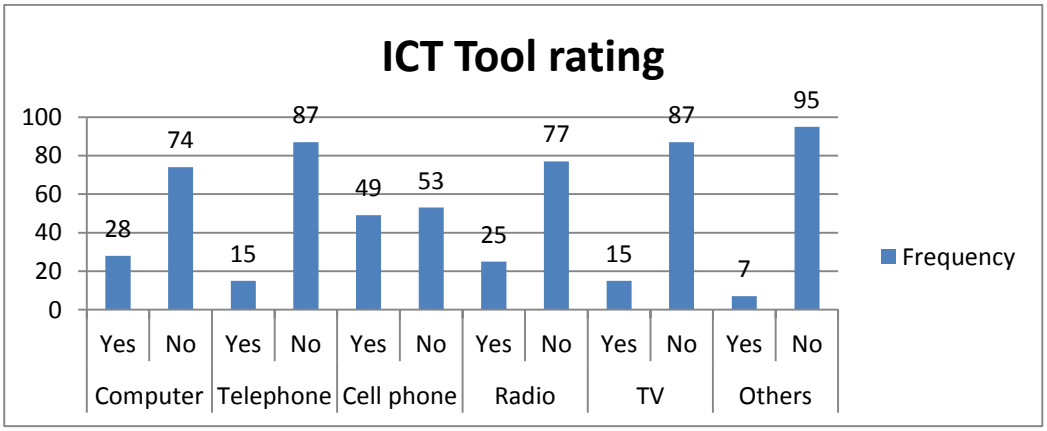


Figure 4.9: ICT Tool Rating

From the findings, majority of the respondents 95 (93.1%) indicated others as worst ICT tools for disseminating information to farmer based on their experience, 87 (85.3%) stated TV and telephone as worst ICT tools for disseminating information to farmer based on their experience respectively, 77 (75.5%) indicated radio less better ICT tools for disseminating information to farmer based on their experience, 74 (72.5%) indicated computer as less better ICT tools for disseminating information while 49 (48%) indicated cell phone as more better the than the other ICT tools for disseminating information to farmer based on their experience. The findings showed that in ADC farms, cell phone is the only ICT tool mostly used at 48%, followed by computer with 27.5% and radio at 24.5%. The other ICT tools garnered less that 20%.

4.4.3 ICT Platform

The respondents were asked to state the ICT platform they recommended as most suitable as a source of agricultural information. The figure 4.10 shows the findings.

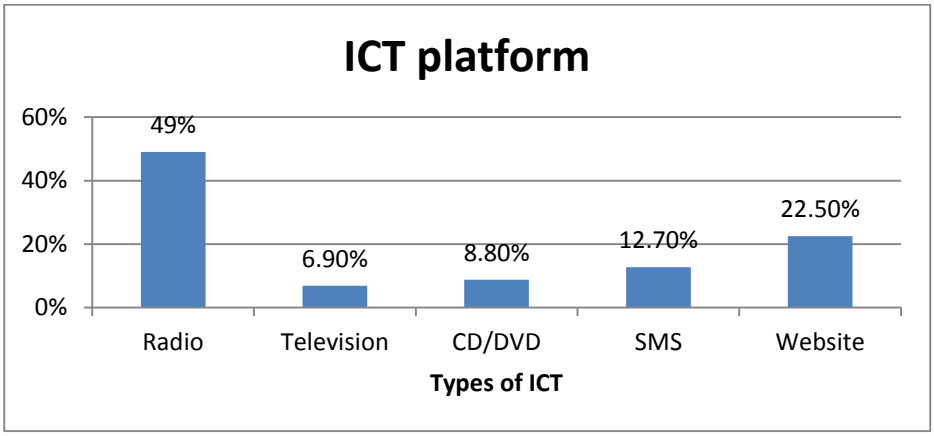


Figure 4.10: ICT Platform

The data presented in the table above showed that 50 (49%) respondents recommended radio as most suitable ICT platform for agricultural information dissemination, 23 (22.5%) recommended website, 13 (12.7%) recommended SMS, 9 (8.8%) recommended CD/DVD while 7 (6.9%) recommended television as most suitable source of agricultural information. This indicated that the radio was the most suitable ICT platform for agricultural information dissemination in ADC farms.

4.4.4 Access to Radio

The respondents were asked to state whether they had access to radio. The figure 4.11 shows the findings.

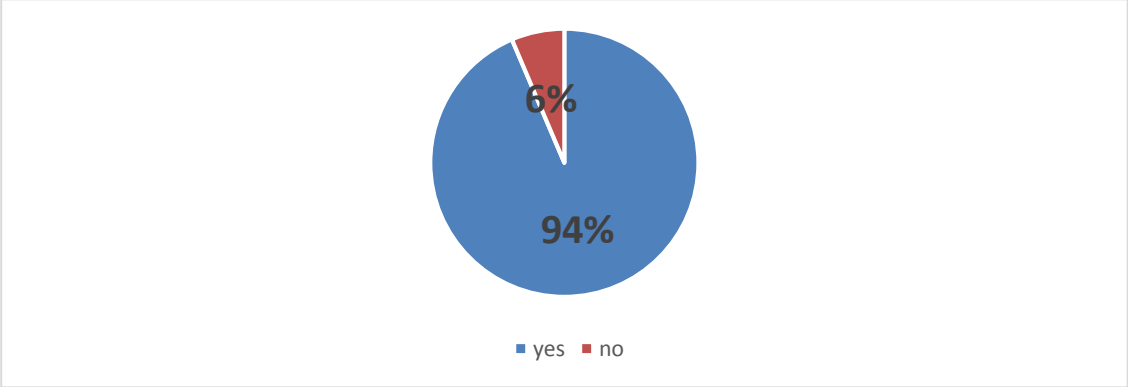


Figure 4.11: Access to Radio

Out of the 102 respondents interviewed, 94% of the respondents admitted to having access to a radio while 6% of the respondents did not have access to a radio. This indicates that most respondents in ADC farms had access to radio.

4.4.5 Listening to the Radio

The respondents were asked if they listen to information on agriculture from the radio. The figure 4.12 illustrates the findings.

From figure 4.12, it showed that 89% of the respondents agreed that they listen to information on agriculture from the radio while 11% of the respondents did not.

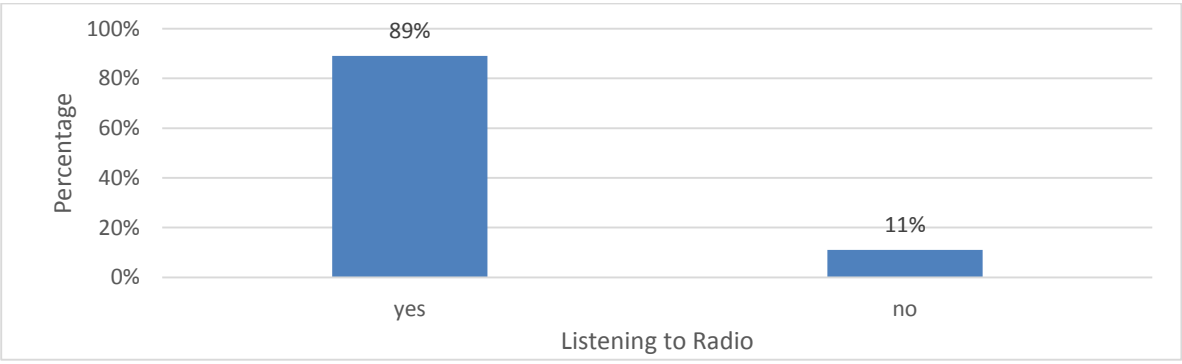


Figure 4.12: Listening to the Radio

4.4.6 Preferred Radio Station

The respondents were asked to indicate why they prefer to listen to the radio. The responses are presented in the table 4.2.

Table 4.2: Preferred Radio Station

Preferred Radio Station		Frequency	Valid Percent
Vernacular Language	Yes	31	30.4%
	No	71	69.6%
Portability	Yes	40	39.2%
	No	62	60.8%
Affordable/cost	Yes	54	52.9%
	No	48	47.1%
Interaction with programme' presenters through phone	Yes	27	26.5%
	No	75	73.5%
Can perform other duties while I listen to programs	Yes	66	64.7%
	No	36	35.3%
No training is required in accessing	Yes	51	50%
	No	51	50%

From the findings, majority of the respondents 66 (64.7%) indicated can perform other duties while I listen to programs as the reason they prefer to listen to radio, 51 (50%) indicated no training is required in accessing as the reason why they prefer to listen to the radio. However, majority of the respondents 75 (73.5%) indicated that effective Interaction with programme' presenters through phone as the reason why they prefer to listen to the radio, 71 (69.6%) indicated vernacular language while 62 (60.2%) indicated portability. The findings showed that the respondents were able to perform other duties while they listened to radio.

4.4.7 Radio Programs on Agriculture

The respondents were asked how often the radio present programs on agriculture that they listen to does. The findings are indicated in the table 4.3.

Table 4.3: Radio Programs on Agriculture

Radio Programs on Agriculture	Frequency	Valid Percent
Regularly	55	53.9%
Occasionally	41	40.2%
Rarely	4	3.9%
Never	2	2%
Total	**102**	**100%**

From the findings, majority of the respondents 55 (53.9%) stated that they regularly listen to radio programs on agriculture, 41 (40.2%) indicated that they occasionally listen to radio programs on agriculture, 4 (3.9%) indicated that they rarely listen to radio programs on agriculture while 2 (2%) indicated that they never listen to radio programs on agriculture. This indicated that a large number of respondents in ADC farms listened to radio programs on agriculture regularly.

4.4.8 Air time Convenience

The study requested the respondents to indicate if they thought the air time for agricultural information programmes was convenient. The responses are indicated by figure 4.13

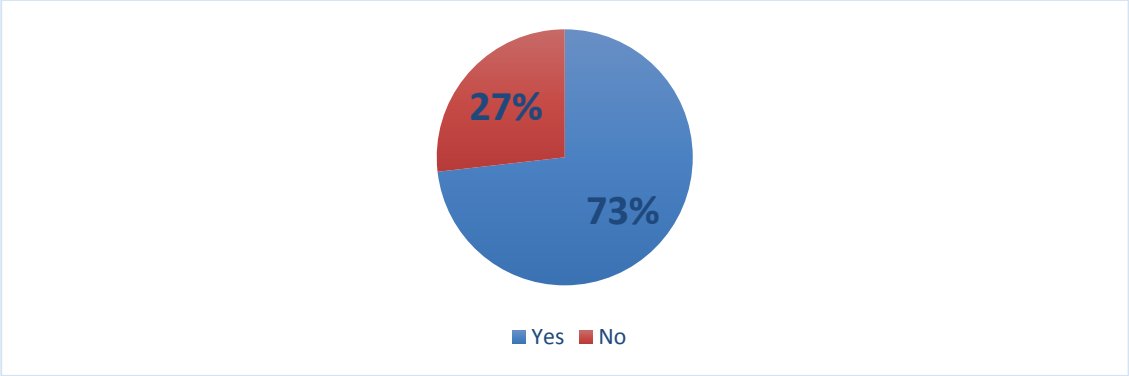


Figure 4.13: Air time Convenience

From the findings, majority of the respondents (73%) indicated that they thought that the air time for agricultural information programmes was convenient while 27% of the respondents did not. The findings therefore indicated that the air time for agricultural information programmes was convenient among respondents in ADC.

4.4.9 Access to a TV

The respondents were asked to state whether they had access to a TV. The figure 4.5 shows the findings.

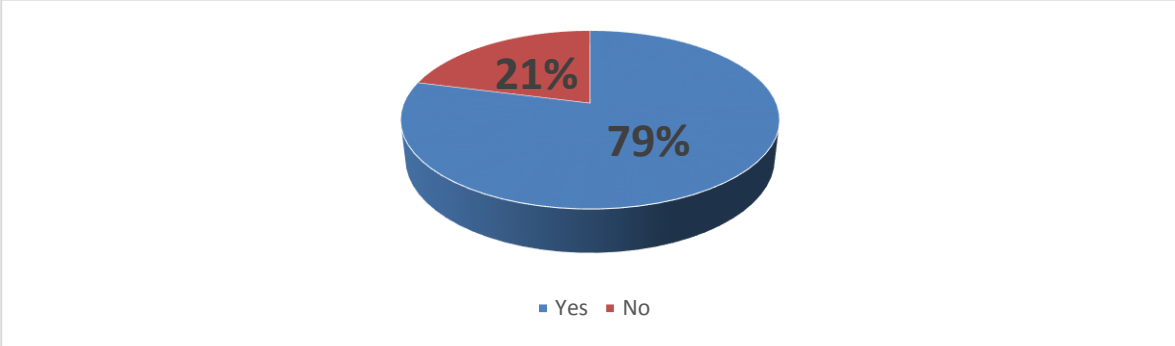


Figure 4.14: Access to a TV

From the findings, majority of the respondents (79%) admitted to having access to a TV while 21% of the respondents did not have access to a TV. This indicated that most respondents in ADC had access to a TV.

4.4.10 TV Watching

The study further asked the respondents to indicate whether they watch agricultural programmes on TV. The responses as shown in the figure 4.15.

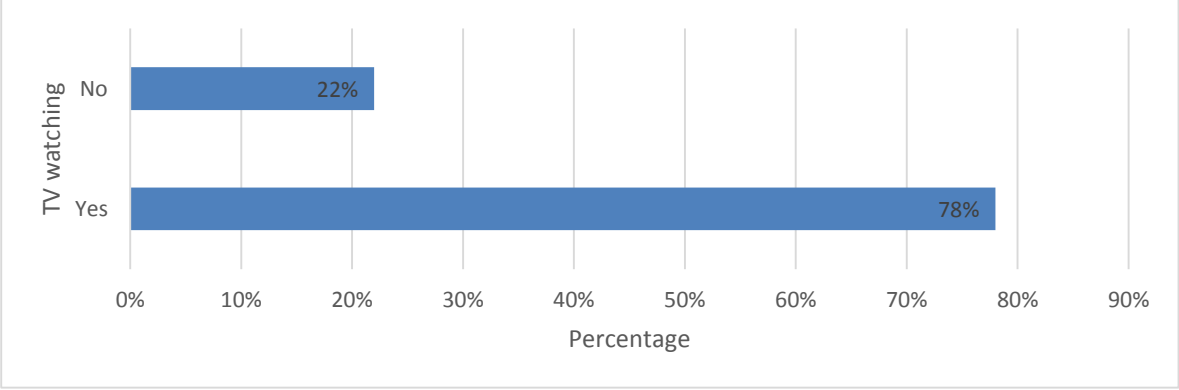


Figure 4.15: TV Watching

From the findings, majority of the respondents (78%) stated that they watched agricultural programmes on TV while 22% of the respondents did not.

For those respondents who agreed to watch agricultural programmes on TV, they were asked to indicate how often they watch agricultural programmes. The responses are indicated by table 4.4.

Table 4.4: Watch Agricultural Programmes

Watch Agricultural Programmes	Frequency	Valid Percent
Regularly	28	27.6%
Occasionally	57	55.9%
Rarely	11	10.8%
Never	6	5.9%
Total	**86**	**100%**

From the findings, majority of the respondents 57 (55.9%) stated that they occasionally watch agricultural programmes on TV, 28 (27.6%) indicated that they regularly watch agricultural programmes on TV, 11 (10.8%) indicated that they rarely watch agricultural programmes on TV while 6 (5.9%) indicated that they never watch agricultural programmes on TV. This indicated that a large number of respondents in ADC watched agricultural programmes on TV occasionally.

4.4.11 TV Preference

The study further asked the respondents to indicate why they prefer to watch agricultural programmes on TV. The table 4.5 shows the responses.

Table 4.5: TV Preference

TV Preference	Frequency	Valid Percent
TV is audio visual	47	46.1%
TV is interesting to watch	15	14.7%
Due to language TV present information	6	5.9%
Demonstration	33	32.4%
Others	1	1%
Total	**102**	**100%**

From the findings, majority of the respondents 47 (46.1%) indicated they prefer to watch agricultural programmes on TV because TV is audio visual, 33 (32.4%) stated demonstration, 15 (14.7%) stated that TV is interesting to watch, 6 (5.9%) stated they prefer to watch agricultural programmes on TV due to language TV present information while only 1 (1%) stated others. The findings therefore revealed that most respondents preferred to watch TV as a result of it being audio visual.

4.4.13 Use of Computer

The study asked the respondents to state whether they use the computer to access agricultural information. The findings are shown in the table 4.6.

Table 4.6: Use of Computer

Use of Computer	Frequency	Valid Percent
Yes	67	65.7%
No	35	34.3%
Total	**102**	**100%**

As shown from the table above, 67 (65.7%) of the respondents agreed that they use the computer to access agricultural information while 35 (34.3%) of the respondents did not. This indicated that the majority of respondents used the computer to access agricultural information to enhance their farming activities.

4.4.13 How often they used the computer

The respondents were asked to indicate how often they use the computer to access agricultural information. The responses are shown in the table 4.7.

Table 4.7: How often use of Computer

Often use of Computer	Frequency	Valid Percent
Regularly	16	15.7%
Occasionally	78	76.5%
Rarely	5	4.9%
Never	3	2.9%
Total	**102**	**100%**

From the findings, majority of the respondents 78 (76.5%) stated that they occasionally use the computer to access agricultural information, 16 (15.6%) indicated that they regularly use the computer to access agricultural information, 5 (4.9%) indicated that they rarely use the computer to access agricultural information while 3 (2.9%) indicated that they never use the computer to access agricultural information. This indicated that a majority of respondents in ADC farms occasionally used the computer to access agricultural information

4.4.15 Average Number of Hours Spent on Internet

The respondents were asked to indicate the average number of hours spent on internet. The findings are shown in the table 4.8.

Table 4.8: Average Number of Hours Spent On Internet

Average Number of Hours Spent On Internet	Frequency	Valid Percent
One week	30	29.40%
One Month	50	49%
One Year	22	21.6
Total	**102**	**100%**

From the findings, majority of the respondents 50 (49%) stated one month as the number of hours spent on internet, 30 (29.4%) indicated one week as the number of hours spent on internet while 22 (21.6%) as the number of hours spent on internet. This indicated that the

majority of the respondents in ADC farms took at least a week to access internet, others were taking a month and the rest one year .

4.4.16 Internet information preference

The respondents were asked to indicate why they prefer information from the internet. The findings are shown in the table 4.9.

Table 4.9: Internet information preference

Internet information preference		Frequency	Valid Percent
I can download	Yes	77	75.5%
	No	25	24.5%
I can print	Yes	89	86.3%
	No	13	13.7%
I can repeat to understand	Yes	29	28.5%
	No	74	72.5%
I can access information from the internet any time I want	Yes	63	61.8%
	No	39	38.2%
There is vast information from the internet	Yes	29	28.4%
	No	73	71.6%
There is vast information from the internet	Yes	41	40.2%
	No	61	59.8%

From the findings, majority of the respondents 89 (86.3%) indicated they preferred information from the internet because they could print, 77 (75.5%) stated they preferred information from the internet because they could download, 63 (61.8%) indicated they preferred information from the internet because they could access information from the internet any time they want. However, 74 (72.5%) of the respondents disagreed that they preferred information from the internet because they could repeat to understand, while 41 (40.2%) indicated that they preferred information from the internet because there was vast information from the internet.

The findings therefore indicated that majority of the respondents in ADC farms preferred information from the internet because they could print and download.

4.4.17 Use of Computer to Access Information from CD/DVDs

The study asked the respondents if they used the computer to access agricultural information in CD/DVDs. The findings are shown in the table 4.10.

Table 4.10: Use of Computer to Access Information from CD/DVDs

Use of Computer to Access Information from CD/DVDs	Frequency	Valid Percent
Yes	35	34.3%
No	67	65.7%
Total	**102**	**100%**

From the findings, majority of the respondents 67 (65.7%) indicated that they did not use the computer to access agricultural information in CD/DVDs while 35 (34.3%) of the respondents indicated that they use the computer to access agricultural information in CD/DVDs. The findings show that most respondents at ADC farms did not access agricultural information in CD/DVDs ..

If they did not use the computer to access agricultural information in CD/DVDs, the respondents were asked to indicate why. The responses are shown in the table 4.11**.**

Table 4.11: Why did not use the computer to access agricultural information

Why not use computer to access agricultural information	Frequency	Valid Percent
I am not aware of CD/DVDs contain agricultural information	15	14.7%
I cannot afford to buy CDs/DVDs	77	75.5%
Others	20	19.6%
Total	**102**	**100%**

From the findings, majority of the respondents 77 (75.5%) indicated that they cannot afford to buy CDs/DVDs, 20 (19.6%) had other reasons and 15 (14.7%) of the respondents indicated that they were not aware that there are CD/DVDs containing agricultural information. The results therefore indicated that most respondents at ADC farms cannot afford to buy CDs/DVDs that contain agricultural information.

4.4.18 Mobile Phones

The respondents were requested to indicate if they own a mobile phone. The findings are indicated in the table 4.12.

Table 4.12: Mobile Phones

Mobile Phones	Frequency	Valid Percent
Yes	98	96.1%
No	4	3.9%
Total	**102**	**100%**

As shown from the table above, 98 (96.1%) of the respondents agreed that they owned cell phones while a relatively less number of the respondents 4 (3.9%) did not. This indicated that the majority of the respondents owned cell phone.

4.4.19 Access Agricultural Information through Mobile Phone

The respondents were asked if they had access to agricultural information from their mobile phone. The responses are recorded in the table 4.13.

Table 4.13: Access Agricultural Information through Mobile Phone

Access Agricultural Information through Mobile Phone	Frequency	Valid Percent
Yes	69	67.6%
No	33	32.4%
Total	**102**	**100%**

From the findings, majority of the respondents 69 (67.6%) indicated that they access agricultural information from their mobile phone, while 33 (32.4%) of the respondents did not access agricultural information from their mobile phone. This clearly indicates that most respondents in ADC farms had access to agricultural information from their mobile phone.

For the respondents who agreed to have access to agricultural information from their mobile phone, the study asked how often they used the phones. The table 4.14 shows the findings.

Table 4.14: Rate of use of Mobile phone

Rate of use of Mobile phone	Frequency	Valid Percent
Regularly	56	54.9%
Occasionally	40	39.2%
Rarely	4	3.9%
Never	2	2%
Total	**102**	**100%**

From the findings, majority of the respondents 56 (54.9%) stated that they regularly used the mobile phone to access agricultural information, 40 (39.2%) indicated that they occasionally use mobile phone to access agricultural information, 4 (3.9%) indicated that they rarely use mobile phone to access agricultural information while 2 (2%) indicated that they never use mobile phone to access agricultural information. This indicated that a large number of respondents in ADC farms used mobile phones to access agricultural information regularly.

4.4.20 Practiced on Agricultural Information

The study requested the respondents to indicate if they had put the agricultural information they got into practice. The table 4.27 represented the findings.

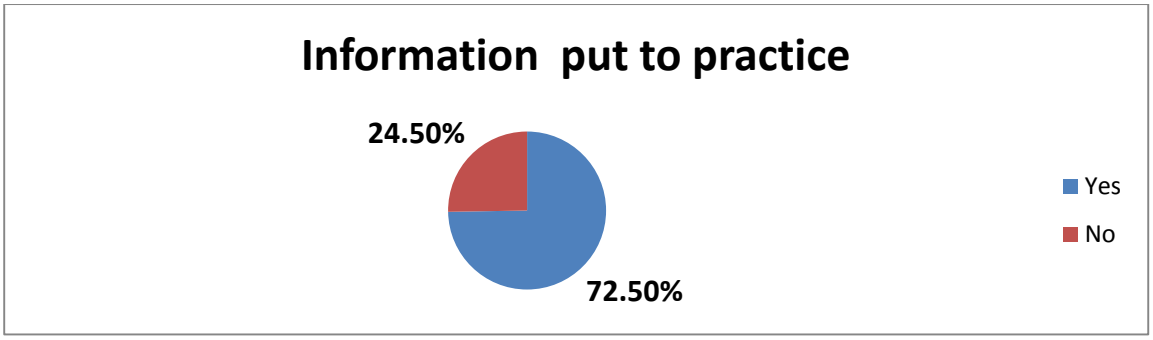


Figure 4.16: Practiced on Agricultural Information

From the findings, majority of the respondents 74 (72.5%) indicated that they had put the agricultural information they got into practice while 28 (24.5%) of the respondents did not put the agricultural information they got into practice. This clearly indicated that majority of the respondents in ADC farms put the agricultural information they got into practice.

As a result of most respondents indicating to have put the agricultural they get into practice, they were also asked to state whether changes have occurred in their output and income since they started applying the agricultural information. The table 4.15 showed the results.

Table 4.15: Changes in Output

Practiced on Agricultural Information	Frequency	Valid Percent
Increased	98	96.1%
No Change	4	3.9%
Total	**102**	**100%**

From the findings, majority of the respondents 98 (96.1%) indicated that there was an increase in changes in their output and income since they started applying the agricultural information while only 4 (3.9%) of the respondents indicated that there was no change in their output and income since they started applying the agricultural information.. This findings show that most respondents agreed that there has been an increase in their output and income since they started applying the agricultural information.

4.5.0 Challenges associated with the dissemination of information through ICT

4.5.1 Problems Encountered in Accessing Radio Agricultural Programs

The study requested the respondents to indicate the problems they encounter in accessing radio agricultural programs. The table 4.16 represents the findings.

Table 4.16: Problems Encountered in Accessing Radio Agricultural Programs

Problems Encountered in Accessing Radio Agricultural Programs		Frequency	Valid Percent
Unfavourable airtime schedule	Yes	40	39.2%
	No	62	60.8%
Use of difficult terms	Yes	7	6.9%
	No	95	93.1%
Lack of transfer to other devices for reference	Yes	36	35.3%
	No	66	64.7%
I have no control over the program during its presentation	Yes	49	48%
	No	53	52%
The channel is not audio visual	Yes	22	19.6%
	No	82	80.4%
Lack of training in usage of the channel	Yes	12	11.8%
	No	90	88.2%
Battery needs constant charging	Yes	31	30.4%
	No	71	69.6%
Information explosion	Yes	8	7.8%
	No	94	92.2%
Power blackouts	Yes	45	44.1%
	No	57	55.9%

From the findings, majority of the respondents 94 (92.2%) disagreed with information explosion as the problem they encounter in accessing radio agricultural programs, 95 (93.1%) disagreed with use of difficult terms as the problem they encounter in accessing radio agricultural programs, 90 (88.2%) disagreed with lack of training in usage of the channel as the problem they encounter in accessing radio agricultural programs. The findings indicate that information explosion is not a major problem encountered in accessing radio agricultural programs.

4.5.2 Problems Encountered in watching TV agricultural programs

The study also requested the respondents to indicate the problems they encounter in watching TV agricultural programs. The table 4.17 represents the findings.

Table 4.17: Problems Encountered in Watching TV Agricultural Programs

Problems Encountered in Watching TV Agricultural Programs		Frequency	Valid Percent
Unfavourable airtime schedule	Yes	35	24.5%
	No	77	75.5%
Use of difficult terms	Yes	14	13.7%
	No	88	86.3%
Lack of transfer to other devices for reference	Yes	33	32.4%
	No	69	67.6%
I have no control over the program during its presentation	Yes	33	32.4%
	No	69	67.6%
The channel is not audio visual	Yes	12	11.8%
	No	90	88.2%
Lack of training in usage of the channel	Yes	8	7.8%
	No	94	92.2%
Battery needs constant charging	Yes	15	14.7%
	No	87	85.3%
Information explosion	Yes	49	48%
	No	53	52%
Power blackouts	Yes	15	14.7%
	No	87	85.3%

From the findings, majority of the respondents 94 (92.2%) disagreed that lack of training in usage of the channel as the problem they encounter in accessing radio agricultural programs, 90 (88.2%) disagreed that channel is not audio visual as the problem they encounter in accessing radio agricultural programs, 88 (86.3%) disagreed with use of difficult terms as the problem they encounter in accessing radio agricultural programs, 87 (85.3%) disagreed battery needs constant charging and power blackouts as the problem they encounter in accessing radio agricultural programs respectively. The findings indicate that lack of training in usage of the channel is not a problem they encounter in accessing TV programs.

4.5.3 Problems Encountered in Surfing the Internet for Agriculture Related Information

The study further requested the respondents to indicate the problems they encounter in surfing the internet for agriculture related information. The table 4.18 represents the findings.

Table 4.18: Problems Encountered in surfing

Problems Encountered in surfing		Frequency	Valid Percent
Unfavourable airtime schedule	Yes	36	35.3%
	No	66	64.7%
Use of difficult terms	Yes	14	13.7%
	No	88	86.3%
Lack of transfer to other devices for reference	Yes	10	9.8%
	No	92	90.2%
I have no control over the program during its presentation	Yes	21	20.6%
	No	81	79.4%
The channel is not audio visual	Yes	15	14.7%
	No	87	85.3%
Lack of training in usage of the channel	Yes	15	14.7%
	No	87	85.3%
Battery needs constant charging	Yes	26	25.5%
	No	76	74.5%
Information explosion	Yes	23	22.5%
	No	79	77.5%
Power blackouts	Yes	28	27.5%
	No	74	72.5%

From the findings, majority of the respondents 92 (90.2%) disagreed that lack of transfer to other devices for reference as the problems they encounter in surfing the internet for agriculture related information, 88 (86.3%) disagreed with use of difficult terms as the problems they encounter in surfing the internet for agriculture related information, 87 (85.3%) disagreed that lack of training in usage of the channel and the channel is not audio

visual are the problem they encounter in surfing the internet for agriculture related information respectively, 81 (79.4%) disagreed that having no control over the program during its presentation is the problem they encounter in surfing the internet for agriculture related information. The findings indicated that lack of transfer to other devices for reference is not the major problem they encounter in surfing the internet for agricultural related information.

4.5.4 Problems Encountered in Accessing Information from the Mobile Phone

On matters regarding mobile phone, the study asked the respondents to indicate the problems they find in accessing information from the mobile phone. The table 4.19 represents the findings.

Table 4.19: Accessing Information from the Mobile Phone

Accessing Information from the Mobile Phone		Frequency	Valid Percent
Unfavourable airtime schedule	Yes	34	33.3%
	No	68	66.7%
Use of difficult terms	Yes	12	11.8%
	No	80	78.4%
Lack of transfer to other devices for reference	Yes	24	23.5%
	No	78	76.5%
I have no control over the program during its presentation	Yes	19	18.6%
	No	83	81.4%
The channel is not audio visual	Yes	14	13.7%
	No	88	86.3%
Lack of training in usage of the channel	Yes	20	19.6%
	No	82	80.4%
Battery needs constant charging	Yes	35	34.3%
	No	67	65.7%
Information explosion	Yes	10	9.8%
	No	92	90.2%
Power blackouts	Yes	19	18.6%
	No	83	81.4%

From the findings, majority of the respondents 92 (90.2%) disagreed that information explosion is the problems they encounter in accessing information from the mobile phone, 88 (86.3%) disagreed that the channel is not audio visual is the problems they encounter in accessing information from the mobile phone, 83 (81.4%) disagreed that having no control over the program during its presentation and the power blackouts are the problem they

encounter in accessing information from the mobile phone respectively, 82 (80.4%) disagreed that lack of training in usage of the channel was the problem they encountered in accessing information from the mobile phone.

4.6 Data related to the utilization of ICT tools in agricultural sector

4.6.1 Sources of Accurate Information

The respondents were asked if they believed the following sources give the employees accurate information. The responses were rated on a five point Likert scale where: 1= strongly believe, 2= believe, 3= neutral and 4= strongly disbelieve. The mean and standard deviations were generated from SPSS and are as illustrated in table 4.20.

Table 4.10: Sources of Accurate Information

	Mean	**Std. Deviation**
Neighbours	2.82	0.870
Extension workers	1.98	0.762
Government officers	1.93	0.728
Websites	1.60	0.780
Sales agents	2.50	0.871

From the findings, majority of the respondents strongly believed that extension workers, government officers and websites give accurate information with mean scores of 1.98, 1.93 and 1.60 respectively. Other respondents believed that neighbours and sales agents give accurate information with mean scores of 2.82 and 2.50 respectively. The findings therefore insinuated that most respondents at ADC farms believed that extension workers, government officers and websites are the main sources of accurate information in regard to agricultural activities

4.6.2 Type of Information

The respondents were asked to indicate the type of information would you like to acquire in order to improve your productivity. The responses are indicated in the table 4.21.

Table 4.21: Type of Information

Type of Information		Frequency	Valid Percent
pest management	Yes	35	34.3%
	No	67	65.7%
use of fertilizer	Yes	27	26.5%
	No	75	73.5%
soil improvement	Yes	56	54.9%
	No	46	45.1%
market price	Yes	34	33.3%
	No	68	66.7%
use of insecticide	Yes	20	19.6%
	No	82	80.4%
weather forecast	Yes	46	45.1%
	No	56	54.9%
financial management	Yes	37	36.3%
	No	65	63.7%

From the findings, majority of the respondents 56 (54.9%) indicated that soil improvement as the type of information they would like to acquire in order to improve their productivity. However, 82 (80.4%) disagreed with use of insecticide as the type of information they would like to acquire in order to improve their productivity, 75 (73.5%) disagreed that use of fertilizer is the type of information they would like to acquire in order to improve their productivity, 68 (66.7%) disagreed that market price is the type of information they would like to acquire in order to improve their productivity. The findings indicate that most respondents in ADC farms were in agreement that soil improvement as the type of information they would like to acquire in order to improve their productivity.

4.6.3 Positive Outcomes

The study further asked the respondents to indicate the positive outcomes that have resulted from the information they received. The table 4.22 shows the findings.

Table 4.22: Positive Outcomes

Positive Outcomes	Frequency	Valid Percent
Increase amount of productivity	38	37.3%
Higher quality of productivity	42	41.1%
Lower cost	8	7.8%
Higher selling price	12	11.8%
Total	**102**	**100%**

The study revealed that higher quality of productivity is the most positive outcome expected from the information they received from the majority of the respondents (41.1%) followed by increase amount of productivity (37.3%). The study shows that the positive outcomes that are expected from the information received are higher quality of productivity and increase amount of productivity.

4.7 Data and Information Dissemination

4.7.1 Format of Agricultural Information Dissemination

The study also asked the respondents to indicate the format agricultural information is disseminated in the organisation. The table 4.24 indicate the findings.

Table 4.24: Format of Agricultural Information Dissemination

Format of Agricultural Information Dissemination	Frequency	Valid Percent
Text	33	32.4%
Image	15	14.7%
Video	7	6.9%
Audio	47	46.1%
Total	**102**	**100%**

From the findings, majority of the respondents 47 (46.1%) indicated audio as the format agricultural information is disseminated in the organisation, 33 (32.4%) stated text as the format agricultural information is disseminated in the organisation, 15 (14.7%) stated image as the format agricultural information is disseminated in the organisation while 7 (6.9%) stated video as the format agricultural information is disseminated in the organisation. The findings therefore revealed that most respondents value audio as the format agricultural information is disseminated in the organisation.

4.7.2 Format Most Preferred By Farmers

The study further asked the respondents to indicate the format most preferred by farmers. The table 4.25 that follows indicate the findings.

Table 4.25: Format Most Preferred By Farmers

Format Most Preferred By Farmers	Frequency	Valid Percent
Text	50	49%
Image	7	6.9%
Video	9	8.8%
Audio	36	35.3%
Total	**102**	**100%**

The data presented in the table above shows that 50 (49%) respondents indicated text as the format most preferred by farmers, 36 (35.3%) indicated audio as the format most preferred by farmers, 9 (8.8%) recommended video as the format most preferred by farmers while 7 (6.9%) recommended image as the format most preferred by farmers. This indicated that text is the format most preferred by respondents in ADC farms.

4.7.3 Personalized Agro-Advice

The respondents were requested to indicate whether the organisation give personalized agro-advice to farmers using ICT. The responses are shown in the table 4.26.

Table 4.26: Personalized Agro-Advice

Personalized Agro-Advice	Frequency	Valid Percent
Yes	67	65.7%
No	35	34.3%
Total	**102**	**100%**

As shown from the table above, 67 (65.7%) of the respondents agreed that the organisation give personalized agro-advice to farmers using ICT while 35 (34.3%) of the respondents did not. This indicated that the organisation give personalized agro-advice to farmers using ICT, hence the respondents could benefit from agro-advice in relation to agricultural activities.

4.7.4 ICT guideline

The study requested the respondents to state if they had an ICT guideline on how processed information is disseminated to the farmer. The findings are illustrated in the table 4.27.

Table 4.27: ICT guideline

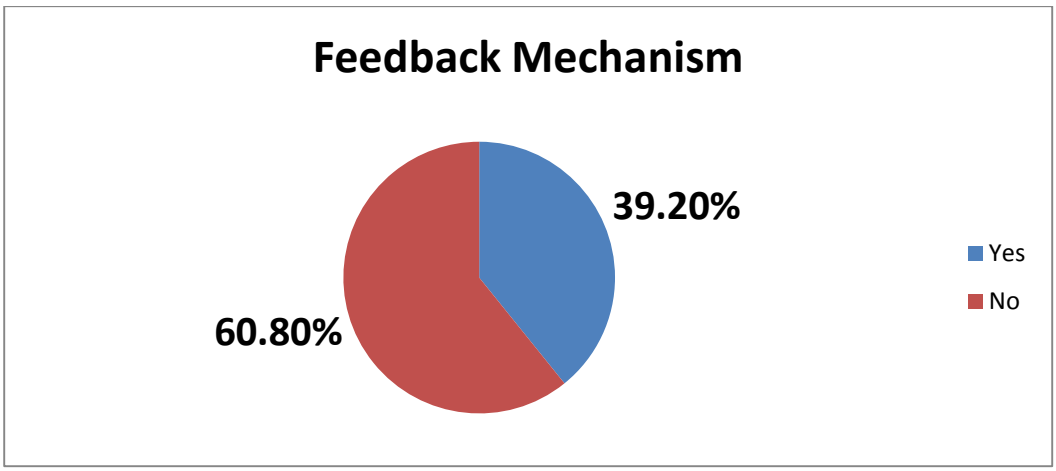
ICT guideline	Frequency	Valid Percent
Yes	20	19.6%
No	82	80.4%
Total	**102**	**100%**

From the findings, majority of the respondents 82 (80.4%) indicated that they did not have an ICT guideline on how processed information is disseminated to the farmer while 20 (19.6%) of the respondents had an ICT guideline on how processed information is disseminated to the farmer. This indicated that the organisation did not have an ICT guideline on how processed information is disseminated to the farmer.

4.7.5 Feedback Mechanism

The respondents were asked if the users had a feedback mechanism. The findings are shown in the table 4.28.

Figure 4.17: Feedback Mechanism



From the table above, majority of the respondents 62 (60.8%) indicated that they did not have a feedback mechanism while 40 (39.2%) of the respondents had a feedback mechanism. This indicated that most respondents in ADC farms had no a feedback mechanism hence had less information clarified in regard to agricultural information.

4.7.6 Response to a Feedback

The respondents were asked how often they responded to feedback. The findings are shown in the table 4.28.

Table 4.28: Response to a Feedback

Response to a Feedback	Frequency	Valid Percent
Daily	30	29.4%
Weekly	6	5.9%
Monthly	10	9.8%
Quarterly	36	35.3%
Annually	20	19.6%
Total	**102**	**100%**

From the findings, majority of the respondents 36 (35.3%) indicated that they quarterly responded to feedback, 30 (29.4%) responded to feedback daily, 20 (19.6%) responded to feedback annually, 10 (9.8%) responded to feedback monthly while 6 (5.9%) responded to feedback weekly.

4.8 Framework Development

Radio and cell phones were most preferred ICT tools for disseminating information to farmers. It can be deduced from the findings that of all the respondents in this study, 48% preferred cell phones and 25.5% radio as most suitable tools of disseminating agricultural information. However, agricultural information delivered by these tools cannot be repeatedly played and rewound by the farmers to satisfy themselves with the details of what they listened to, therefore it can be concluded that the use of radio and cell phones as communication tools in this research might not be suitable on there own.

It was also found out that preference for the use of computers as an ICT tool for disseminating agricultural information was considerably high with a 27.5% of the respondents. Agricultural information dissemination through computers may be a suitable option to be considered in combination with other tools since farmers can save the information for future references.

Although ICT tools, such as computers, mobile phone's and the internet are commonly used around the world, their appropriateness within specific situations and the readiness of potential users to use them posed a lot of challenges in the dissemination of information amongst farmers. From the findings a number of challenges were cited. The absence of a robust feed back mechanism and ICT policy or guideline to streamline the flow of information is a set back in ADC farms operations. At least 34.3% of the respondents are not accustomed to using Computers to access agricultural and 76.5% of the respondents access it occasionally. From the findings the sources of agricultural information were critical to the delivery of information to ADC farms and other farmers in general. From the study, extension officers, government officers and the internet were the main sources. However, from the socio-economic profile, the findings indicated that most of the respondents attained certificate as their highest level of education and majority are aged between 31-50years. The findings also indicated that ADC farms are based mainly in two rural counties whose ICT infrastructure and networks are at infant stage.

4.8.1 The Proposed Framework

The objective of developing the framework was to establish communication between farmers, extension agents, agricultural experts, research centers, and community. The framework ensured that communication between all variables was mutual and information was based on farmers need. Internet, computers and cell phone was used as the devices to transfer the advanced agricultural information to the farming community

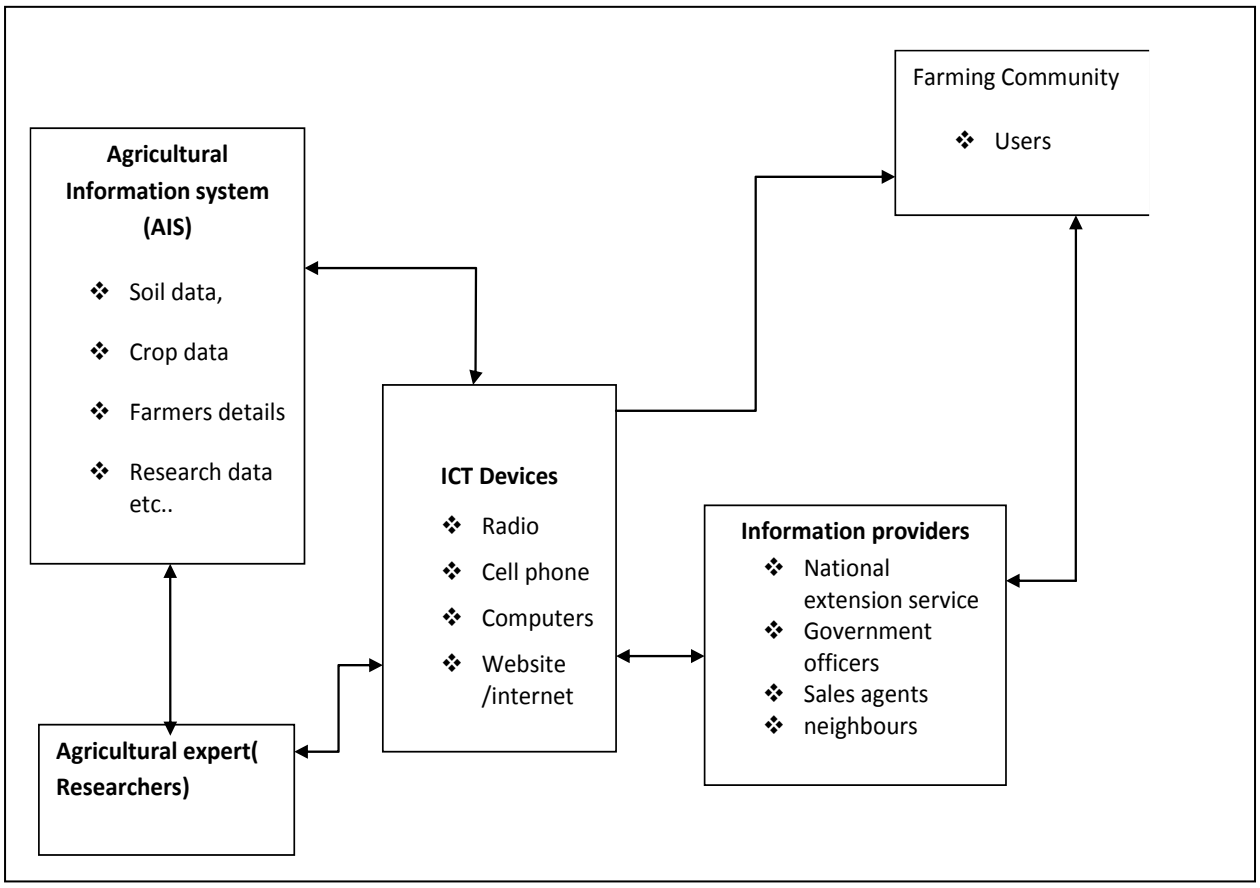


Figure 4.18: ICT framework for Agricultural Information Dissemination (2016)

The proposed framework is made up of five(5) components: that is Agricultural information systems(IAS), Agricultural expert, Agricultural information providers(AIP),ICT channels and users. The dissemination of agricultural information is two way where feedback is essential for the framework to work as shown by figure 4.18

4.8.2 Agricultural Information Systems

This is the repository that contains the much needed information by farmers. It interfaces with the agricultural experts and the ICT tools in the dissemination of specific information

about agricultural inputs, soil data, research data, pests and diseases and information on market prices.

4.8.3 Agricultural Expert

This is the team of agricultural technical experts who should update the AIS, interpret and disseminate the information to the farmers through ICT channels and information providers (extension services) .The agricultural experts answer queries from the farmers.

4.8.4 ICT channels

These are the tools or devices that are used by the farmers ,agricultural experts and providers in the dissemination and exchange of agricultural information amongst themselves. These devices interface between the various groups of stakeholders to deliver the much needed information and at the same time update the information database.

4.8.5 The information providers

These are the people who act as intermediaries between the farmer ,the the agricultural information system and the Agricultural expert in the delivery of agricultural information . For example the extension workers , who are a direct link to farmers can benefit from agricultural and information through the ICT devices.

4.8.6 Users

These are the farmers who use ICT devices (cell phone, computer) for voice based information and data for running their farming operations. The farmer can directly receive information but also sometimes through the information providers who can interpret information for them and advice on its application.

4.9 Description of the relationship between the variables

Correlation Analysis

Spearman's correlation was used to examine if there was any correlation or degree of association between parameters suitable for the establishment of ICT-based framework for adoption in the dissemination of agricultural information among farmers in Kenya. Table 4.29 presents the results.

Table 4.29: Correlation Analysis

Spearman's correlation Coefficient(r)	Agricultural information dissemination	ICT Technologies	Socio-economic characteristics	Agricultural information providers
Agricultural information dissemination	1			
ICT Technologies	0.728**	1		
Socio-economic characteristics	0.490*	0.401*	1	
Agricultural information providers	0.614**	0.537**	0.308	1

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

From the findings, there is a strong positive significant relationship between Agricultural information dissemination and ICT Technologies having a correlation coefficient of 0.728. The findings indicate that ICT technologies like radio, computers and phones disseminate agricultural information well.

The findings also found a strong positive significant relationship between agricultural information providers and agricultural information dissemination having a correlation coefficient of 0.614. The findings indicate that if information has to be disseminated well to farmers, information providers have to be effective and accurate in providing the information in time.

Finally, there exists a positive significant relationship between socio-economic characteristics and agricultural information dissemination with a correlation coefficient of 0.490. The findings indicate that socio- economic characteristics like age help in disseminating agricultural information.

4.10 Validation of the Framework

For the research questions to be answered adequately, the proposed framework was validated by the researcher by conducting a survey using the likert type scale questions and the data analysed using SPSS. The findings revealed that respondents had a positive attitude towards the cell phone, computer and radio as interface for the ICT framework.

Table 4.36: Average Score and Standard Deviation for Computer

Opinion	Mean	Std. Deviation	Evaluation
Has enough storage memory to store information for future reference	3.42	1.120	Agree
Easy to use when trained	2.77	0.411	Agree
Has consistency in the provision of information	3.88	0.850	Agree
Capable of producing both sound and written information	4.21	1.783	Agree
Can be used to access multiple information at the same time	3.39	0.085	Agree

Table 4.31: Average Score and Standard Deviation for Radio

Opinion	**Mean**	**Std. Deviation**	**Evaluation**
Vernacular language	4.70	0.462	Agree
Portability	4.58	0.497	Agree
Affordable /cost	4.42	0.497	Agree
Effective Interaction with the programme presenter through phone	4.73	0.448	Agree
Can perform other duties while listening to the programme	4.33	0.475	Agree
No training is required in accessing	4.50	0.504	Agree

Table 4.32: Average Score and Standard Deviation for Cell phone

Opinion	Mean	Std. Deviation	Evaluation
Its portable	3.78	0.168	Agree
Can receive information without having credit	3.83	0.990	Agree
Can store message for reference	4.51	0.837	Agree
Easy to use	3.85	0.237	Agree
No training is required	4.44	1.700	Agree
Its cost effective	3.88	0.228	Agree

It can be concluded that, the average score in each aspect was to the level of agreement opinion; therefore, it may be assumed that generally participants realized the benefits of using radio, cell phone and computer to receive agricultural information. It can therefore be concluded that generally, respondents were satisfied with this framework. Therefore, this kind of framework was effective in the target respondents' view.

4.11 Discussion of Findings

The study established that in ADC farms where the research was undertaken, ICTs had contributed to agricultural information access and dissemination through generation of agricultural reports, posters and miscellaneous documents, showing live or recorded agriculture programmes, activities, or practices easily viewed through (Television/video, radio, etc), and delivery and receipt of messages (by Internet, mobile) which benefit the farmers irrespective of their geographical location.

Pertaining to farmers information needs, the study established the following needs; availability of agricultural inputs , pest management and control and the results of soil testing, pricing and pricing techniques, modern ways of farming, marketing of products and services, preservation and conservation of products. The research further established information needs keep on changing from time to time as also did strategies to satisfy them.

In ADC farms, the findings showed that ICT devices (e.g. Cell phone 48% & Computer 27.5%) played a critical role in the dissemination of agricultural information with the main aim of increasing Agricultural production by farmers. In this case, ICT devices equipped farmers with necessary knowledge which eventually increased their profitability in production. Farmers easily grasped the ICT applications, acquired information, and jumped into new market opportunities

Numerous challenges that frustrated farmers in accessing and utilizing agricultural information were established. These include, lack ICT skills (Computer illiteracy), inadequate ICT infrastructure such as power and telephones, lack of suitable content at the appropriate level and in a language they comprehend and operate with. Other unavoidable circumstances such as irregular power supply, viruses contributing to constant loss of files or documents.

With proper ICT devices in place, farmers needs shall be met due to good access and utilization of disseminated agricultural information. This will lead to increased efficiency in extension services since databases of relevant information could be kept and new research findings and discoveries relayed to farmers as soon as they are generated. Trainings and demonstrations can also be conducted easily through videos, DVDs and VCDs. The choice of delivery systems of ICT knowledge should be based on what is efficient, effective and not expensive as people should use their resources carefully to derive maximum utility.

The study also established that, good ICT oriented agricultural framework could be adopted in Kenya as per literature review as it is the practise in Asian countries so as to enhance information dissemination. Information access and utilization is crucial in enhancing and developing the adaptive capacities of all economies to adopt new agricultural concepts to improve socio-economic development (Okumu & Obora, 2013). Information should be transmitted to farmers using technologies available in their settings such as rural radios and other community based forums like religious services and gatherings and farmers' field days.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

In line with the general objective of the study, this chapter summarizes the conclusion and recommendations which were arrived at after analysis of the data. It also gives suggestions for further research.

5.1 Summary of Findings

The study was carried out in ADC farms in Transnzoia and Nakuru County. The study found out that, majority of respondents (70.3%) practiced rain fed Agriculture and TV as ICTs device is not used in the course of their work. The study further found out that 64.7% of respondents preferred listening to radio to increase production of their agricultural activities. A large number of respondents in ADC farms listen to radio programs on agriculture regularly.

Furthermore, the study found out that the air time for agricultural information programmes was convenient among respondents in ADC. The study also found that most respondents did not use a TV to access agricultural information in CD/DVDs. It also found that most respondents at ADC farms did not access agricultural information in CD/DVDs using the computer but most respondents in ADC farms had access to agricultural information from their Cell phones. The study revealed that most respondents agreed that there has been an increase in their output and income since they started applying the agricultural information through ICT devices.

On the challenges associated with the dissemination of information through ICT, the study revealed that information explosion as a problem is not encountered in accessing radio agricultural programs. Lack of training in usage of the channel is not a problem they encounter in accessing radio agricultural programs. It found that lack of transfer to other devices for reference is the problems they encounter in surfing the internet for agriculture related information. It found out that information explosion is one of the least challenges they encountered in accessing information from the mobile phone.

The study found that majority of the respondents in ADC farms believe that extension workers, government officers and websites gave accurate information in regard to agricultural activities. Soil improvement was the type of information the respondents wanted to acquire in order to improve their productivity. The positive outcomes that are expected by the respondents as a result of acquired information were higher quality of production and increased amount of productivity. The findings revealed that most respondents valued audio and text as the preferred format that agricultural information should be disseminated in the organisation.. The study also found out that the organisation gave personalized agro-advice to farmers using ICT and the respondents decried the lack of a feedback in relation to queries raised or misunderstood agricultural information required to increase productivity.

In addressing the constraints and challenges faced by farmers in the dissemination of agricultural information, the findings assisted the researcher to develop a framework to be adopted by stake holders to ensure that there is a continued flow of information from the sources through ICT devices to the recipients who happen to be the farmers. The framework is supposed to ensure that feedback from the farmers are delivered to the Agricultural expert and resend back to the recipient to apply. The framework showed how all the variables are communicating to each other and how they are inter-dependent on each other. Thus the proposed framework would bridge the gap to ensure that the collection, storage, processing, transmission and presentation of information in multiple formats met the diverse needs of farmers.

5.2 Conclusion

The study assisted the researcher to answer the research questions and to achieve the overall objectives of the study. However, there should be a concerted effort in rolling out ICT infrastructure to the rural counties and encourage farmers to adopt the use of ICT devices as a way of life.

The study concluded that ICTs were not information themselves although they could provide information about themselves. ICTs played a vital role in the generation of information, processing, keeping information safe until its required for use, retrieval of information and disseminating information in a format that the farmers could access and utilize.

The study concluded that Rain fed Agriculture was mostly practised by the respondents in ADC farms. ICT devices such as cell phone, computer and radio are the devices being used

by farmers in the course of their work despite the low uptake and usage . It was found out that listening to information on agriculture from the radio and other audio channels is well entrenched in ADC farms. The study concluded that most respondents at ADC farms believed that extension workers, government officers and websites gave accurate information in regard to agricultural activities.

The study captured in detail the information needs of the farmers by addressing what they required in the course of normal agricultural activities. It was found out that farmers required information on soil management, pest management, use of fertilizer, weather forecast and financial management tips for mainly improving their productivity. The study concluded that there were positive outcome whenever accurate and timely information is disseminated to the farmer which led to higher quality of production and increase in productivity.

The study found out some constraints and challenges that impacted the dissemination of agricultural information in ADC farms namely; the organisation does not have an ICT guideline on how processed information is disseminated to the farmer, respondents confirmed lack of transfer of information to other devices for reference as a major problem between ICT tools. The study revealed that 82% of respondents mentioned lack of training in the usage of the ICT devices.

The study concluded that the organisation gave personalized agro-advice to farmers using ICT tools, hence the respondents can use it to access any information in relation to agricultural activities. This confirmed the extent to which ICTs have assisted in bridging the gap in the dissemination of agricultural information. Finally, the findings assisted the researcher to come up with the parameters suitable for developing a framework for information dissemination in Kenya.

5.3 Recommendations

The study found out that there was no seamless transfer of information across ICT devices for continuous referencing by respondents in ADC farms. The study recommended that ADC should work towards providing downloadable information that could be saved and shared across ICT devices for future reference.

The study found out that there was no ICT policy guideline (table 4.27) in the organisation to guide the farmers in the dissemination of processed agricultural information. The study

recommended that policy makers should implement an ICT policy framework to assist in agricultural information dissemination and offer a consistent way to data preparation and dissemination to users.

ADC as an organisation needs to improve on the uptake of ICT technology in its operations to increase efficiency and timely operations.

5.4 Suggestions for further Research

The study suggests that further research should be done on why there is low uptake of ICT technology within the rural counties in Kenya and further establish a suitable feed back mechanism to be adopted.

Also come up with a multimodal solution which can assist to interface various ICT devices seamlessly irrespective of geographical location, literacy and language.

REFERENCES

Adetumbi, et al, (2013): Assessment of Use of Selected Information Communication Technologies (ICTs) for Extension Service Delivery: Implication for Agricultural Development in Nigeria. International Journal of Agricultural Management and Development (IJAMAD), 3(2).

Ajit, M. et al (2014): ICTs improving family farming.

Bashir, Y.G.A. (2008):"Assessment of agricultural information needs in African, aribbean & Pacific (acp) states", Eastern Africa: Country Study Sudan, Technical Center for Agricultural and Rural Cooperation (CTA).

Csoto, M. (2011): Towards a new theoretical framework: The dynamics of using ICT for farming purposed

FAO,(2006): Framework on effective rural communication for development

Hansen, J. P. et al(2014):ICT and Social media as drivers for multi-actor innovation in Agriculture

Kalusopa, T. (2005): The challenges of utilizing information communication technologies (ICTs) for the small-scale farmers in Zambia. Library Hi Tech , 414 -424.

Kiplang'at, J. (2004): Diffusion of ICTs in communication of agricultural information among agricultural researchers and extension workers in Kenya.

Kokate, K.D.& Singh, A.K. (2012):Use of mobile technologies for empowering small holder farmers in India

Mittal, S., Gandhi, S., & Tripathi., G. (2010):Socio-economic Impact of Mobile Phones on Indian Agriculture. Indian Council for Research on International Economic Relations, (p. Working Paper 246).

Musa, N. et al (2013): Challenges of using ICTs to disseminate agricultural information to farmers in Sudan.

Olila, P.O. et al(2006):Agricultural policy in Kenya: issues and processes

Orodho, J.A.(2010): Techniques of writing a research proposal and reports on education and Health sciences.

Ommani, A. R. (2005):Information and Communication Technology (ICT) for Agricultural Information Dissemination (policy development of Agricultural Information Dissemination of developing countries)". Dehati Journal (to Persian), Vol. 2 , 18-27.

Okello, J. et al (2014): Determinants of Awareness and Use ICT-based Market Information Services in Developing-Country Agriculture.

Okumu, M. & Obora, M. (2013): Climate Change and the Agricultural Sector: Overview of National and Sectoral Initiatives and Programmes. Ministry of Agriculture, Climate Change Unit. Naivasha, Kenya.

Roberts, J. & Sbihi, N. (2013): Exploring the Memory-Bandwidth Trade off in Information Centric Network. Arxiv Preprint, 1–24.

Rogers, E.M. (2003): Diffusion of innovations (5th Ed.). New York: Free Press.

Rogers, E.M. (1995): Diffusion of Innovations. The Free Press.

Sonnino, A. et al (2009): Socio-economic impacts of non-transgenic biotechnologies in developing countries: The case of plant micro-propagation in Africa. FAO.

Salau E.S. and Saingbe N.D. (2008): Access and Utilization of Information and Communication Technologies (ICTs) among agricultural researchers and extension workers in selected institutions in Nasarawa State of Nigeria PAT 2008; 4 (2): 1-11.

Shaukat, M.R. et al (2013): Farmers inclination to the adoption of mobile phone agricultural information and trade systems in Pakistan

Tantisantisun,K.(2011): Information dissemination for farming communities in Thailand.

UNDP,(2012): The importance of ICTs in the provision of information for improving agricultural productivity and rural incomes in Africa

USAID, (2013): Exploring the promise of ICTs for women farmers in Kenya.

APPENDIX A: QUESTIONNAIRE

Section A: Socio-economic Profile

1. Name of unit/farm----------

2. County----------

3. What is the highest level of education attained? [Tick}

   [ ] Certificate Level [ ] diploma [ ] Degree Level [ ] Master's Degree

   [ ] PhD

4. Gender

   [ ] Male [ ] female

5. Age range (excluding months)

   [ ] below 20 years old [ ] 21 – 30 years old [ ] 31 – 40 years old

   [ ] 41 – 50 years old [ ] 51 – 60 years old [ ] over 61 years old

6. Average income (per month in Kshs.)

   [ ] less than 3000 [ ] 3001 – 5000 [ ] 5001 – 8000

   [ ] 8001 – 10000 [ ] 10001 – 20000 [ ] more than 20000

7. How long have you served in the Corporation?

   [ ] less than 1 year [ ] 2yrs -5yrs

   [ ] 5yrs-10yrs [ ] over 10yrs

8. Which type of agriculture do you practice?

   [ ] Rain fed agriculture [ ] Horticulture

   [ ] Greenhouse irrigation [ ] others specify----------

9. Which of the following crops do you grow? (Select more than one if necessary).

   [ ] Maize [ ] coffee [ ] Wheat [ ] potatoes

[ ] Others specify ……..

10. What livestock species do you keep on the farm?

[ ] Cattle [ ] Goats [ ] Sheep [ ] Pigs

[ ] Others specify ……

11. For how long have you been working for ADC?

[ ] 1 – 5 years [ ] 6-10 years [ ] 11-15 years [ ] above 15 years

Part B: ICT Channels for information dissemination

12. What ICTs do you use in the course of your work? [Tick]

[ ] Computer [ ] Telephone [ ] Cell phone [ ] Radio [ ] TV

[ ] Internet [ ] All the above

13. Based on your experience which ICT tool below would you rate as best for disseminating information to farmer(s)? [Tick]

[ ] Computer [ ] Telephone [ ] Cell phone [ ] Radio [ ] TV [ ] others

14. What ICT platform below would you recommend as most suitable as a source of agricultural information? [Tick]

[ ] Radio [ ] Television [ ] CD/DVD [ ] SMS [ ] Website [ ] Web Portal [ ] Email [ ] Instant Mail (chat)

15. Do you have access to a radio?

[ ] Yes [ ] No

16. Do you listen to information on agriculture from the radio?

[ ] Yes [ ] No

If yes, in which language does the channel you listen to disseminate the information?

---

17. Why do you prefer to listen to the radio? (Select more than one if necessary).

[ ] Vernacular Language

[ ] Portability

[ ] Affordable/cost

[ ] Effective Interaction with programme' presenters through phone

[ ] Can perform other duties while I listen to programs

[ ] No training is required in accessing

[ ] Others specify ……..

18. How often does the radio present programs on agriculture that you listen to?

[ ] Regularly [ ] Occasionally [ ] Rarely [ ] Never

19. Do you think the air time for agricultural information programmes is convenient?

[ ] Yes [ ] No

If not what suggestion can you make for adequate time?

……

20. Do you have access to a TV?

[ ] Yes [ ] No

21. Do you watch agricultural programmes on TV?

[ ] Yes [ ] No

If yes, how often do you watch agricultural programmes?

[ ] Regularly [ ] Occasionally [ ] Rarely [ ] Never

22. Why do you prefer to watch agricultural programmes on TV

[ ] TV is Audio visual [ ] TV is Interesting to watch

[ ] Due to the languages TV present information [ ] Demonstration

[ ] Others specify ……..

23. Do you use the TV to access agricultural information in CD/DVDs?

    [ ] Yes [ ] No

    If not why?

    [ ] I am not aware of CD/DVDs that contain agricultural information

    [ ] I cannot afford to buy CDs or DVDs

    [ ] I do not have a DVD Player

    [ ] There are no CDs/DVDs in the market with agricultural information

    [ ] Others specify ……

24. Do you use the computer to access agricultural information?

    [ ] Yes [ ] No

    If yes how often?

    [ ] Regularly [ ] Occasionally [ ] Rarely [ ] Never

25. What is the average number of hours per week do you spend surfing the internet……

26. Why do you prefer information from the internet?

    [ ] I can download

    [ ] I can print

    [ ] I can repeat to understand

    [ ] I can access information from the internet any time I want

    [ ] There is vast information from the internet

    [ ] I can select information that is relevant

    [ ] Others specify ……

27. Do you use the computer to access agricultural information in CD/DVDs?

[ ] Yes [ ] No

If not why?

[ ] I am not aware of CD/DVDs contain agricultural information

[ ] I cannot afford to buy CDs or DVDs

[ ] Others specify …….

28. Do you own a mobile phone?

[ ] Yes [ ] No

29. Do you access agricultural information from your mobile phone?

[ ] Yes [ ] No

If yes, how often?

[ ] Regularly [ ] Occasionally [ ] Rarely [ ] Never

If not, what do you use your mobile phone for?

[ ] Communicating with friends

[ ] Charting

[ ] Surfing information other than agricultural information

[ ] Money transactions

[ ] Others specify ……

30. Have you put the agricultural information you get into practice?

[ ] Yes [ ] No

If not why?

…….

If yes, what changes have occurred in your output and income since you started applying the agricultural information?

[ ] Increased [ ] No change [ ] Decreased

Part C: Challenges associated with the dissemination of information through ICT

31. What problems do you encounter in accessing radio agricultural programs? (pick more than one where necessary).

    [ ] Unfavourable airtime schedule

    [ ] Use of difficult terms

    [ ] Lack of transfer to other devices for reference

    [ ] I have no control over the program during its presentation

    [ ] The channel is not audio visual

    [ ] Lack of training in usage of the channel

    [ ] Battery needs constant charging

    [ ] Information explosion

    [ ] Power blackouts

    [ ] Others specify …….

32. What problems do you encounter in watching TV agricultural programs (pick more than one where necessary).

    [ ] Unfavourable airtime schedule

    [ ] Use of difficult terms

    [ ] Lack of transfer to other devices for reference

    [ ] I have no control over the program during its presentation

    [ ] The channel is not audio visual

    [ ] Lack of training in usage of the channel

    [ ] Battery needs constant charging

[ ] Information explosion

[ ] Power blackouts

[ ] Others specify ……

33. What problems do you encounter in surfing the internet for agriculture related information? (Pick more than one where necessary).

[ ] Unfavourable airtime schedule

[ ] Use of difficult terms

[ ] Lack of transfer to other devices for reference

[ ] I have no control over the program during its presentation

[ ] The channel is not audio visual

[ ] Lack of training in usage of the channel

[ ] Battery needs constant charging

[ ] Information explosion

[ ] Power blackouts

[ ] Others specify …….

34. What problems do you find in accessing information from the mobile phone? (pick more than one where necessary).

Unfavourable airtime schedule

Use of difficult terms

Lack of transfer to other devices for reference

[ ] I have no control over the program during its presentation

[ ] The channel is not audio visual

[ ] Lack of training in usage of the channel

[ ] Battery needs constant charging

[ ] Information explosion

[ ] Power blackouts

[ ] Others specify …….

Part D: Data related to the utilization of ICT tools in agricultural sector

35. Do you believe the following sources give you accurate information?

    Please fill in the following table for each source of information.

Information source	Strongly believe	believe	neutral	Strongly disbelieve
Neighbours				
Extension workers				
Government officers				
Websites				
Sales agents				

36. What type of information would you like to acquire in order to improve your productivity? (Can make more than 1 choice)

    [ ] pest management [ ] use of fertilizer [ ] soil improvement [ ] market price

    [ ] use of insecticide [ ] weather forecast [ ] financial management

    [ ] others (please specify)……....

37. Which positive outcomes have resulted from the information you have received from these providers? (Please tick any that apply.)

    [ ] increasing amount of productivity [ ] higher quality of productivity

    [ ] lower cost [ ] higher selling price [ ] others (please specify)……

38. Which negative outcomes have resulted from the information you have received from these providers? (Please tick any that apply.)

[ ] failure of productivity [ ] higher cost but lower productivity

[ ] low selling price [ ] complicated processes

[ ] no follow-up process to stimulate the success

Others (please specify)……....

Part E: Data and Information Dissemination

39. In what format is agricultural information disseminated in your organisation? [Tick]

    [ ] Text [ ] Image [ ] Video [ ] Audio [ ] All the above

40. What format below is most preferred by farmers? [Tick]

    [ ] Text [ ] Image [ ] Video [ ] Audio

41. Does your organisation give personalized agro-advice to farmers using ICT? [Tick]

    [ ] Yes [ ] No [ ] Don‘t know

42. Do you have an ICT guideline on how processed information is disseminated to the farmer?[Tick]

    [ ] Yes [ ] No [ ] Don‘t Know

43. Do users have a feedback mechanism? [Tick]

    [ ] Yes [ ] No [ ] Don‘t know

44. How often do you respond to the feedback? [Tick all applicable]

    [ ] Daily [ ] Weekly [ ] Monthly [ ] Quarterly [ ] Annually

    [ ] Other……