USE OF ICT TOOLS BY ONION FARMER'S IN ACCESSING AGRICULTURAL EXTENSION INFROMATION.

A CASE STUDY OF HARUGONGO SUB-COUNTY, KABAROLE DISTRICT

BUSINGE RICHARD

2015-M302-20022

MARCH, 2018

The use of ICT tools by onion farmers in accessing Agricultural Extension Information

A Case Study Harugongo Sub county, Kabarole District

A Postgraduate dissertation

Presented to

Faculty of Agriculture

in partial fulfillment of the requirement for

The Award of the Degree of

Master of Science in Monitoring and Evaluation

Uganda Martyrs University

Businge Richard

2015-M302-20022

March, 2018

Dedication

I dedicate this work to my dear Mum Immaculate Kato Nasejje, my wife Teopista Kemigisa, and my children, Mujuni Sebastian Stephen, Komujuni Revokate, Mucunguzi Adrian, Businge Ponsiano and my grandfather the late Damiano Daaki (R.I.P); my brothers: Mugarra Innocent, Mujuni John and Musinguzi David and relatives for the love, care and strong emotional and constant encouragement and, most especially my wife for her long patience that helped me remain focused throughout the study period.

I further dedicate it to my colleagues the Nsambya Group international namely; Peter Olanya, Kibathi Peter, Jimmy Ssempuuma, Ivan Bakka, Lubanga Stephen and Denith Tunwinomugisha for all the support they gave to me. May the Lord reward you abundantly!

Above all I thank God, the Almighty, for the wisdom and strength that he has given me to accomplish this work.

Acknowledgements

My heartfelt gratitude go to my supervisor, Associate Professor Zaake, for his sterling guidance and friendly support during the writing of this thesis. His encouragement and thoughtful comments made this work a success.

Special thanks go to the farmers of Harugongo and the Kabarole District Agricultural officer for their willingness and co-operation during data collection.

Above all, I give glory to the Almighty God for giving me strength and endurance throughout the study period.

Table of Contents

List of Tables

List of Figures

List of Equations

List of Abbreviations

UBOS	Uganda Bureau of Statistics
NAADS	National Agricultural Advisory
TAM	Technology Acceptance Model
FAO	Food and Agricultural Organization
ICT	Information Communication Technology
TV	Television
SMS	Service Messages
CD	Compact Disc
IFPRI	International Food Policy Research Institute
FM	Frequency Modulation
CBS	Central Broadcasting Services
KRC	Kabarole Research Centre
IICD	International Institute of Communication Development
NALEP	National Agriculture and Livestock Extension Program
WAP	Wireless Application Protocol
PDA	Personal Digital Assistance
VPP	Village Phone Program
PIWA	Panos Institute of West Africa

Abstract

In many developing countries, rural populations are heavily dependent on agriculture as well as different social services for their livelihoods. Just like any other developing country, in Uganda over 80 percent of people living in rural areas largely depend on Agriculture as their main source of income (Gollin & Rogerson, 2010); And yet Uganda's Agricultural sector is continuously facing numerous challenges as well as constraints in the application and use of ICT tools to access 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 to farmers.

This study assessed the use of ICT tools by farmers to access agricultural extension information, where access was measured in the capacity of a farmer being able to utilize ICT tools to search or seek Agricultural extension information. Specifically, the study focused on determining the readily available ICT tools, how well the available ICT tools are being used to access agricultural extension information and determined the farmers' socio-economic characteristics that influence use of ICT tools. The sample population for the study was drawn from Harugongo Sub county, Kabarole District.

The research was a case study design, both quantitative and qualitative approaches were used with a total 144 onion farmer participant involved in the study and 3 agricultural officers from the district. Two approaches of data collection were employed which included; questionnaire which was the main instrument with closed and open-ended questions and key informant interviews. Completeness and consistency of the collected data was done by review of the completed questionnaires. Coding and analysis of the collected data was done using R software and the findings presented using tables, charts and graphs with their respective interpretation. Ethical issues of getting consent, protecting participant from harm, and confidentiality were considered.

It was found out that 66% of respondents possessed mobile phones and 76% radios while 6% Television which is less owned. The data showed that most farmers occasionally use ICT tools to access agricultural information and the most used ICT tool was a mobile phone(70%), which is mainly used for communication through consulting fellow farmers on farming issues. However, farmers mentioned that they struggle to know where (source) to access agricultural information. Respondents mentioned that ICTs such as radio tend to share agricultural programs at wrong hours of the day which affected farmers attention to access training programs. The results revealed most radios and messages received through text on phones mainly talk about input prices for seeds and who is offering the best price of inputs, leaving out the most relevant information such as use of fertilizers.

The social economic factors that were found to have a positive influence on use of ICT tools include; Education, training in use of ICT tools, on farm income, access to agricultural loans, while Age, Nearest market distance from home and Household size had a negative influence on use of ICT tools to access agricultural information. Based on the findings, it is recommended that the socio-economic characteristics of the farmers should be considered when planning for different programs that involve ICTs in provision of agricultural information. The district extension system should focus on sensitizing farmers about the sources of information, training how to use ICT tools and design radio programs that are aired at the right time for farmers to listen in.

CHAPTER ONE: GENERAL INTRODUCTION

1.0 Introduction

This chapter consists of the background to the study, problem statement, purpose of the study, study objectives, research questions, scope of the study, significance of the study, operational definitions of key terms and conceptual framework

1.1 Background to the Study

Historical perspective

In many developing countries, rural populations are heavily dependent on agriculture as well as different social services for their livelihoods. Yet, access to adequate knowledge, improved technologies, financial services and other relevant social services remains a critical issue (FAO, 2014). Just like any other developing country, in Uganda over 80 percent of the households and 85 percent of the people living in rural areas largely depend on Agriculture as their main source of income (Gollin & Rogerson, 2010). Uganda's Agricultural sector is continuously being confronted with challenges of decreasing production amidst a rapidly growing population (35 million people (UBOS,2014). Furthermore, there is a decrease in availability of natural resources like water, declining soil fertility, effects of drastic climate change and outbreak of pests and diseases.

According to a study by Deloitte (2012), Agricultural information can be one of the most important factors of production and therefore an effective integration of information and communication technologies (ICTs) in the agricultural sector can lead to sustainable agriculture by providing timely and relevant agricultural information, which will enable farmers make informed decisions on farming to increase productivity. According to Baryamureeba (2004), ICT are broadly defined

as tools that enable, electronically the creation, storage, management and dissemination of information. Information and communication have always mattered in agriculture and farmers have always sought information from each other. For example, farmers can seek information to answer questions such as, sources of improved seeds, how to use pesticides, among other issues. World Bank (2012), asserts that farmers do not usually get appropriate answers to questions arising from their concerns, even though the same issues arise season after season.

Agriculture in Kabarole District

Kabarole district is one of the rural districts located in central - western part of the Western Region of Uganda, with a population of 474,216 where 74% (352,623) is rural (UBOS, 2014) and 80% of the people in the district earn a living from agriculture. The District has two counties, one municipal, 15 sub counties and 4 town councils. Subsistence farming is the main source of livelihood for the rural areas of Kabarole and in the urban area, backyard farming is practiced to supplement incomes. Crops grown in the district include tea, coffee, cassava, bananas, vegetables including onions, tomatoes, and greens (District Development Plan, 2015/2016). Women play a major role in agriculture and horticulture farming is one of the main income generating activity done by youth and women. Harugongo as the target sub county for the study is one of the main producers of horticulture products like onion, green paper, cabbages which are the main value chains that engage women (District Annual report, 2016).

Information Communication Technologies in Kabarole District

Kabarole district has a total of 7radio stations and 61% of householders own a radio (District Development plan 2015/2016). The districts has access to four pay television broadcasting services and 60% of the people have access to mobile phones (District Development Plan, 2015/2016). Even with the increase in ICT options to support agricultural communication, the farmers in Harugongo still face multitude of challenges accessing agricultural information partly due to reasons that have not been well documented.

Extension Services in Kabarole District

Kabarole district has 10 Agricultural officers who are being supported by the Wealth Creation officials to manage the extensional services in the District. The district extension officers are expected to play a key role in brokering between communication technologies and the farmer groups they serve. In this role, they are expected to examine the appropriateness of various ICTs and their accessibility to the farming community. Despite the availability of a wide range of ICTs in the district, the district extension services have been using traditional extension methods that rely on knowledge transfer through home visits, demonstration and small group trainings. In addition, due to the governments, restructuring process of the NAADS programs to involve the Army this has affected the number of extension workers while the number of farmers who demand extension services is increasing, hence the need to access how ICTs are being used in disseminating agricultural extension information.

Theoretical Perspective

The theoretical approach informing this study was drawn from two theories: (1) Consumer-based E-tax Adoption Model and theories and practices of development communication.

The Consumer-based E-tax Adoption Model developed by Elizabeth *et al*. (2012). This theory was developed in Uganda's context and extends TAM (Technology Acceptance Model) after conducting a field study to define the Uganda's context of e-tax use. Apart from the four factors established in TAM: perceived usefulness, perceived ease of use, attitude towards using and behavioral intention to use, the new model added three additional theoretical constructs: Cognitive factors (training, user support, awareness, accessibility and use of local language), social factors (trust, benefits and attitudes) and other factors (education, compatibility). Just like for accessing agricultural information, farmers need to be aware of the sources of agriculture information for them to be able to utilize the ICT tools to access agricultural information.

The study also employed the theories and practices of development communication. Development communication is the utilization of existing communication tools and applicable theories for result-driven strategies for the advancement of society (FAO, 2000). Development communication can also be defined as purposive communication intended for a specific target audience that allows for translation of information into action resulting in a higher quality of life (Mazammel, 2012). By using ICTs, players in the agricultural value chain can be targeted with specific messages and/or innovations that aim at increasing agricultural productivity. Just like in this study, farmers need to be targeted with messages that are relevant to their value chains.

Conceptual Perspective

Anderson and Feder (2007), define agricultural extension as the "delivery of information inputs to farmers", and refer to a form of education that introduces new knowledge and technology to farmers. Anderson (2006), goes ahead to assert that agricultural extension or agricultural advisory services refer to the entire set of organizations that support and facilitate people engaged in agricultural production to solve problems and to obtain information, skills and technologies to improve their livelihoods. While Alenea *et al*. (2016) asserted that agricultural extension information are the various sets of information and messages that are relevant to agricultural activities such as market information, agricultural emergency assistance, agricultural consultations and agricultural practice. In this study, the definition of Alenea *et al*. (2007) will be adopted for the study and agricultural extension information will be characterized by input market information, output market information and agricultural emergency assistance information which will focus mainly on disease and pest management information. However, looking at the definition of the extension services suggested by Anderson (2008) it is important to note that the field of 'extension' encompasses a wider range of communication and learning activities that require a medium of communication which may include ICTs. According to Food and Agriculture Organizations Information Communication Technologies (ICTs) are being seen as potential tools for effective information dissemination channel that facilitates sustainable relationships between farmers and other stakeholders in agriculture sector

Agricultural Extension information needs of rural farmers in Kabarole

Ozowa, (1995), asserts that no one can categorically claim to know all the information needs of farmers, especially in an information dependent sector like agriculture where there are new and rather complex problems facing farmers every day. Literature reveals that information needs of the rural communities just like in Kabarole are issues to deal with food production, food marketing and food utilization. According to Ozowa, (1995) information needs by farmers may be grouped into five headings: agricultural inputs; extension education; agricultural technology; agricultural credit; and marketing. Just like Ozow, (1995) asserts, in Kabarole district, the most expensive input for improved onion farming is adequate and access to knowledge and information in areas of new agricultural technologies, early warning systems (drought, pests, diseases etc), improved seedlings, fertilizer, credit, market prices etc. Farmers in Kabarole district are not harvesting and earning optimally from onion farming, probably due to some constraints that lead to lack of access to timely and up-to-date information, which would have enabled them to achieve optimal yield from their farmlands. Such information is highly desired by farmers and can only be made available to them via extension workers, community libraries, ICTs, state and local government agricultural agencies as well as the World Wide Web (WWW) which cannot easily be accessed by famers.

Kabarole district has a total of 7 radio stations and 61% of householders own a radio (District Development plan 2015/2016). The districts have access to four pay television broadcasting services and 60% of the people have access to mobile phones (District Development Plan, 2015/2016). Through wealth creation program me, the government put in place measures like extension officers to train, distribute quality seeds to farmers and Agricultural information, but all this is yielding less results towards empowering farmers.

1.2 Problem Statement

Despite the availability of many ICT tools in Kabarole district, farmers and more especially onion farmers still face multitude of challenges in accessing relevant agricultural extension information leading to limited knowledge on best agronomic practices, input prices, output prices and weather forecasts information. More than 80% of onion farmers still employ poor agronomic practices and lack access to inputs of high quality as well as outputs market information (District Development plan 2015/2016). As result, this prompted the researcher to assess the use of ICT tools among onion farmers in accessing agricultural extension information in Kabarole district taking Harugongo as the case study and ultimately to evaluate the contribution of ICTs towards improving agronomic practices.

1.3 Objective of the study

1.3.1 Major Objective

The general objective of this study was to examine the use of ICT tools by onion farmers' in accessing agricultural extension information.

1.3.2 Specific objectives

- To find out the information communication tools (ICTs) readily available to use in accessing agricultural extension information by onion farmers in Harugongo sub county
- To evaluate how well the available ICTs are being used to access agricultural extension information.
- To determine the social- economic factors influencing the use of ICT tools in access agricultural extension information by onion farmers at Harugongo Sub county.

1.4 Research Questions

The study was guided by the following research questions to achieve the above objectives

i) What ICT tools are readily available to use in accessing agricultural extension information by onion farmers at Harugongo sub county, Kabarole district?

ii) How well are the available ICT tools being used to access agricultural extension information at Harugongo sub-county?

iii) What are the social- economic factors influencing the use of ICT among onion farmers to access agricultural information in Harugongo sub county?

1.5. Scope of the study

Geographical scope

The study was carried out in Harugongo Sub county, Kabarole district, Western Uganda. Harugongo sub county is a newly created sub county in Kabarole district curved out of Kichwmba sub county (Local Government Budget Frame Worker Paper, Vote 513, Kabarole District, 2016/2017). The main economic activity of the people of Harugongo is farming focusing mainly on crop farming and cattle keeping. Youth and women in the sub county practices horticulture farming as their main source of income (Local Government Budget Frame Worker Paper, Vote 513, Kabarole District, 2016/2017). Kabarole District is bordered by Ntoroko District to the north, Kibaale District to the northeast, Kyenjojo District to the east, Kamwenge District to the southeast, Kasese District to the south, the Democratic Republic of the Congo to the southwest and Bundibugyo District, across the Rwenzori Mountains to the west. Fort Portal, the 'chief town' in the district, lies approximately 320 kilometers (200 mi), by road, west of Kampala, the capital city of Uganda. The coordinates of the district are: 00 36N, 30 18E (Latitude: 0.6000; Longitude:30.3000). (UBOS, 2014).

Content scope

The study focused on determining the information communication tools (ICTs) readily available for farmers to use in accessing agricultural extension information, evaluated how the available ICT tools are being used to access agricultural extension information as well as determining the key social economic factors that influence the farmers' use of ICT tools to access agricultural extension information. The study dealt with only onion farmers who were either ICT users or non-users, while focusing on three ICT tools; Radio, TV and Mobile phones. Agricultural extension officers who are the direct link between farmers and other actors in the agricultural knowledge and information system were also involved in the study.

Time scope

In order to understand the use of ICT tools and their contribution in accessing agricultural information to farmers, the researcher studied a ten-year period of time data, from 2007 to 2017. This period was long enough to give a comprehensive historical and present scan of the study area.

1.6 Significance of the study

The study findings can be utilized by the district agricultural office and the ministry of agriculture, to re-think of ways to establish information portals that can be accessed by farmers, to act as sources of information or knowledge sharing, since farmers mentioned not knowing where to access agricultural extension information. The finds can also be utilized by the ministry of agricultural, to rethink its policy on how extension services are provided by integrating use of ICT in delivery of extension services. Academically the study facilitated the researcher gain knowledge

and skills in issues related to ICT utilization by farmers and understanding the art of modeling to understand how rural communities can adopt new technologies.

1.7 Justification of the Study

The study is expected to contribute to the advancement of knowledge to farmers for better farming practices. Appropriate development and implementations of ICT agriculture communication sources and channels will be looked at. The study will accelerate adoption of agriculture technology based on the findings. This will be made possible by improving dissemination and access of ICT agricultural based information in Kabalore district.

1.8 Operational Definition of Key Terms

Agriculture is defined as the production, processing and distribution of food, fish, forest products and fiber. It is the sector from which most of the rural poor derive their income (Richardson, 2006).

A mobile phone is a wireless handheld device that allows users to make calls and send text messages, among other features.

Agricultural extension is a service or system which assists farmers through educational procedures in improving farming methods and techniques, increasing production efficiency and income, bettering their levels of living and lifting the social and educational standards of rural life (Maunder, 1973)

Communication channel: Medium through which a message is transmitted to the intended audience. Examples in this study are the radio, television and mobile phones

Farmers: People that produce agricultural products from controlled use of characteristic plants

and animals through use of resources like land, labour, physical and human capital

Information: Externalized and accessible knowledge that is channeled to farmers to enable them make decisions on their farming businesses.

Information Communication Tools: Any electronic device that is capable of accessing, storing, manipulating, retrieving and transferring information in a digital format. In agriculture, the commonly used ICTs are radios, televisions, computers, mobile phones and the internet.

Information Communication Technology refers to the convergence of audio-visual and telephone networks with computer networks through a single cabling or link system. **http://www.igi-global.com/dictionary/technology-acceptance-model-tam/29485**

Television or **TV** is a telecommunication medium used for transmitting moving images in monochrome (black-and-white), or in color, and in two or three dimensions and sound.

Radio is the technology of using radio waves to carry information, such as sound, by systematically modulating property of electromagnetic energy waves transmitted through space, such as their amplitude, frequency, phase, or pulse width.

1.9 Conceptual framework.

Independent variables

Dependent variables

Social economic factors

- Age
- Gender
- On farm Income

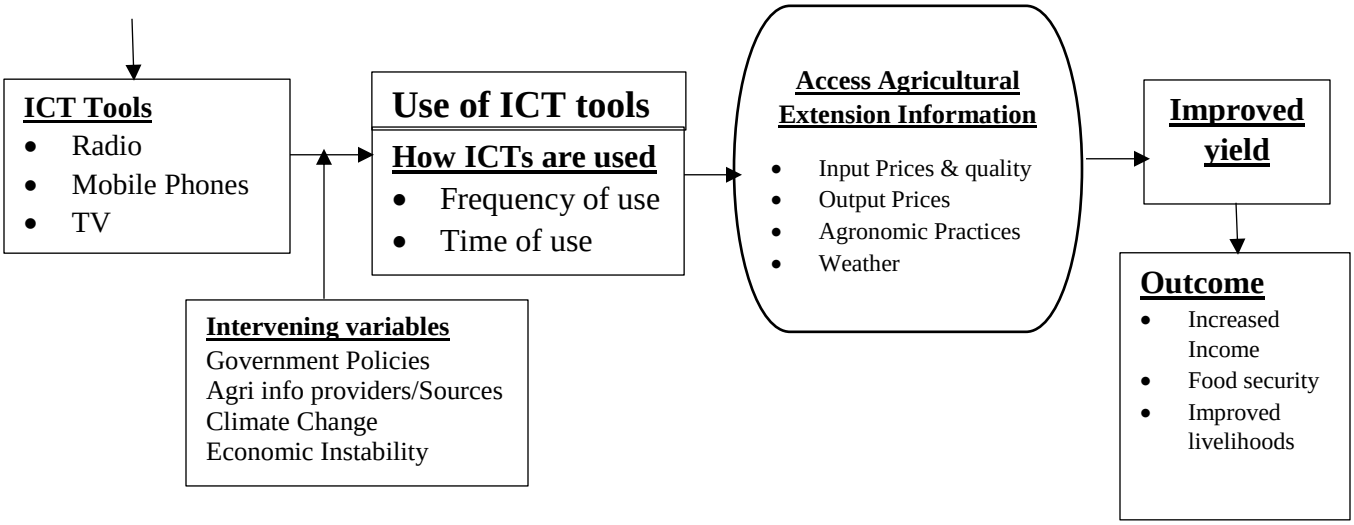

Figure 1. Conceptual Framework.

Source: **Developed by the researcher (2017)**

The dependent variable in this study was use of ICT tools to access agricultural extension information. Use of ICT tools meant a farmer being active in utilizing the ICT tools to search or get agricultural extension information such as; output Market information, among others.

The independent variables of the study are social economic factors influencing use of ICT tools in accessing Agricultural extension information. The conceptual framework shows the relationship between the dependent, independent variables and the intervening variables. The entire conceptual frame was represented by the model; Y **(Use of ICT tools) = $Bx_1 + \beta X_2 + \ldots + \beta X_n$, where X_n are the social economic and institutional factors influencing use of ICTs**

CHAPTER TWO: LITERATURE REVIEW

2.0 Introduction

This chapter presents the review of the literature related to the study from the previous studies carried out by various scholars. Theoretical perspectives related to this topic have also been reviewed and presented in this chapter. Review was also made on the study variables the influence use of ICT tools to access agricultural extension information.

2.1 Theoretical perspective of the study

The theoretical approach informing this study was drawn from two theories: (1) Consumer-based E-tax Adoption Model and Theories and Practices of Development Communication.

During the use of the e tax model in Uganda, some of the key findings of the model pointed to lack of awareness as limiting e-tax adoption in Uganda. Elizabeth *et al.*, (2012), asserts that in the early stages of implementation, awareness contributes to a willingness to adopt new technologies. Just like in this study, if farmers are not aware of the where to access agricultural information and how to use the ICT tools, even if they have ICT tools such as phones, TVs or radios, they will not have access to agricultural information. Accessibility is an important method of building useful user-centered e-government services (Elizabeth *et al.*, 2012). Like Elizabeth *et al.*, (2012), asserts, it can be stated if farmers have nowhere to access agricultural information, even with them having radio and TVs ICTs which do provide information, it yields less value to supporting farmers accessing a agricultural information. According to Kabazo *et al.*, (2012), 90% of the FM radio stations in Uganda tend to play music all the time with limited slots for development information such as Agriculture. I would concur with the research in sense that such practices do not promote

defined or structured programs on radios to creates awareness about the existence of development programs which farmers can follow to know when and at what time they are being aired.

In the E-Tax model, training was another element stressed as one of the factors that led to adoption of e tax system; and in the literature, Elizabeth *et al.,* (2012),) asserts that Training involves identifying the training needs, setting objectives for the training, designing training program, identifying users who need the training, conducting the training with follow-up. Like in this study farmers need to be trained how to use ICT tools, followed up by extension workers to inform them about the potentials sources of the right farming information, as well as taking time to understand the real information needs of farmers in order to harness the opportunities of ICTs. Currently in Uganda, farmers can access agricultural extension information through use of their mobile phones on platforms such as WEFARM (https://wefarm.org/) which gives farmers an opportunity to share information on best agronomic practices and provide opportunities for peer to peer consultations.

2.1.1. Relevancy and applicability of the theory

The e tax model was relevant to this study due its tested Ugandan context. In the model Elizabeth, *et al*., (2012), asserts that for ordinary citizens to recognize the value of the new technology, its potential utility must be known and in a similar way, for farmers to utilize ICT tools to access agricultural extension information, the ministry of agricultural or private sector players need to create awareness about how the ICTs tools can be utilized to access agricultural information without necessarily having to wait for agricultural extension officers.

In the e tax model, Elizabeth *et al*., (2012), goes ahead to assert that for e-government services to be adopted in Uganda, consumers must access computers, the internet, training, user support and specific e-government service software. Like Elizabeth *et al.,* (2012), suggests, for farmers to

adopt utilization of ICT tools to access agriculture extension information, extension officers need to guide or train farmers how to use mobile phones to access portals that have agricultural information. Radio stations need to have a deliberate effort to design programs that talk about agriculture and the programs must run at appropriate times that favor farmers time off the field. Below is the e-tax model that guided the study.

The E-tax adoption model

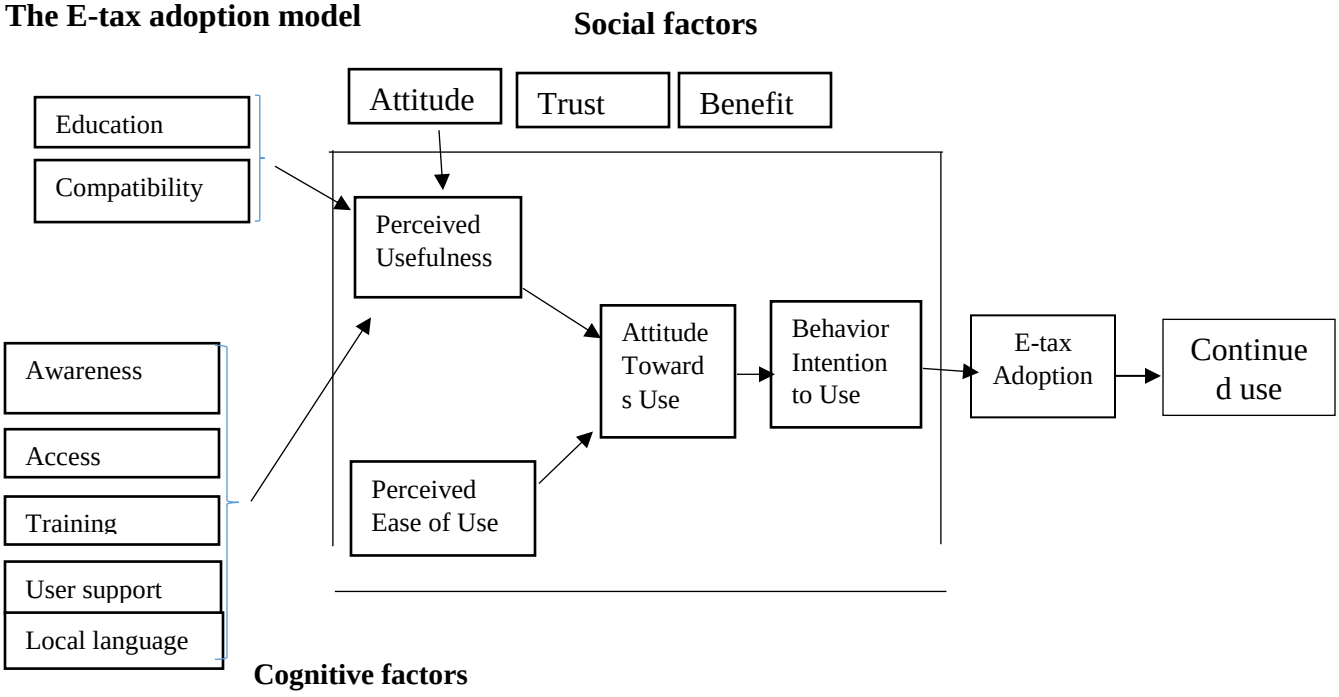

Figure 2. Theoretical Perspective Model

The above E-TAX model comes from the TAM model and consists of the three theoretical constructs that were added to the TAM model. The three constructs include; Social factors construct and cognitive factors construct. Putting e-tax adoption model into the context of the study, the constructs will guide the study in the following ways;

Cognitive factors;

Awareness: Is the state or ability to perceive, to feel, or to be conscious of events and objects. Like in this study awareness was all about farmers being able to know that they can use their tools

to access agricultural information and knowing sources from which the get agricultural information. According to Elizabeth *et al.,* (2012), they assert that in the early stages of implementing, awareness contributes to a willingness to adopt new technologies.

Accessibility: Likewise, in this study, for farmers to appropriately utilize the ICTs, Agricultural programs on Radios, TVs need to be organized and aired in time that are most convenient for farmers to listen in, thus making them accessible.

Training: Like in this study famers need to be guided how use the ICTs tools to access agricultural information.

Local language: Elizabeth asserts that the language of content:(both English and local language) eases the complexity of use of e-Government services such as websites and other e-applications and therefore, impacts positively on Perceived Ease of Use. Therefore, like in the study the agricultural information shared on radios, TVs and Phones should be relevant and in local language to support utilization of the information.

Also in theories and practices of development communication assert that development communication is the utilization of existing communication tools to pass on information to the intended audience (FAO, 2000). By using existing ICTs, players in the agricultural value chain can be targeted with specific messages and/or innovations that are aimed at increasing agricultural productivity.

2.2. Review of the main Concepts of the Study

2.2.1 Information and Communication Technology

Information Communication Technologies (ICTs) encompass a range of electronic technologies that facilitate the production, storage and exchange of information. Though a distinction is often made between new ICTs such as computers, Internet and mobile phones and older ICTs such as newspapers, radio, television and landline telephony. The new ICTs are known for their digital transmission mechanisms, greater interactivity, wider geographical coverage, cost-effectiveness, and availability on a 24/7 basis. Indeed, most literature seems not to put a difference between digital ICTs and traditional ICTs as well as the integration of traditional ICTs into digital technologies. For instance, in recent times, most mobile phones being manufactured come with radio functionality, making them different from the traditional ICTs.

According to Karen (2013), the term "ICT" has been around since the 1980s, when it was popularized in the United Kingdom. Karen (2013), stresses that ICT is different from information technology (IT) because it emphases the role of communications and the integration of telecommunications networks and computer networks. The communications component is critical when designing and delivering technology that is meant to widen dissemination among communities, deepen understanding for individuals and increase democratization of information which allows more people to provide and access information. Karen (2013), goes ahead to urge that to design an effective ICT strategy requires a thorough understanding of the functions of agricultural extension. It is at this point that I agree with Karen (2012), that the Governments need to understand the how the functions of agricultural extension can be integrated in modern technologies for farmers to utilize the information.

According to Bell *et al*., (2011), the functions of extension are to: link farmers to markets; raise general awareness of opportunities; provide technical information, demonstrate or train; diagnose problems and recommend solutions; respond to follow-up questions raised by clients/farmers; provide mass advisories; facilitate access to credit and inputs; assist with business planning; and conduct surveys, monitoring and evaluation, and enumerations. Karen (2012), points out that those functions require different ICT strategies and options. For instance, providing technical information requires there to exist a knowledgeable entity such as an NGO, extension office, private partner) to create both written and video information that can be delivered on demand through SMS, CDs or Internet to farmers. I would like to concur with the research, in that the ministry of Agriculture should take the initiate to avail farmers with the information they need using the most appropriate tools available, like establish farmers resource centers where farmers can access information with videos or CDs.

The application of ICT in agriculture is not a new concept. Saravana (2011), asserts that farmers have always had access to a variety of traditional information sources (TV, radio and newspapers), which they regularly access for agricultural information. These traditional ICT's have been an important tool since past several decades to disseminate scientific and technical agricultural knowledge to farmers and also leading to improved adoption of technologies. They played an important role during the green revolution in 1970'sand 1980's (Sulaiman *et al.*, 2011). In late 1950's and early 1960's radio broadcasts were initiated (Kameswari *et al.,* 2011). The common feature of the traditional ICT's was that they were purely one-way mode of transmitting information (Mittal and Mehar, 2009). Although slowly and gradually the traditional ICT's started disseminating information in localized language, but since their transmission was for a large mass of farmers spread over various districts and villages, the content was not specific to specific needs

and was generic for major new innovations and technologies. Evolution of community radio was a step forward where for each village or a group of villages dedicated radio services and transmissions were initiated.

The use of ICT has arisen because of the need to cope with information explosion in the various sectors including Agriculture. In-order-to keep pace-with disseminating the increasing number of information from different research institutes, computers telecommunications must be utilized to handle information processing and dissemination with greater speed and accuracy than manual processing; and delivery through extension agents and/ or contract farmers because we live in a rapidly changing world.

2.2.2 Agriculture Extension information.

According to Simrin M. *et al.,* (2016) of the International Food Policy Research Institute, (IFPRI), Agricultural extension (also known as agricultural advisory services) plays a crucial role in promoting agricultural productivity, increasing food security, improving rural livelihoods, and promoting agriculture as an engine of pro-poor economic growth. Extension as a rural support service is needed to meet the new challenges agriculture is confronted with: changes in the global food and agricultural system, including the rise of supermarkets and the growing importance of standards and labels; growth in non-farm rural employment and agribusiness; constraints imposed by HIV/AIDS, and other health challenges that affect rural livelihoods; and the deterioration of the natural resource base and climate change. Therefore, like IFPRI asserts, extensions services in rural areas need to be looked at with a different perspective to fit into the change in operational systems including agricultural systems.

According to Ajani *et al.,* (2012) asserts that most of the family farmers in developing countries live in rural areas and are in most cases divorced from technology and vital agricultural support services needed to carry out farming activities. However, I would like to disagree with the research, in recent times, the rural communities are changing their perception about how to do farming using improved technologies as a result of the advancement mobile networks connections.

Mabe *et al.,* (2012), asserts that extension and advisory services are relevant to smallholder farmers, who remain the bedrock of the agricultural and food supply chains in developing countries. Therefore, providing farmers with (i) timely and relevant information; (ii) access to credit; and (iii) better market prices could go a long way in addressing global poverty and improving agricultural productivity Mabe *et al.,* (2012), goes ahead to assert that the aspect of timely and relevant information, especially with the role of Information Communication and Technology to connect farmers with the information they need has received much attention in the last decade. However, in the context of Uganda, such opportunities have not yet been well exploited as the research has indicated that farming programs are not timely due to the time scheduled and aired on radios.

Bell (2016), asserts that the aspect of information access has received increasing attention, especially in terms of the potential role of Information Communication Technology (ICT) to connect farmers with the information they need. ICT has already been shown to have the capacity to dramatically expand communication and improve access to information (and facilitate monetary transfers). "**However, the question is, how can the promise of ICT be realistically harnessed to help the rural farmers given the enormous amount of ICT tools possessed by farmers**"

According to Fafchamps *et al.,* (2005), Agriculture includes farming crops, animals, fishery and foresting. Farming crops includes banans, wheat, vegetables, sugarcane, pulses etc; animal farming includes dairy, poultry, fishery, etc (The main phases of the agriculture industry include crop cultivation, water management, fertilizer application, pest management, harvesting, post-harvest handling, transport of food products, packaging, food preservation, food processing/value addition, quality management, food safety, food storage, and food marketing. All stakeholders of agriculture industry need information and knowledge about these phases to manage them efficiently and therefore a strong database house all information needs for each value chain and its processes need to be established.

According to Diao *et al.*, (2007), E-Agriculture is an emerging field focusing on the enhancement of agricultural and rural development through improved information and communication processes. More specifically, e-Agriculture involves the conceptualization, design, development, evaluation and application of innovative ways to use information and communication technologies (IT) in the rural domain, with a primary focus on agriculture.

To convert agriculture into e-agriculture in a developing country like Uganda the mobile phones, television and radios can play an important role. For instance, in Uganda more than 80% people of are using mobile phone to communicate with others as well as more than 5000 million taka are transacted daily by the mobile user (Diao *et al.*, 2007),

2.3 The Information Communication Technology tools used in accessing agricultural extension information by onion farmers

The ICT tools which are owned by many rural farmers are radio and mobile phones (Cieslikowsk *et al.,* 2009). The increase in the use of ICT has been in mobile telephony where subscriptions in

developing countries increased from about 30 percent of the world total in 2000 to more than 50 percent in 2004 and to almost 70 percent in 2007 (Cieslikowsk et al., 2009). It is argued that mobile voice telecommunication leads the market in Tanzania by having more subscriptions (98%) than to fixed line services (2%) (TCRA, 2007). Mtega (2012), argues that the main source of agricultural information used in Kilosa district include radio, newspapers, television and mobile phones. This concurs to the studies by Sanga *et al.*, (2014) which were done in Kilosa. However, the choice of information sources is always influenced by Information and communication technology such as Radio Television Mobile phones Magazine Newspapers Internet. It should be noted that farmer's preference in information dissemination pathways and media is an important in determining adoption of technologies and productivity (Mbugua, 2012). It is argued that many agricultural researchers and extension workers have previously been using conventional communication channels to disseminate agricultural information to farmers and other stakeholders (Kiplagat, 2004).

These channels of communication that have been used were commonly which are monologue and have not allowed much interaction, but the new ways of communications are being adopted via ICTs such as the Internet, email, mobile phones, and electronic sources among others. ICTs are, therefore, innovations that are perceived as new by both the agricultural researchers, extension workers and farmers and have been adopted to facilitate communication of agricultural information (Mbugua, 2012). There are various communication channels used as explained below;

In recent times advances in Information and Communication Technologies (ICTs) are revolutionizing agriculture extension by offering various technological options such as television, internet, mobile, telephony etc (Sarin et al., 2009). This form of participatory communication has proved to be very successful as a tool for social and economic development at grass root level.

The local community needs which are often neglected by the mainstream media could be adequately addressed by community radio. Even farmer to farmer extension can be easily made possible through adequate capacity building as the HAM radio experience underway in Tamil Nadu and Andhra Pradesh shows (Fafchamps *et al.,* 2011). However, even with the existence of community radio stations, for instance in Uganda almost each district has a radio station, radio programs are not well structured to fit into the community's development needs. Most times radios have played music rather than airing development programs.

2.3.1 Radio

According to Sanusi (2010), FM radios have scored high in popularity and listenership in developing countries because of their focus in broadcasting in local languages and this has enabled agricultural programs aired through the national and private radio stations reach rural communities effectively. Munyua (2007), asserts that with the advent of the frequency modulated (FM) radio stations, which are mostly private sector initiative, FM radios have become handy tools in improvement of small scale agriculture in rural areas and he goes on to say that the initiatives by Panos institute of West Africa (PIWA), FAO, UNESCO and CTA among others have demonstrated the convergence of radio and internet technology and how this technology can provide new opportunities for rural development. Though radio is popular to the rural people, sometimes the development aspect is missing (inter media, 2005). Music dominates the programmes and entertainment surpasses education and information dissemination where by majority of people listen to entertainment or political programmes making agriculture and rural development less important. Van de ban (1996), also argues that Radio is much cheaper and will be effective when information need not to be presented visually. I would very much agree with the Van de ban (1996), that the radio is cheap to use for communication, however, the information

passed on the radio needs to be relevant to the needs of the community, other ways it will turn out to be expensive if the community is poor and cannot afford acquiring a radio and buying of batteries.

According to Farm radio international (2008), the challenge for Agricultural communicators today is developing a well packaged message and content that appeal to their target audiences. Though broadcasters need to develop relevant content, but they also need to be concerned about whether farmers listen to their programmers and to enhance this, radio need to be linked with new ICTs. Looking at the current trend of how radios are used, I would like to agree with FARM radio international that if the messages are not well packaged to fit into the needs of the community then the messages are irrelevant and use of ICTs won't be relevant and according to the theories of development communication, development communication is the utilization of existing communication tools and applicable theories for result-driven strategies for the advancement of society (FAO 2000). Therefore fore, FARM radio international's argument holds water, messages should aim at advancement of society.

Bukenya (2009), argues that the proliferation of FM radio stations and the expanding mobile phone connectivity in Uganda offers the opportunity for not only advisory service providers, but also farmers to link to sources of information and knowledge. However, Ray (1998), says that, accessibility of farm radio depends on the extent of radio ownership, the reception of radio signals, understandably of the message and convenience of listening time. Though in Uganda radio accessibility is increasing but other problems are associated with radio such as the time when agricultural programs can be aired, and the languages used as well as radio signal strength.

According to Intermedia (2015), many stations lack quality programming. Stations try to cut across education, informational and entertainment needs, but often its entertainment that dominates. Even on many stations, programmes tend to be full of drama created by comical presenters with lack of systematic flow of program me to programme. Now with the advent on mobile phone, the interactivity of the two ICTs is of more importance to advisory service providers. Internationally, there are four international broadcasting stations and examples are British Corporation (BBC), Radio China International (RCI), Voice of America (VOA) and Radio France International (RFI), all satellite-fed broadcast interlinked with FM broadcast. At local level, there are several radio stations; the commercial free-to-air radio market is characterized by audience fragmentation along class, ethnicity, race and clutter. Indeed, a few stations such as CBS FM, Bukedde FM radios in Kampala and KRC FM in Kabarole district are distinct in terms of audience.

2.3.2 Mobile phones

According to a study in Meghalaya state of India by Saravana *et al.*, (2014), it showed that majority of the farmers owned mobile phones as well as television and radio and the most frequently used ICT was mobile phone but this is debatable in rural areas of Uganda such as Kabarole district on availability and use of mobile phone to access information. A similar study carried out in Kenya found out that Mobile phones were widely used by the farmers for social communication, contacting middle men for the marketing of produce and contacting experts on real time basis for getting agricultural advisories (Saravana *et al.,* 2015). Farmers also reported that mobile phones proved to be useful during health emergencies. Information services on availability of inputs, quality of inputs, and pest and disease management of crops were also used by the farmers through ICTs (Ibid).

James (2004), reported that rural telephone and community radio services initiated in India and Sri Lanka had received a positive response from farmer communities. The International Institute of Communication Development (IICD) and Manobi, an African telecom company have initiated a collaborative program to help the farmers of Burkina Faso, Ghana, Mali, Uganda and Zambia gain access to market price information via text messages, Wireless Application Protocol (WAP), or the mobile internet as well as personal computers and personal digital assistants (PDA) Bayes (2001), has argued that the Village Phone Program (VPP) of Grameen Bank of Bangladesh can convert telephones into production goods by lowering transaction costs.

Technologies involving use of short messaging services with the mobile phones have been developed in Uganda as well as other countries for example in Kenya, the NAFIS which is an information Service developed by the National Agriculture and Livestock Extension Program (NALEP) to enable farmers get extension information simply by calling the service or browsing the NAFIS website (Mburu, 2013). It is a voice-web information service for providing agricultural extension information. It is a highly innovative system that is updated through the Web by field extension officers. NAFIS is a dynamic system that has been developed to exploit mobile telephone and internet technologies. It provides information through a detailed website and also through mobile phones. Information is entered locally through the internet by extension officers and accessed via this website or through mobile phones, thereby reaching as many farmers as possible (Ibid). While in Uganda, such a system none exists that could potentially support extension officers to share agricultural information using mobile phone.

Several researchers have convincingly argued that telephones are more important than PC based systems in developing countries (Duncombe *et al.,* 1999; Donner, (2006; Rashid *et al.,* 2009) and a special case has been made out for mobile phones. Mobility, less reliance on infrastructure and

basic literary for operation, technological versatility and innovative payment mode have been cited as some of the reasons for their greater suitability to meet the information needs of the less developed nations. I would like to agree with writer that telephones could be more important than PCs, more especially with the coming of smart phones which could act as small computers and require less skills to operate and as well as the integration of radio functionality in phones this has also enabled farmers to find the mobile phone more handy.

According to Jensen's (2007), in a study conducted in the state of Kerala, India, showed that adoption of mobile phones by fishermen translated into direct economic benefits. In this case, mobile phones helped in reducing price dispersion, elimination of waste, and adherence to one price, thereby benefiting both fishermen and traders. In a similar line of argument Aker (2009) reported that the use of mobile phones had a positive impact on the way local consumer goods markets operate in Niger. Mobile phones helped in reducing costs and gave traders access to a wider market. This in turn led to a harmonization and reduction in prices which eventually benefited the consumers.

In a study conducted with gherkin farmers in Sri Lanka, it was found that mobile phones can be used to reduce wastage through a simple feedback system. In this case, text messages were sent to the farmers on a daily basis giving details of a mount of gherkins rejected and the reasons for same, so that they could take immediate remedial measures (Soysa 2007). Again just like in Sri Lanka, in Kabarole district onion farmers can be send message of how pesticides to apply and fertilizer to use.

In Ghana, a unique and innovative service aimed at providing agricultural information, advice and support over the phone to smallholder farmers. As well as in Kenya the farmer's Helpline was

launched in October 2009 by Ken Cell, 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 (Mburu, 2013). There is also the LINKS that is a Livestock Information Network and Knowledge System which provides regular livestock prices and volume information on most of the major livestock markets in Ethiopia, Kenya and Tanzania along with information on forage conditions, disease outbreak, conflict and water supply to support decision making at multiple scales.

In Uganda, there is also a web based agricultural systems (http://weFarm.org) which farmers can access with their phones to acquire details of agricultural farming, but few farmers are aware of the technology and even if they accessed the platform the language used is English which may not favor small holder's farmers in the respective languages.

2.3.3 Television

The success of agricultural development programs in developing countries largely depends on the nature and extent of use of mass media in mobilization of people for development. The planners in developing countries realize that the development of agriculture could be hastened with the effective use of mass media (Salleh, 2010). Television has been acclaimed to be the most effective media for diffusing the scientific knowledge to the masses. In a country like Uganda, where literacy level in rural areas is low, the choice of communication media is of vital importance and therefore, use of TV would enhance user uptake of agricultural information, given that TV can allow use of graphics. In this regard, the television is significant, as they transfer modern agricultural technology to literate and illiterate farmers like in the rural areas within a short time. (Nazari *et al.*, 2008).

Television is acknowledged as the most important medium for communicating with the rural populations of developing countries (FAO, 2001). Television has proved to be a profound means of communication and potentially capable of leaving the desirable effect on society. Although the cost and expenditure of television exceeds than that of radio, it is more effective and powerful from the educational point of view (Nazari, 2010).

2.4 How the available ICTs are being used to relay agricultural extension information.

Saravanan *et al.,* (2014) asserts that use of mobile phones is setting an unprecedented pace despite the poorly developed rural electrification in rural areas. Mobile technology has provided multi-dimensional benefits to the rural people. Its importance in usage is clear in sense of urgency and emergency (Sife *et al.,* 2010). According to a study conducted by (Saravanan *et al.,* 2014) in Northern India, they found out that farmers reported to use ICTs to know the market days, to know where products could be sold and identifying different market location for efficient marketing of produce (Oyeyinka et al., 2013).

Relating the study to Uganda's context, Nakweya (2013), put it that it is possible for farmers to use mobile phones too to consult on market prices through peers, nevertheless, this may not be the case for Uganda if there are no specific service providers that rely the information to farmers about market prices. However, the study also noted that traditional ICTs such as radio and television have also been reported to be used by farmers in accessing agriculture related information (Nazari and Hasbullah (2008), which is the same case for Kabarole and Uganda at large given the many FM radio stations.

In a study carried out in India, ICT applications such as calls, and Short Messaging Services have been found to be used often by farmers in India (Mtega *et al.,* 2013) and this indicates that the use

of mobile phones are increasing and gaining importance in the lives of the people to further contribute to development and better communication. Computers and internet have also been shown to be used for agricultural information and sharing (Shetto, 2008).

For instance, Internet kiosks in Tamil Nadu, India were reported to be owned by rural women to encourage savings and form credit groups (Narender *et al.,* 2008). Also farmers in Tanzania use internet to access agricultural information (Mtega *et al.,* 2013). However, use of short messaging services and internet may not be possible due to most farmers being illiterate and nonexistence of structures at village level from where farmers can access agricultural information.

According to a study conducted in India Mtega *et al.,* (2013), it found out that farmers can easily accept the use of the mobile telephony to find for instance fertilizer prices if the traditional process could easily accommodate the use of the technology. The study found out that Farmers were contacting other farmers or dealers about fertilizer prices and sources of fertilizers. Without changing the human agents, farmers and the people they contacted for information and the nature of communication, a cheaper and easier mechanism could be developed with the help of the technology.

Results from a study conducted in India by Bidit *et al.,* (2015) reveals that the use of mobile telephony could only be effective where the technology was consistent with the social processes and farmers' lifestyles. The study found that simple changes in the social communication process (i.e. getting information about fertilizer price) were being initiated by the use of mobile 'phones.

A similar study also found out farmers were still contacting the same people fellow farmers and fertilizer traders to get the same information about the sources and prices for fertilizer. The use of mobile telephony only changed their mode of communication and saved time and money for them.

The study also revealed that farmers found the use of mobile telephony less applicable for getting output price information. The use of mobile telephony cannot change the nature of the marketing of agricultural produce at the farmgate level (Mtega *et al.,* 2013). It is also not possible to eliminate the middlemen. Their role in the process often facilitates the farmers. Through this example, it can be argued that the existing social system and process can inhibit the effective use of a technology.

2.5 Social- economic factors influencing use of ICT tools to access extension information

According to Amos *et al.,* (2017) from their study about the determinants of use of Information and Communication Technologies (ICTs) in Agriculture, their results showed that, gender, age, education and group membership were significant in determining the decision of rural people to use ICT tools. In the study they found out that younger people are more likely than older people to be enthusiastic about new technology and hence more likely to purchase advanced technology. Regarding gender, they also found out that men were more likely to use the Kenya Agricultural Commodity Exchange than women and this was associated with the factor that cultural practices could be at play which assigns most of the domestic chores to women, leaving them with almost no extra time to allow them to seek such services. Group membership was also another factor found to be significant to decision making whether to use ICT services. They noted that belonging to a social group increases the likelihood of using ICT tools as information is disseminated to groups, members of those groups acquire more knowledge about existing services than non-members. Chabossou *et al.,* (2009) also asserted in their study that there is a relationship between mobile adoption and being a member of "social networks" (church groups and sports clubs). In their model, they found that belonging to such networks contributed positively to the probability of mobile adoption.

According to Snowden, Spafford, Michaelides, & Hopkins, (2006), they assert that Perceived usefulness of a technology has an important influence in technology adoption. These findings are not any different from this study theoretic technology use literature (Elizabeth, et al, 2012) - Tax adoption mode). Amos, Sabina and Julius (2017) also urge that increased perception of importance and affordability of services is significant to the propensity of farmers to use ICT services.

Form a study conducted by Mittal, Gandhi, and Tripathi, (2010), they assert that the deficiency of extension staff and poor access to information has impeded the transfer of technology at the farm level. These results are not any different from the findings of; Amos, Sabina and Julius (2017), who found that contacts with extension workers was not statistically significant. Which was an indication of a weakening impact of extension services on farmers decision to use new technologies in farming and this was contributed to the erratic contact between extensions workers and the farmers.

Amos, Sabina and Julius (2017), assert that in their study of determinants of factors that influence a farmer's use of the Kenyan commodity exchange platform, there was no demonstrated relationship, between distance to the nearest market and use of ICT tools. However, from another study conducted by Okell *et al*, (2011) they found an inverse relationship between distance to the market and number of mobile phone calls made by farmers for agricultural transaction purposes. From the two studies this implies that distance may be a factor that has a positive influence depending on the context of the study and the opportunities that the nearest market may offer such as electricity.

According to Kirui, Okello and Nyikal, (2010), they argue that farmers use mobile phones for mostly non-agricultural transactions, such as money transfer, which could be a true argument. However, according to Amos, Sabina and Julius (2017), they argue that farmers use the mobile

phone to as well consult about farming activities if they know whom to consult or the source where to access agricultural information.

According to Anselme, *et al.,* (2012), they found out in their study that the use of mobile calls in farming activities was positively influenced by land size owned and cultivated by farmers. Which forces farmers to consult fellow farmers about the best agronomic practices to avoid make huge loses having invested in big plots of land that have been cultivated. In the same study by Anselme, *et al.,* (2012), they found out that skills of reading and writing were required to adopt mobile use in farming activities . In another study conducted by Shiro (2008) he found out the lack of farmers ICT knowledge prohibited them from using ICT frequently. Dixon (2009) also stresses that frequent usage and exposure to ICT tools must be considered if someone wants to form a positive attitude towards ICT. Dixon asserts that when people frequently use and expose to ICT, it will inform them that ICT is helpful and beneficial to them thus creating a positive attitude towards ICT usage.

CHAPTER THREE: RESEARCH METHODOLOGY

3.0 Introduction

Despite the availability of many ICTs in Kabarole district, farmers and more especially onion farmers still face multitude of challenges accessing relevant agricultural extension information leading to limited knowledge on best agronomic practices, input prices, output prices and weather forecasts information. As result, this prompted the researcher to assess the use of ICT tools among onion farmers in accessing agricultural information in Kabarole district taking Harugongo as the case study, and ultimately to evaluate the contribution of ICTs towards improving agronomic practices.

This chapter provides research methods that were used to collect data from the respondents to address the research problem. The chapter dealt with the research design, area of study, study population, sample size and sampling procedure, instruments of data collection, procedure for data collection, validity and reliability of instruments, ethical considerations and data analysis.

3.1 Research Design

The researcher employed case study research design using a mixed approach of both quantitative and qualitative approaches. Case study made thorough examination on the factors the influence use of ICT in accessing agricultural extension information. According to Mugenda and Mugenda (2003), a case study design is used because of its in-depth investigation of an individual, group, institution and makes detailed examination of a single subject. Similarly, Rowley (2002), noted that a case study is widely used because it provides insights that cannot be achieved by other approaches and this permitted marriage of diverse techniques within the same study. In addition, it helped the researcher to generate new understanding, explanations or hypotheses about the problem that was being investigated.

A mixed approach of both qualitative and quantitative methods was used to reduce bias in the study. For example, Qualitative approach was helpful in interpreting people's opinions, perceptions about the use of ICT tools in accessing agricultural extension information using interviews. This also gave narrative and descriptive information that explained a deeper understanding and insight into a problem as suggested by Amin (2005). The approach was used to collect data in words from subjects using ordinary language, it also provided verbal descriptions rather than numerical (Kothari, 2004).

In quantitative approach strives for precision by focusing on items that can be counted into predetermined categories and subjected to statistical analysis. The methods complement each other in that, qualitative methods provided in-depth explanations while quantitative methods provided the hard data needed to meet required objectives (Charmac, 2006). Some of the objectives are

better assessed using qualitative methods while for others quantitative methods are preferable (Mugenda & Mugenda, 2003).

3.2 Area of the Study

This study was carried out in Harugongo Sub county in Kabarole district. Harugongo sub county was part of Hakibaale subcounty before the split of Kabarole district. Kabarole district is located in mid-western Uganda and is bordered by Ntoroko District to the north, Kibaale District to the northeast, Kyenjojo District to the east, Kamwenge District to the southeast, Bunyangabu district in the south and Bundibugyo District across the Rwenzori Mountains to the west. Fort Portal, the 'chief town' in the district, lies approximately 320 kilometers (200 mi), by road, west of Kampala, the capital city of Uganda. The coordinates of the district are:00 36N, 30 18E (Latitude:0.6000; Longitude:30.3000) (UBOS, 2014).

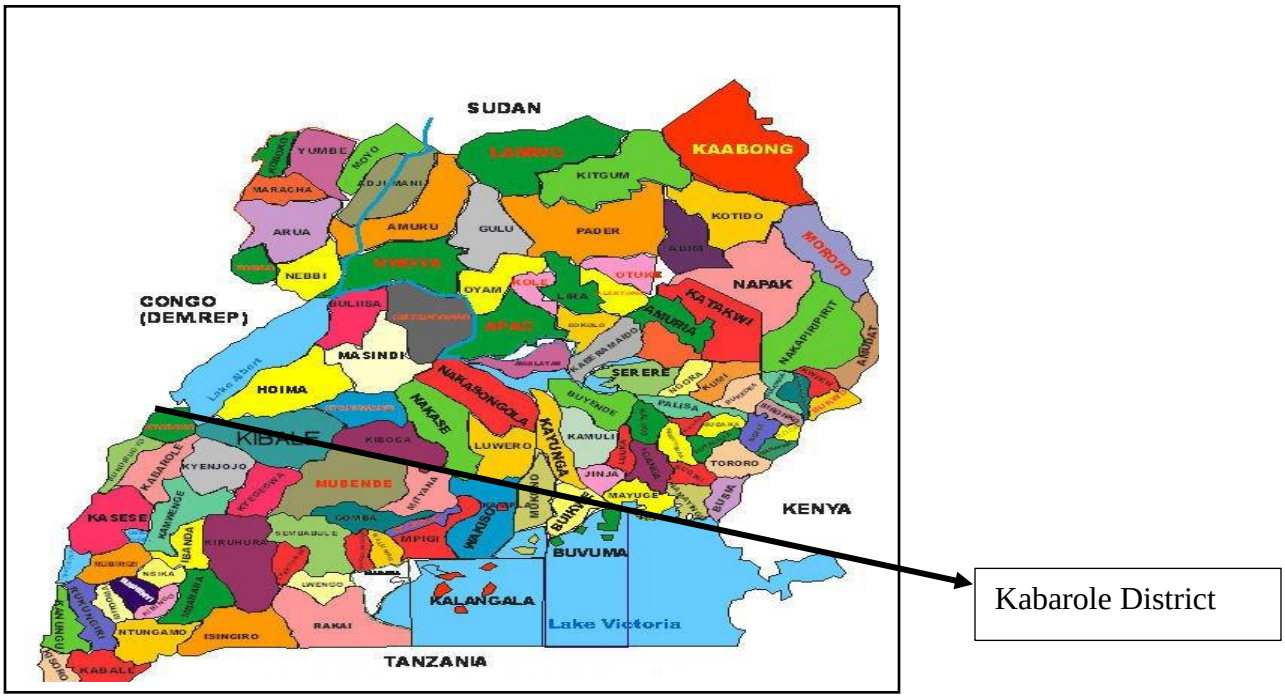

Figure 3: Map of Uganda showing Kabarole District
Source: http://www.geonames.org/UG/administrative-division-uganda.html

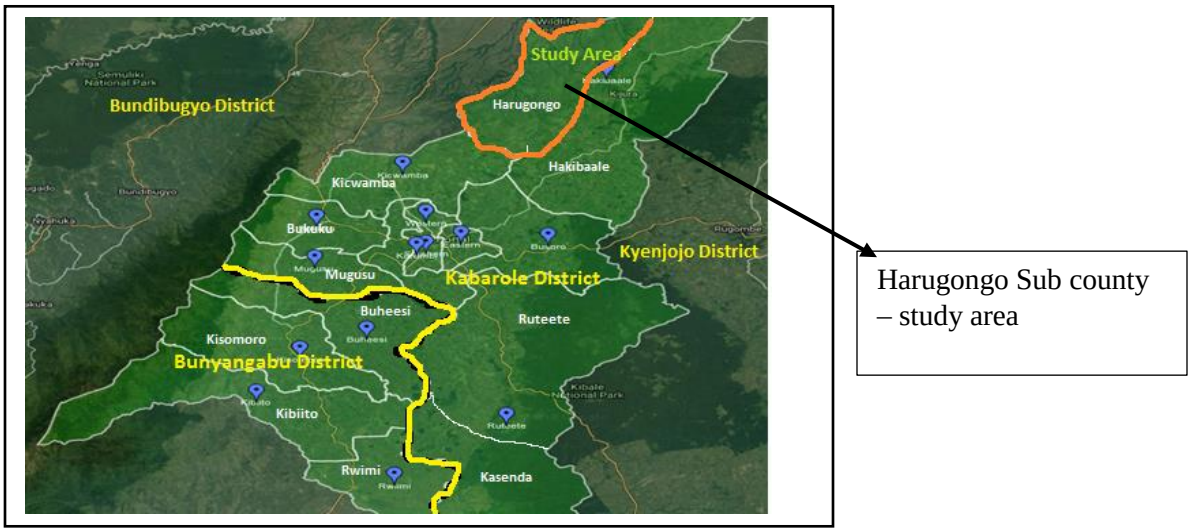

Figure 4: Map of Kabarole District showing the study area
Source: http://www.lcmt.org/uganda/kabarole

3.3 Study Population

According to Kothari (2005), target population refers to the entire total of respondents that meet the selected set of criteria. In this regard, the present study mainly focused on onion farmers based at Harugongo sub county and Extension Agents at the district and sub county. Wealth creation officers based at the sub county were also interviewed to provide a thorough understanding of extension services. The total number of farmers in Harrugongo sub county is 162 onion farmers and 3 agricultural officers.

3.4 Sampling Procedures

3.4.1 Sample size

Sekaran (2003), identified that, sampling is the process of choosing the research units of the target population, which are to be included in the study. According to Oliver et al., (2005) an appropriate

sample size should be at 10% of the total population. In this study, the researcher applied the sample size formula by Taro (1967), as below;

Equation 1. Sample Size

$$n = N/1+Ne^2$$

Where;

n = Sample Size

N = Population size (population of onion farmers in Harugongo sub county [278 farmers])

e = Confidence interval (0.05).

According to UBOS 2014, the total population for Harugongo subcounty is 8,368 people and from the records of the sub county Agricultural extension officer there are a total of 278 farmers who do onion farming as business (District Agricultural officer, 2017)

Using the above formula and substituting in the values, a total sample (n) of 162 onion farmers was considered for the study at **95%** level of Confidence and **5%** margin of error. The three district agricultural officers were purposively selected to provide more insights about how farmers use the available ICTs to access agricultural information

3.4.2 Sampling Techniques

Kothari (2005), defined sampling technique as the procedure a researcher uses to gather people, places or things to study. It is a process of selecting a number of individuals or objects from a population such that the selected group contains elements representative of the characteristics found in the whole group. In this study, the researcher used proportional stratified sampling

technique to ensure a fair representation of both women and men who are involved in onion farming as a business. Having defined the sample size, a list of farmers who do onion farming as business was obtained from the district agricultural officer and the list was divided into two come up with the lists of men and women. Thus, two strata/groups were formed from which samples were taken. According to Shalabh (2015), s**tratified** random **sampling** is a sampling approach used when the researcher wants to highlight a specific subgroup within the population. Therefore, since onion farming is a quick cash group and being practices by both women and men who have small plots of land, two specific group were formed, and this was the most ideal approach for sampling.

3.5 Data Collection Methods and Instruments

Data collection methods are the means through which the researcher gathers data from selected respondents (Oliver and Serovin and Mason, 2005). The researcher used primary data and according to Kothari (2005), it is "afresh and for the first time" through direct communication with respondent from the field, and reviewing related literature.

3.5.1 Data collection procedures

The researcher developed a proposal for 4 weeks with the guide of a University supervisor. Once the proposal was approved, he got permission from the University research committee to proceed with the study at Harugongo Sub-county to collect primary data from a sample size of 162 respondents who were onion farmers using interviews and questionnaires. Respondents were drawn from different villages to ensure that analysis takes into account the varying perceptions within the sector. Two trained research assistants were used to interview the respondents and fill in the answers in the interview guide, and 162 questionnaires were administered but only 144 were

valid. A total of 3 interviews were administered to Agricultural officers. For qualitative research the research visited 17 respondents through an iterative process and involved collecting data, assessing the variation in issues raised, and then continue to collect data.

Using an introduction letter from the University, arrangements were made to meet the for key informant such as the district agricultural officer, one sub-county agricultural officer and one community development officer for interviews. Interviews involved direct personal investigation and meeting the people from whom data is sought (Berg, 2007). Before starting the interviews, the research assistants had to seek consent from the respondents.

3.5.2 Research instruments

The researcher used both qualitative and quantitative data collection instruments, the researcher used two data collection tools including questionnaires and interview guide to collect primary data. Primary data collected in the field using interview guides offered some important facts in this study and it supplemented by questionnaires as apparatuses for collecting information from the targeted groups.

The Primary data collection instruments that will be used;

Questionnaires guide

Questionnaire were used to collect information on onion farmers, who mainly do onion growing as a business for income and use of ICT tools to access agricultural extension information as tools or instruments for communication. Questionnaires were used since the study was concerned also with all variables that cannot be directly observed such as views, opinions and perception of respondents. Therefore, such information is best corrected through questionnaires Charmac, 2006). The sample size was quite large (162) respondents and given the time constraints, questionnaires

were sought to be ideal tool for collecting data, these are people who are literate and will be able to respond to questionnaire items.

Questionnaire as a data collection instrument are useful because a researcher can collect a lot of information from a large number of people in a short period of time (Chamack, 2008). The chances of a researcher to have bias information are low because same questions are asked both participants and many people are familiar to the questionnaire to air out their ideas as compared to the interview. Most people were inferior of interviews. Questionnaires were used to as they were easy to be quantified by a researcher. It also a room for a researcher to contrast the responses among the participants. These questionnaires provided a deep understanding of the contribution of ICT to local small holder farmers.

Interviews guide

For this particular study, it was important to confirm the responses given in the questionnaires using interviews. Collecting in-depth data was undertaken using face-to-face interviews after administering the questionnaire (Bailey, Hutter, Hennink. 2011). The interview guide was prepared to gather information from agricultural officers on onion farmer's communication practices. Charmac (2006) defined interview as a conversation in which the interviewer questions the respondents' in order to gain information, interviews are done to collect information on a particular area. Improved innovations in agriculture is one of the key pillars in the ministry of agriculture today, therefore the use of interviews enabled the researcher to get in depth information on issue of ICT.

For the researcher to get the information using the interviews concerning his topic on the contribution of ICT to farmers in the study area; therefore, interviews proved to be effective, as the researcher managed to interact directly with District heads, community development officers

and extension workers. The researcher got the opportunity to read nonverbal dues of the respondent. The researcher decided to use the interviews because the researcher could easily get the valuable information. Interviews also allowed the researcher and the respondent to talk face to face so that the researcher can ask more information from the respondents

3.6 Quality Control Methods

Quality control was done by use of Validity and Reliability tests, these relate to controls put in place to focus on the objectives of the study and eliminate diversions.

3.6.1 Validity

Validity is the extent to which you can draw accurate and meaningful inferences based on the results obtained from an instrument (Mugenda and Mugenda, 1999). Content and construct validity were used to evaluate the inferences based on the results from the instruments. Content validity is the degree to which an instrument actually measures the variable it claims to measure (Kathuri and Pals, 1993). That is to ensure the items in the questionnaires represent the content area. Construct validity is a measure of the degree to which data obtained from an instrument is meaningfully and accurately reflects a theoretical concept (Mugenda and Mugenda, 1999). To establish content and construct validity the researcher sought expert opinion concerning the research instruments from the supervisors and fellow students. A pilot study for a sample of 10 farmers was carried out on farmers in Fort Portal municipality to ascertain their validity and reliability. This helped the researcher to establish the accuracy of the instruments to be used.

Reliability

To ensure consistency of the instrument obtained from the test, the tools were pretested using a random sample of 10 onion farmers from Fort Portal Municipality, Kabarole district. This location

was chosen because it has similar characteristics as those found in the study areas. The number 10 farmers were chosen for the pretest based on Kathuri and Pals (1993) suggestion that it is the smallest number that yields meaningful results in data analysis in a survey research. The pretest was subjected to the spilt-half analysis technique according to Cronbach's formula;

$$\alpha = (N*r/1+(N-1)*r)$$

Where N = number of items and r is the average inter-item correlation among the items.

The study used Cronbach alpha as the reliability coefficient of at least 0.7 which is accepted (Santos and Reynaldo, 1999). Since a reliability coefficient of 0.7 was obtained from the pretest, the instrument was therefore used for survey.

3.7 Data Management and Processing

Data Processing implies editing, coding, classification and tabulation of collected data so that they are amenable to analysis (Charmac, 2006). Data preparation involved two main tasks, that is producing a verbatim transcript of interviews with the extension officers from Kabarole District.

All transcripts were labeled with file names for example INTW 2 Note taker, INTW 2 transcript (translated), this which helped in locating the file needed during analysis. Transcribing started immediately after talking to the 3 extension officers.

3.8 Data Analysis

The data obtained from different questionnaires and interviews was analyzed using R software and presented by the researcher using both qualitative and quantitative methods. In the analysis, R software version i386,3.4.1 was used.

R software was preferred, due its capability to provide a wide variety of statistical (linear and nonlinear modelling, classical statistical tests and classification) and graphical techniques. In this research R was used to for produce univariate statistics for both objective one and two as well as testing for multicollinearity.

Prior to running the logistic regression analysis under objective three, both the continuous and discrete explanatory variables were checked for the existence of multi-collinearity using variance inflation factor (VIF). Results from the analysis reflected that there is no strong association among the variables for this reason, all of the explanatory variables were included in the final analysis.

According to Richard (2015), multicollinearity is a common problem when estimating generalized linear models, including logistic regression. Richard 2015, stressed that this occurs when there are high correlations among predictor variables, and this can lead to having unreliable and unstable estimates of regression coefficients. Most data analysts know that multicollinearity is not a good thing. But many do not realize that there are several situations in which multicollinearity can be safely ignored.

3.8.1 How each objective was analyzed

Objective 1: To find out the information communication tools (ICTs) readily available for farmers to use to access agricultural extension information in Harugongo sub county. This objective was analysed using R software to produce univariate or descriptive statistics.

Objective 2: To evaluate how well the available ICTs are being used by farmers to access agricultural extension information. This objective was analysed using R software to produce descriptive statistics or univariate statistics.

Objective 2: To determine the social- economic factors influencing the use of ICT among onion farmers to access agricultural information. This was analyzed using the binary logistic regression model which is as specified below;

In the logistic regression model, pi donates the probability of the farmer using an ICTs tool to access agricultural extension information, denoted by Yi = 1 and exp (Zi) stands for the irrational number **e** to the power of Zi. Therefor the model can be written as;

$$P_i = E\left(Y = \frac{1}{X}\right)\frac{1}{1 + e^{-(Bo+B1X1)}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

For the case of explanation, Equation 1 is written as

Equation 2. Probability that a farmer uses ICT tools to access Agricultural information

$$\text{Pi} = \frac{1}{1+e^{-Zi}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

The probability that a given onion farmer has used ICTs is expressed by Equation 2 while the probability of not using ICTs is expressed by Equation 3;

Equation 3.Probability that a farmer not using ICT tools to access Agricultural information

$$\text{1- Pi} = \frac{1}{1+e^{Zi}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Therefore, Equation 3 above can be expressed a follow;

$$\frac{Pi}{1 - Pi} = \frac{1 + e^{Zi}}{1 + e^{-Zi}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Now that (Pi/1-Pi) is simply the odds ratio in favor of using ICTs. The ratio of the probability that a farmer used ICTs tool to the probability of that he/she not does use ICTs tools, finally, takes the natural log of Equation 4 above and we obtain;

$$\text{Li} = In\left(\frac{Pi}{1-Pi}\right) = Zi = \beta o + \beta 1X1 + \beta 2X2 + \beta nXn + Ui \ \ldots\ldots\ldots\ldots (5)$$

Where Pi= is a probability of using ICTs ranges from 0 to 1, Zi = is a function of n explanatory variables (x), β0 is an intercept, β1β2βn are slopes of the equation in the model, Li= is log of the odds ratio, which is linear in the parameters, Xi= is vector of relevant farmer characteristics

If the disturbance term (Ui) is introduced, the logit model becomes;

Equation 6. Logit model used in analysis

$$\mathbf{Zi = \beta\ 0 + \beta\ 1\ X1 + \beta\ 2X2 + \beta n\ Xn + Ui} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \mathbf{(6}$$

In this study, the above econometric model (Equation 6) was used to analyze the data. The model was estimated using the interactive maximum likelihood estimation procedures. This estimation procedure yields unbiased, efficient and constant parameter estimation

3.8.2 Social -economic variable measurement

In order to conduct thorough analysis of the social economic factors that influence use of ICTs to access agricultural extension information, all variables with responses that are qualitative were converted to quantitative data by assigning them dummy numerical codes as reflected in table one below. Conversion of qualitative data to quantitative data was done enable perform the logistic regression analysis.

Table 1. Variable measurement for the Logistic Regression model

Variable	Description	Measure
Age	Farmers Age	Years
Sex	Farmer's Sex	1=male, 0=female
Education level	Farmers Education Level	Years in school

Household size	Household size	Number
Number of Farming plots	Number of farming plot a farmer	Number
Nearest Market Distance	Farmer distance from nearest market	Number
Off-farm income	Farmer's access to off-farm income	1=yes, 0= no
On Farm Income	Farmers' on Farm Income	UGX
Access to Agricultural Loans	Access to agricultural loans	1=yes, 0= no
Frequency visit to Trading center	Frequency of visiting Trading Centre	Number
Frequency of extension contact	Frequency of contacting Extension officer	Number
Frequency of getting Agri programs	Frequency of getting Agri Programs	Number
Know sources of Agri Programs	Know Sources of Agri Programs	1=yes, 0= no
Access to ICT tools	Access to ICT tools	1=yes, 0= no
Trained in use of ICT	Trained in use of ICT TOOLS	1=yes, 0= no
Ownership of land	Ownership of Land	1=yes, 0= no

3.9 Ethical Considerations

The ethical considerations focused on issues such as; who is to benefit from the research? What was the research giving back to the community? How was the researcher planning to enter into a study community and present himself to the study community? Below were the ways he addressed the potential research ethical issues;

He approval from Research Ethics Committee of Uganda Martyrs University and request for an introductory letter from the University before the commencement of data collection process. The letter was used as an introductory letter seeking for permission from the local leaders and respondents within the area of study.

During participant recruitment, the researcher provided adequate information and seeks consent from the participants whether they have agreed to participate in the study. Anonymity of the

respondents were prioritized, and all identifiable information were removed from the transcript and quotations used and for confidentiality he restricted recordings of the interviews to be listened to by only research team during transcribing.

3.10 Limitations of the study

The purpose of the research was to assess the use of ICT tools to access agricultural extension information, while focusing on three ICT tools which included, radio, television and mobile phone and did not consider the rest of ICTs which can also be used by the onion farmers to access agricultural information. Therefore, this could potentially skew the results given that the ICT tools used were minimal. Secondly the study was conducted basing on one sub county in Kabarole, and this limits the generalization of findings since each region has different environmental and institutional factors that influence use of ICT tools. One sub county was considered for data collection, due to the financial resources that were needed to cover a wider area.

CHAPTER FOUR: DATA PRESENTATION, ANALYSIS AND DISCUSSION

4.0. Introduction

This chapter presents the findings about the use of ICT tools to access agricultural extension information by onion farmers in Harugongo sub county. The chapter begins with the demographic characteristics of the respondents which is univariate analysis consisting mostly of frequency tables, and multivariate analysis consisting of the logistic regression model results that looks at factor that influence farmers' use of ICT tools. Analyzed data was derived using R software for statistical data analysis. The entire study was guided by the following research questions; What are the ICT tools currently used by farmers? How are the available ICTs being used by farmers to access agricultural information? And what are factors that influence onion farmers to use ICT tool?

4.1 Questionnaire validity and response rate

Out of the 135 questionnaires distributed, only 120 were returned as valid. This implies that 89% of the questionnaires were returned valid and the table 2 provides details of validity.

Table 2. Questionnaire validity and response rate

Category of Respondents	Sample Size	Number of Questionnaires returned and valid	Number of Questionnaires not retuned or invalid	Percent of Questionnaires returned and valid	Percent of Questionnaires not returned or invalid
Onion Farmers	162	144	18	89%	11%

Agricultural officer	3	3	0	100%	0%

Results from table 2 above reveal that, among the respondents that participated in the research, 89% (n=144) were onion farmers and 100% (n=3) were agricultural officers. The study had planned to cover 162 respondents, but some questionnaires were not returned, and others were not valid. This implies that out of the expected questionnaires, 98% were returned as valid, which is a good number for the study to produce unbiased results.

4.2 Respondent's Background information/Demography characteristics

The first aspect of the study dealt with personal information about the respondents and key information considered include; gender, age, level of education of the respondents, number of people living together with the respondent, number of farming plots, on farm income, and distance to nearest market.

Table 3. Characteristics of respondents

Variables	Frequency	Percentage
Gender		
Female	84	58%
Male	60	42%
Educational level		
No formal school	14	10%
Primary	52	36%
O' Level - Secondary	35	24%
A 'Level - Secondary	13	9%
Vocational training	17	12%
College Educate	10	7%
University	3	2%
Number of people living in house hold		
Less than or equal to 6 people	46	32%
More than 6 people	98	68%
Mean of people living in household	7 people	
Number of farming plots		
1-2Plots	72	50%
3-4 Plots	60	42%

5 and above plots	12	8%
Distance to nearest market		
1-5km	54	38%
6 - 10km	50	35%
11km above	40	28%
Mean distance of travel to market	5km	

Data source: Field Study data, 2017

4.2.1 Gender distribution among respondents

Results from the table 3 above reveal that majority of the respondents 58% were females and 42% males. These findings relate to the study conduct by Amparo et al (2017) who found that the contribution of women to labor in African agriculture was in the range of 60–80% and it also be attributed to the nature of Ugandans agricultural sector where females are the majority people involved in production and at the time of visiting the households, only women were found in gardens.

4.2.2. Educational level of respondents

Results in table 3 above reveal that 36% of the respondents completed primary school, 24% O'Level – Secondary, 9% A 'Level secondary, 12% Vocational training, 7% college, 2% university and 10% did not attend any formal education. This data reflects that most of the respondents can read and write since most have them have at least attained a minimum of primary education.

4.2.3. Household size of the respondents

Findings from table 3 above reveal that 32% of the respondents were living with less than or 6 people in their household and 68% living with more than 6 people in the house hold. On average each household had about 7 people living together under one roof. These results indicators that

most households have about 6 people living together and probably that is why people have many farming plots, given they have labor to support farming activities.

4.2.4. Number of farming plots for respondents

Results from the table 4.2 above revealed that majority of the respondents 50% had 1-2 farming plots, 42% had 3-4 farming plots and 8% had above 5 and above farming plots. Most of the farmers grew different crops on each plot, due to lack of land.

4.2.5. Distance to the nearest Market from respondent's home

Findings from table4.2 above reveal that 34% of the respondents were living within 1-5km of distance from the nearest market, 38% with 6-10km and 28% within a distance of 11 kilometers and above. The mean distance from respondent's residences to nearest market was 6km. These results indicators that probably farmers living nearby markets can access appropriate farmer inputs and possible with high potential is using ICTs to access agricultural information.

4.2.6. Age Distribution of respondents

Figure 5 below provides details of age distribution for respondents who participated in the study

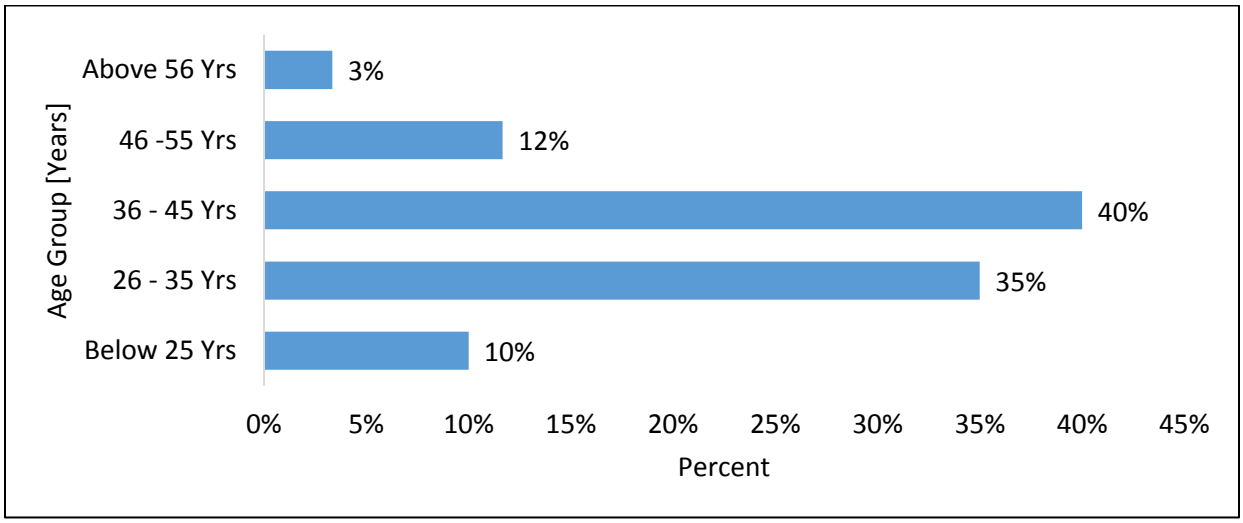

Figure 5. Age Distribution of respondents
Data source: Field Study data, 2017

Results from the figure 3 reveal that majority of the respondents 40% were between 36-45yrs old, 35% between 26-35yrs, 12% between 46-55yrs, 10% Below 25 years and 3% above 56 years and the mean age of respondents was 36.23 years. These results indicate that majority of the participants in the study where between 26 years of age and 45 years, which age group is composed of youth and those interested in farming given that they have to earn money to feed their families. This can be related to the natures of Uganda population, where about 80% of the population depends on agriculture for livelihood.

4.2.7. On Farm Income Distribution for respondents

Figure 6 below shows on farm income distribution earned by respondents in Harugongo sub county

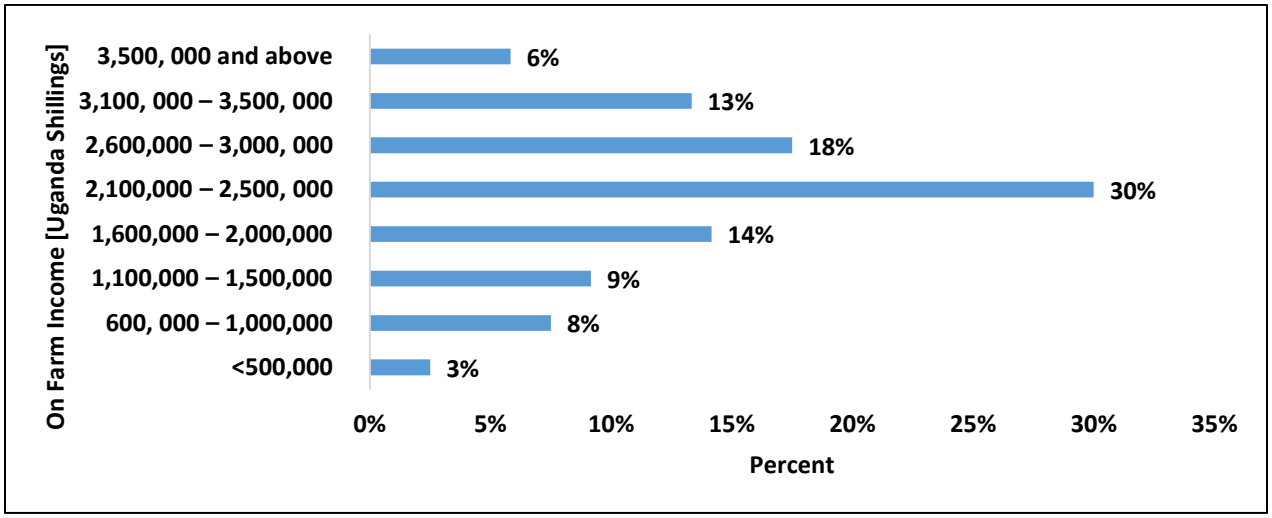

Figure 6. On Farm income for respondents.
Source: Field Study data, 2017

Findings in figure 4 above reveal that 30% respondents earn between 2600,000- 2500,000 from onion farming per season, 18% between 2,600,000-3,000,000, 14% between 1,600,000-2,000,000; 13% between 3,100,000-3,500,000, 9% between 1,100,000 -1,500,000; 8% between 600,000 -

1,000,000; 6% between 3,500,000 above and 3% less than 500,000 Uganda shillings. The findings in the above figure indicate why many youths between the age of 26 to 35 years are involved in onion farming, given that onions maturity period three months and does not require a lot of land size to get involved.

4.3 Information Communication Tools readily available for use by onion farmers to access agricultural information.

4.3.1 ICT tools accessed and possessed by respondents.

Figure 7, below shows ICT tools accessed and possessed by onion farmers.

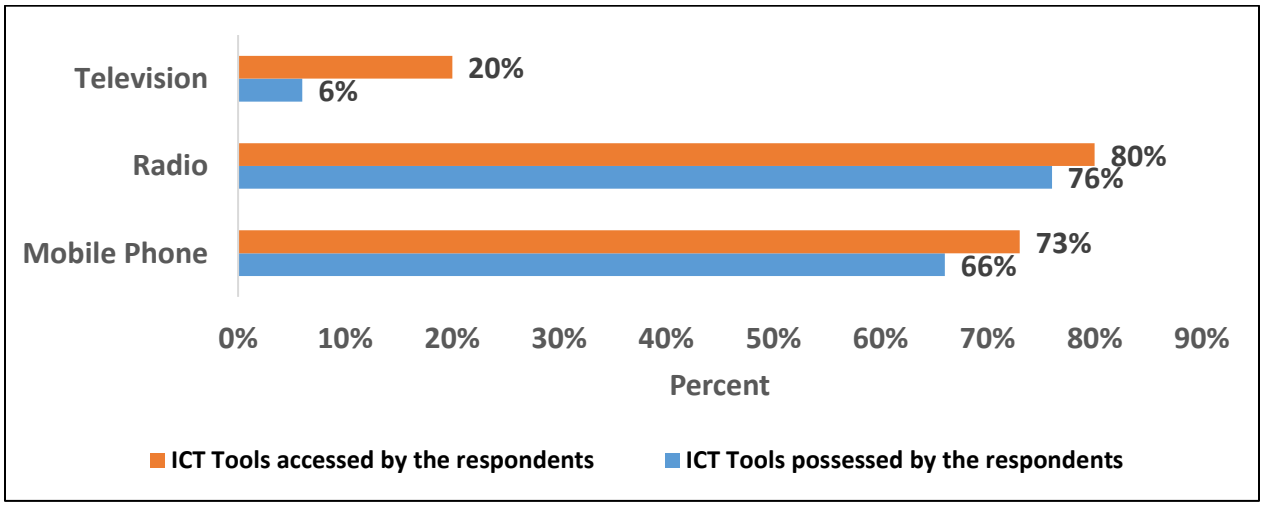

Figure 7. ICT tools accessed and Possessed by onion farmers.
Data source: Field Study data, 2017

Finding in figure 5 above show that 80% and 70% of the respondents have access and own a radio respectively, 73% and 66% have access and own mobile phone respectively while 20% and 6% have access and own a Television respectively. The results indicate that most people at least own a radio and mobile phone, and this can be explained by the advancement in mobile phones which are currently coming with inbuilt radio receivers thus facilitating people to have access to both a

mobile phone and radio. At the same time, with the recent increase in FM radio stations, it has also compelled people in rural areas to acquire radio receivers to have access to generation information about both local, national and international affairs. Television access is at 20% while ownership of television is at 6% and this indicates that most people can access television but do not own, and this can be explained by the increase in the number of local video cinemas halls locally called "BIBANDA" that show football and the many bars in trading centers with TVs which are acquired with aim of attracting customers by showing news.

4.3.2. Whether respondents have used ICT tools to access agricultural information and whether they are aware of where to access agricultural information (Sources)

Figure , below shows the percentage of farmers who have used ICT tools to access agricultural information and percentage of farmers who know where to access agricultural information using the ICT tools they possess.

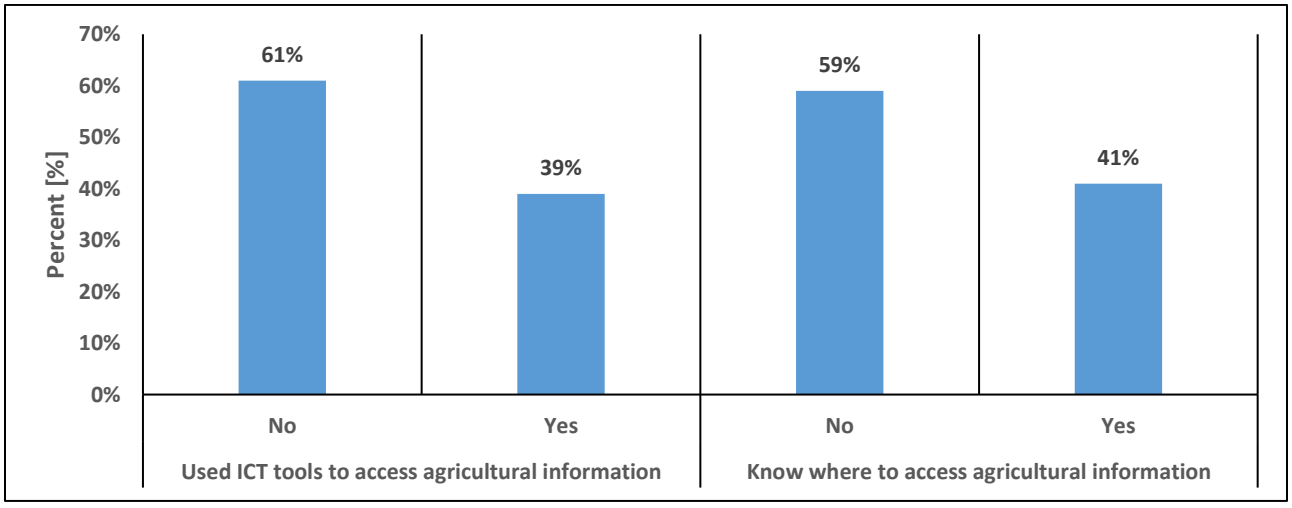

Figure 8. Respondents use of ICT and known source of Agricultural information
Source: Field Study data, 2017

(a) Whether have used ICTs to access agricultural information.
Results in the above figure indicator that 39% of the respondents have ever used ICT tools to receive agricultural information, while 61% have not used the ICT tools to receive Agricultural

information. These results indicate the high use of mobile phones by farmers to consult one another.

(b) Whether respondents know sources of agricultural information

Finding in figure 6 above show that 59% of the respondents do not know where to access agricultural information using ICTs tools while 41% are aware of the sources for agricultural information. The results tell that farmers rely on one another to consult on agricultural information through probably use of mobile phones.

4.3.3 Information communication Tools used most to access agricultural information

Table 4 below gives details of the most accessed and used ICT tools by the onion farmers.

Variables	X-tics	Frequency	Percentage
The ICT tools most used for accessing agricultural related information	Mobile phone	46	32
	Radio	84	58
	Television set	14	10
The tool respondents prefer most	Mobile phone	63	53
	Radio	40	33
	Television set	17	14
The ratio of radios to family members in the family	1:1	34	28
	1:2	60	50
	1:3	21	18
	1:4	5	4
The ratio of phones to family members in the family	1:1	30	25
	1:2	41	34
	1:3	25	21
	1:4	24	20
The ratio of television sets to family members in the family	1:1	106	88
	1:2	14	12
Whether the respondent thinks his/her family needs more ICT tools	Yes	107	89
	No	13	11

to be able to get enough agricultural information

Table 4. Information communication Tools used most to access agricultural information
Data source: Field Study data, 2017

4.3.3.1 ICT tools most used for accessing agricultural information;

A close look at the results in table 4. above reveal that 58% of the respondents cited radio as the ICT tool used most for receiving agricultural related information, 32% mentioned a phone, and 10% mentioned television. These results are not surprising given that most farmers in rural areas at least have access to radios. It is also important to note that 63% of the respondents preferred getting agricultural information using a mobile phone and probably this can be explained by the factor the most phones currently consist of radio receivers, making the phone handy as a result of multitasking.

4.3.3.2 Ratio of ICTs tool to family members

Results further reveal that 50% of the respondents cited a ratio of 1:2 for radio to family members and this statistic tells why the radio is used most for accessing agricultural information.

The majority 34% also cited a 1:2 ratio of phones to family members. This shows that probably the respondents preferred using phone for agricultural information due to the portability of the phone. Results further reveal that 88% of the respondents cited a 1:1 ratio of television sets to family members in the family. Results further revealed that majority of the respondents consisting of 89% thinks that their family needs more ICT tools to be able to get enough agricultural information.

4.4. How the Available ICT tools are being used by onion farmers to access agricultural extension information.

This section looks at how the available ICT tools are being used to accessed agricultural information.

4.4.1 Frequency of using ICT tools to access agricultural extension information

Figure 9 below shows the rate of utilizing ICT tools by onion farmers to access agricultural information.

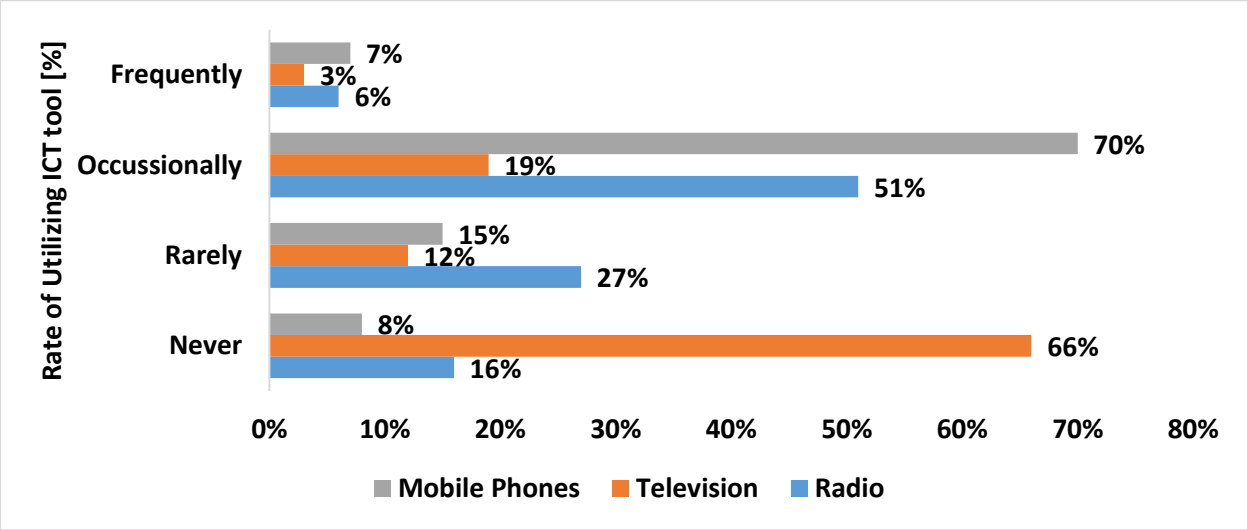

Figure 9. Frequency of using ICT tools to access Agricultural Information
Data source: Field Study Data, 2017

Results in figure 7 indicate that 70% use mobile phone occasional to access agricultural information, 15% rarely use a mobile phone, 8% have not used a mobile phone and 7% frequently

use a mobile phone. These results of phone use indicate the farmers tend to call either fellow farmers or friends and consult about agricultural information.

The results in the above figure further reveal that 51% of respondents use radio occasionally, 27% rarely, 16% have never got any agricultural information using the radio and 6% frequently access agricultural information through the radio. The results indicator that the radio is one of the ICT tool that farmers constantly use to access agricultural information.

In addition to the radio and mobile phone, the figure above further reveals that 66% have never use TV for agricultural information, 19% occasional access, 12% rarely access while 3% frequently access agricultural information through a TV. These results show that a TV are not used.

4.4.2 How the Radio and Television ICT tools are used by onion farmers

Table 5 below shows how the radio and Television ICT tools are used by onion farmers to access agricultural information.

Variables	X-tics	Frequency	Percentage
The number of hours spent on Radio listening to agriculture programs monthly.	less than 1	113	78
	between 2 to 3	20	14
	Above 4	11	8
Agricultural programs that can be heard in a month by the respondents on radio	One	102	71
	Two	26	18
	Above Three	16	11
Whether the time given for agricultural information programs on Radio and Television is convenient	Yes	10	7
	No	134	93
The reasons for preferring to watch agricultural programs on TV	TV is audio visual	43	18
	TV is interesting to watch	40	16
	Due to the languages TV present information	24	10
	Demonstration	76	31
	Timely transmission	61	25

Table 5. How the radio and Television ICT tools are used by onion farmers
Data source: Field Study Data, 2017

Results in table 4, show that 78% of the respondents spend less than one hour listening to agricultural programs on radio, 14% spend between 2 to 3 hours while 8% spend more than four hours in a month. These results indicators that either farmers do not know when agricultural programs are relied on the radio or programs are relied during times when farmers are busy in their farm fields.

Results further reveal that 71% of the respondents listen one agricultural programs in a month, 18% listen to two agricultural programs and 11% more than three programs in a month. These results justify the why farmers have reported that most radio stations spend a lot of time playing music or discussing political programs, giving less time to agriculture or development programs. Study results also reveal that 93% of the respondents mentioned that the time given to agricultural programs on radio or TV was not convenient and these tells why farmer mentioned that most agricultural programs are put on radio at wrong hours of the day, thus making it difficult to be listen to.

In the study, farmers were also asked if they preferred listening to agricultural programs and why? 31% said that TV programs are better since the demonstrate why they are talking about and they show pictures of what is being talked about. This makes it easier to follow and understand what is being said.

4.4.3 Time of the day when Agricultural extension information is shared on Radios.

Figure 10 below, shows details of when agricultural extension information is usually shared on radios during in a day.

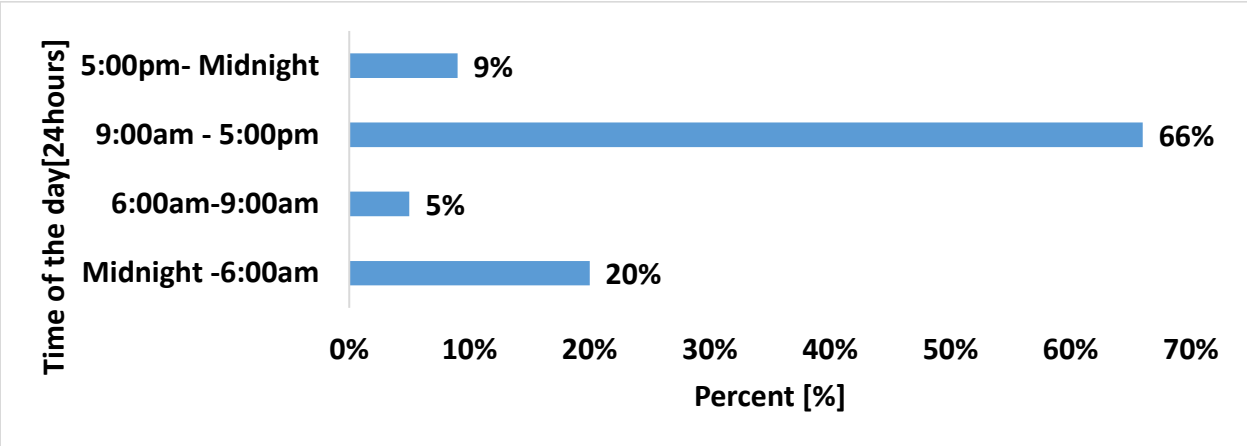

Figure 10. Time of the day when agricultural programs are shared on radio
Source: Field Study Data, 2017

From figure 8 above, shows that 66% of the Farmers reported that agricultural extension programs are to run on the radio between 9:00 – 5 :00pm, 20% reported programs running between midnight-6:00am, 9% between 5:00pm-midnight and 5%6:00am to 9:00am. These findings indicate that most agricultural extension programs are run during the day time when farmers are busy in their gardens and not favoring them to listen the programs. Study findings further reveal that 87% of the respondents noted that the time given for agricultural information program on radios is not convenient. See below one of the quote from a respondent;

> …in this district, we have 6 radio stations and all of them are always playing music from morning to evening …at night time they discuss politics and I wonder why they do not fix teaching programs for agriculture like from

8:00pm to about 11:00pm… Respondent, Nyantobooma village, August 2017.

4.4.4. How the mobile phone is used by the respondents in their day to day business

Figure 11 below shows what onion farmers use the mobile phone for in their day to day business activities.

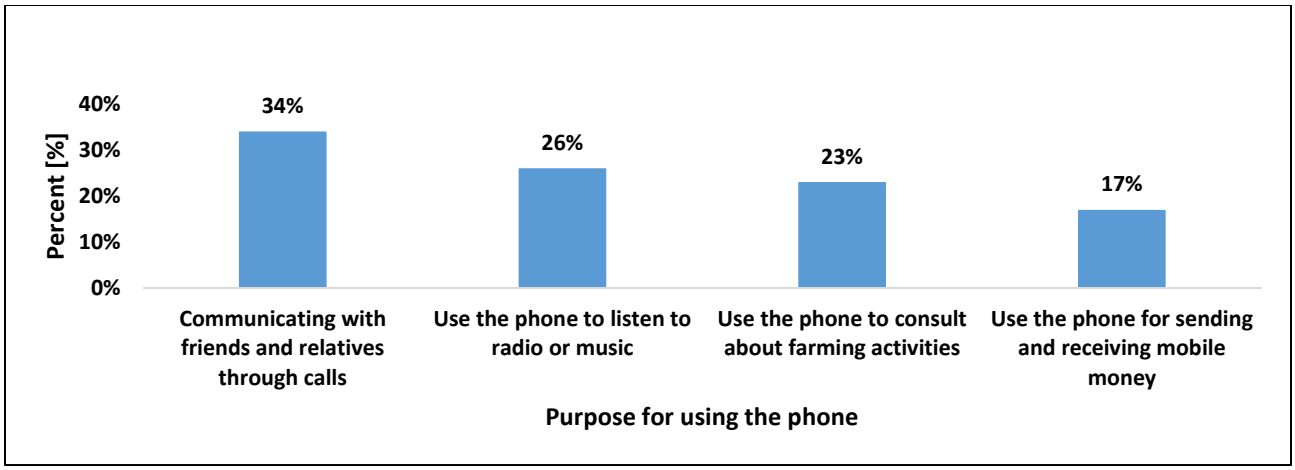

Figure 11. How a mobile phone is used by the respondents
Source: Field Study Data, 2017

Results in figure 9 above reflect that 34% of the mobile phone users among the respondents use the phone for communicating with friends, 26% use the phone for listening to radio or music, 23% use the phone to consult about agricultural information and 17% use the phone for sending and receiving money. The results of the above give a reflection that probably farmers if farmers knew the right sources of agricultural information, they could potentially call and seek advice about farming.

4.4.5 Agricultural information received by farmers through ICTs (Radio and Television)

Figure 12 below shows the kind of agricultural information received by farmers through use of Radio and television ICT tools.

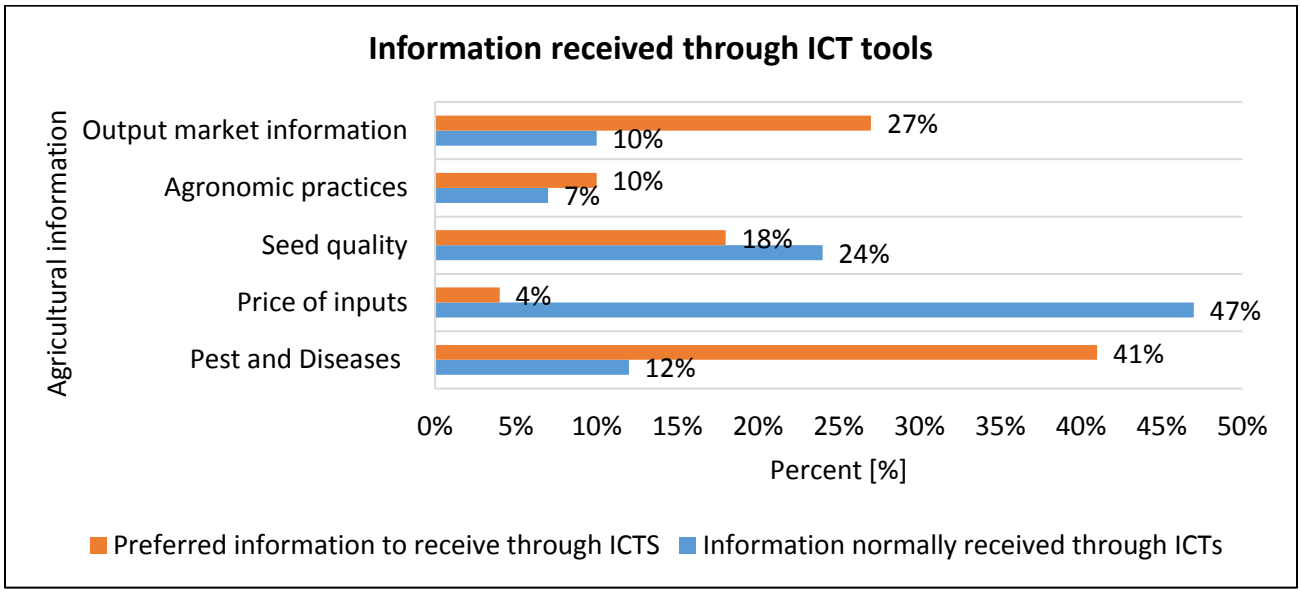

Figure 12. Agricultural information received by farmers through radio and Television Source: Field Study Data, 2017

Finding in the above figure (10) show that 47% of the respondents cited price of inputs as the type of Agriculture information normally received through the ICTs tools. While 41% of the respondents cited pest control knowledge as the agricultural information farmers would prefer to receive through the ICT tools but they don't receive it regularly and at the appropriate time.

Below is a quote for one of the farmers about their preferred information to receive through ICTs;

> …sometimes I receive messages on phone about agricultural information, but all of the text messages talk about the reduced prices of seeds; …and for the Radio, I receive information about where agro input shops are located and how they have good prices for their products. …when the district agricultural officers

are on radio they only tell us about how to plant bananas and they forget about other crops. Respondent, Nyantabooma village

4.4.6 The reasons for preferring to use the different ICT tools

Figure 13 below, gives details of why farmers prefer using the different ICT tools they possess.

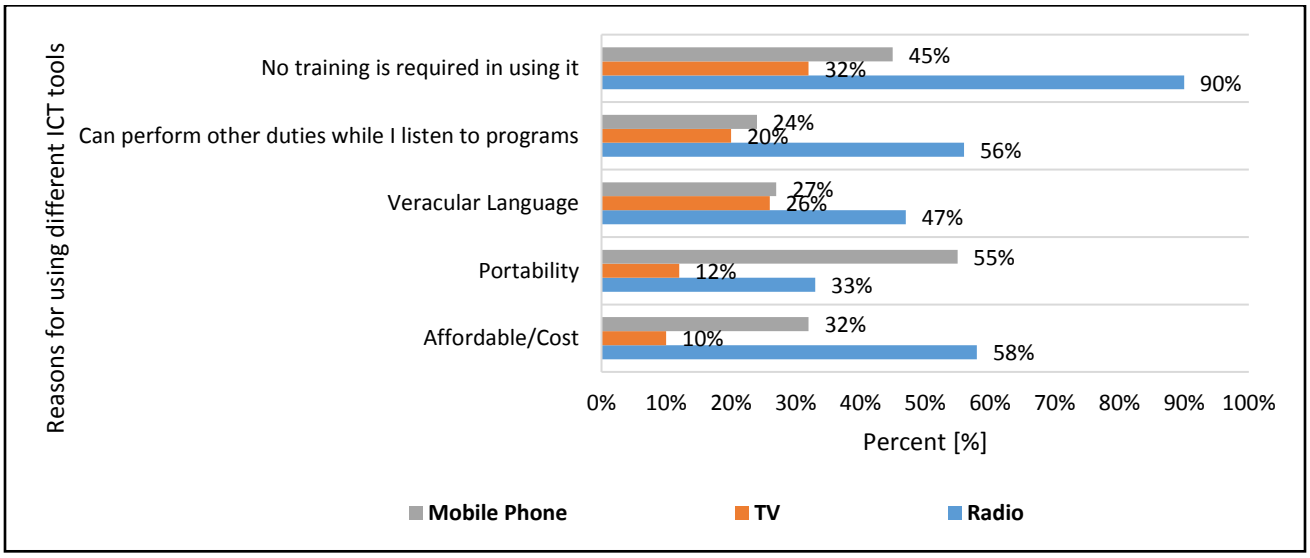

Figure 13. Reasons for preferring to use the different ICT tools
Source: Field Study Data, 2017

The study reveals that 58% of the respondents noted that radio is affordable, 32% noting that mobile phone is affordable, while 10% noted that TV is not affordable but rather gives visual images which help farmers to understand exactly some of practices. Results further revealed that 55% noted that mobile phones are portable and 33% noting that that radio is portable. Below is a farmer comment on why he thinks portability of the radio and mobile phones makes them ideal ICT tool to use for accessing agricultural information;

> …Radio and phones are portable in a sense that, these days mobile phones are killing two birds using one stone; most phones have a radio integrated which means one is always having a radio through the phone, and a phone is small enough to fit into a pocket. However, one of the challenges with phones that have a component of the radio is that their batteries do not last

> long and you have to keep charging all the time and yet power in our village is difficult to get… Respondent, Nyantobooma village, August 2017.

Findings further reveal that 43% noted that radio provides information in vernacular language, and sometimes TV (26%) as well as mobile phones (31%) provides information also in vernacular language. Results further revealed that 56% noted that mobile phones can perform other duties while they listen to programs, 24% cited radios and lastly 20% cited Television.

59% of the respondents noted that Radio does not require training in using, while 32% noted that TV do not need training in using as well.

4.5 Socio-economic characteristics that have an influence on respondents use of ICT tools to access agricultural extension information

A total of 144 farmers were involved in the study and in order to understand the socio-economic characteristics of onion farmers that influence them(farmers) to use of ICTs to access agricultural information, a logit model was used to analyze the data as reflected in table 6. A farmers' use of ICT tools, was measured using a binary choice variable of "Yes" or "No" where Yes- signifies farmers' use or No for not using the ICT tool. The study model had ten continuous and six dummy variables that were modeled. Study findings revealed that a total of eleven variables were found to be significant at less than or equal to ten percent probability level out of the sixteen as having influence on farmers use of ICT tools to access agricultural information.

Based on the model results, access to ICT tools, access to agricultural loans, education, on farm income, training in ICTs use, frequency of getting agricultural programs, number of farming plots, knowing sources where to get agricultural programs, were statistically significant to have an influence on a farmers use of ICT tools to access agricultural information. While the rest were

not significant at (P<0.10) probability level which included age, household size and distance to market.

Table 6. The logistic regression model for social economic factors influencing use of ICT tools to access agricultural extension information

Variable	Odd Ratio	P>|Z|
Age	0.886*	0.086
Sex	5.705NS	0.438
Education level	1.807***	0.009
Household Size	0.427***	0.006
Number of farming plots	1.503**	0.036
Nearest Market distance	0.258**	0.036
Off Farm Income	1.000NS	0.695
On Farm Income	1.001**	0.034
Access to Agricultural Loans	0.33*	0.068
Frequency of visiting Trading Centre	1.070NS	0.855
Frequency of consulting extension officer	0.757NS	0.607
Frequency of getting Agri Programs	2.801**	0.007
Know sources of Agri Programs	121.985*	0.072
Access to ICT tools	0.058*	0.073
Trained in use of ICT tool	322.477**	0.014
Ownership of land	40.842NS	0.157
LR Chi2(16)	164.80	
Probability>Chi2	0.0000	
Pseudo R2	0.8266	
Loglikelihood	-17.288271	
Number of observations	144	

Table 7. The logistic regression model for social economic factors influencing use of ICT tools to access agricultural extension information

Source: Field Study Data, 2017

4.5.1 Interpretations of the significant explanatory variables.

Age: Age showed a negative influence on use of ICTS to access agricultural information, implying that onion farmers who are advanced in age may not be interested in use new technologies to access

agricultural. The variable showed an odd ratio of 0.886 implying that chance of using ICTs can reduce by a factor of 0.886 as the farmers age increases by one year.

Education: Education variable reflects as positive influence on use of ICT to access agricultural information with a P value of less than 0.01, with an odd ration of 1.807, which indicates that the use of ICT for accessing information can increase with a factor of 1.807 as the education status of an onion farmer increases by one year.

Household Size: The size of the family negatively influences use of ICTs to access agricultural information among farmers at P value of 0.01 with an odd ratio of 0.427 indicating that the use of ICT for getting agricultural information decreases by a factor of 0.427 as the family size increase by one unit. This reflected that a family's priorities getting food for their family members rather than investing is ICT tool.

Nearest Market Distance: The distance of a farmer's homestead from an onion market has a negative influence on farmers use of ICTs to access agricultural information at a P value of less than 0.05. The result shows that onion farmers who leave a distance from any potential onion market pauses challenges for them to access farmer inputs from the market and this makes travels to markets costly. Farmer homestead distance from an onion market reflected an odd ratio of 0.258 which reflected that as the distance to the market increases by a factor of 0.258 the likelihood to use ICTs reduces.

Training in use of ICT tools: Training in use of ICT tools is positively associated($P<0.05$) with the use of ICT tools to access agricultural information. This implies that farmers who are used in use of ICTs tools have sufficient knowledge and skills how to utilize the tools in search of

agricultural information. The results in table show an odds ratio of 322.477 which implies the use of ICTs can increases by a factor of 322.477 if a farmer receives any ICT use training.

Number of farming plots: Number of farming plots by a farmer is positively influences use of ICTs to access agricultural information and significant at ($P<0.05$). This implies that a farmer more than one plots for farming is likely to have more incomes and a better perception to using ICTs for agriculture. The variable shows an odds ratio of 1.503 which implies that, if other things to be constant, the odd ratio in favor of the use ICTs in search for agricultural information increases by a factor of 1.503 as the number of plots increase by one unit.

On farm income: On farm income for farmers showed a positive influence on farmers use of ICT tools to access agricultural information. These results show that farmers who earn more from their onion farms are can afford the ICTs as well as being motivated with increasing revenue from farming. The got result was significant at ($P<0.05$), with an odd ratio of 1.001, which reflects, the use of ICT tools can increase with a factor of 1.001, if there is an increase in income, that is if the other variables are constant.

Access to agricultural loan: Access to an agricultural loan is one way which facilitates bridging the gap when a farmer is in need to use a given technology. Acquiring an agricultural loan positively influence use of ICTs in getting agricultural information by farmers ($P<0.1$). This implies that a farmer requires cash as direct means to use of ICTs to access information about agriculture. The positive odds ratio shows appositive influence of the probability of use of ICTs in agricultural extension increases. The odds ratio of 0.033 for access to agricultural loans implies that, other things being constant, the odd ratio is in favor of the use ICTs and increases by a factor of 0.033 as access to agricultural loan increases by one unit.

Access to ICT tools: Access to ICT tools shows positive influence in use of ICTs to access agricultural information by farmers ($P<0.01$). The odds ratio of 0.058 for access to ICT tools indicates that other thing being constant, the odd ratio is in favor of the use of ICTs among farmers' increases by a factor of 0.058 as access to ICT tools increases by one unit.

Frequency of getting Agricultural Programs: The frequency of getting Agricultural programs has positive influence on use of ICTs to access agricultural information by farmers ($P<0.05$). This implies that if a farmer continuously listens to agricultural programs it significantly influences his/her need to use of ICTs. The odds ratio of 2.801 for number of times agricultural programs indicates that, the use of ICTs in agricultural extension increases by a factor of 2.801 as listening to agricultural program increases by one unit.

CHAPTER FIVE: DISCUSSION

5.1 The information communication tools (ICTs) readily available for accessing agricultural extension information

Finding of the study showed that 80% and 70% of the respondents have access and own a radio respectively, 73% and 66% have access and own mobile phone respectively while 20% and 6% have access and own a Television respectively. The results indicate that most people at least own a radio and mobile phone, and this can be explained by the advancement in mobile phones which are currently coming with inbuilt radio receivers thus facilitating farmers to have access to both a mobile phone and radio.

At the same time, with the recent increase in FM radio stations, it has also compelled people in rural areas to acquire radio receivers to have access to general information about both local, national and international affairs. Television access is at 20% while ownership of television is at 6% and this indicates that some people can access television but do not own, and this can be explained by the increase in the number of local video cinemas halls locally called "BIBANDA" that show football and the many bars in trading centers with TVs which are acquired with aim of attracting customers by showing news.

These results are in line with Mbugua, (2012) who noted that former channels of communication that have been used were commonly which are monologue and have not allowed much interaction, but the new ways of communication are being adopted via ICTs such as the Internet, email, mobile phones, and electronic sources among others. ICTs are, therefore, innovations that are perceived

as new by both the agricultural researchers, extension workers and farmers and have been adopted to facilitate communication of agricultural information.

5.1.1 ICT tools most used for accessing agricultural information;

A close look at the results revealed that 58% of the respondents cited radio as the ICT tool used most for accessing agricultural extension information, 32% mentioned a phone, and 10% mentioned television. These results are not surprising given that most farmers in rural areas at least have access to radios. It is also important to note that 63% of the respondents preferred getting agricultural information using a mobile phone and probably this can be explained by the fact that most phones currently consist of radio receivers, making the phone handy because of having two components that is a radio and phone components.

5.1.2 Ratio of ICTs tool to family members

Results from the research show that 50% of the respondents cited a ratio of 1:2 for radio to family members and this statistic tells why the radio is used most for accessing agricultural information. These results are in line with Sanusi (2010) who noted that FM radios have scored high in popularity and listenership in developing countries because of their focus in broad casting in local languages

5.1.3 Use of ICT tool and whether farmers know the sources of agricultural extension information

Study findings showed that 39% of the respondents have ever used ICT tools to receive agricultural information, while 61% have not used the ICT tools to receive. While 59% of the respondents do not know where to access agricultural information using ICTs tools and 41% are aware of the

sources for agricultural information. Agricultural information. These results indicate that farmers use ICT tools to consult one another on issues of farming, which is peer to peer consultations.

5.2 How well the available ICTs are being used to relay agricultural extension information.

Study results reveal that majority of the respondents consisting of 70% use mobile phone to consult about agricultural information occasionally, 51% mentioned using a radio occasionally and 19% use TV as well, but occasionally. This is in line with Rebekka *et al.*, (2014) who asserted that use of mobile phones is setting an unprecedented pace despite the poorly developed rural electrification in rural areas. Mobile technology has provided multi-dimensional benefits to the rural people. Its importance in usage is clear in sense of urgency and emergency. A similar study carried out in Kenya found out that Mobile phones were widely used by the farmers for social communication, contacting middle men for the marketing of produce and contacting experts on real time basis for getting agricultural advisories. Finding from this study and other research show that it's the mobile phone that is changing the art of doing business in Kabarole district among onion famers and other people in the rural area.

Study results revealed that 34% of the mobile phone users among the respondents use the phone for communicating with friends, 26% use the phone for listening to radio or music, 23% use the phone to consult about agricultural information and 17% use the phone for sending and receiving money. The results of the above give a reflection that probably if farmers knew the right sources of agricultural information, they could potentially call and seek advice about farming. These findings are in line with Nazari and Hezbollah (2008), who noted that mobile phones proved to be useful during health emergencies.

Study findings also showed that 47% of the respondents cited price of inputs as the type of Agriculture information normally received through the ICTs tools. While 41% of the respondents cited pest control knowledge as the agricultural information farmers would prefer to receive through the ICT tools but they don't receive it regularly and at the appropriate time as quotes by one farmer who said that;

> …sometimes I receive messages on phone about agricultural information, but all of the text messages talk about the reduced prices of seeds; …and for the Radio, I receive information about where agro input shops are located and how they have good prices for their products. …when the district agricultural officers are on radio they only tell us about how to plant bananas and they forget about other crops. Respondent, Nyantabooma village

Results from the study are in line with a study conducted by Rebekka in Northern India, who found out that farmers reported using ICTs to know the market days, to know where products could be sold and identifying different market location for efficient marketing of produce. The findings are also in line with Nakweya (2013) who noted that it is possible for farmers to use mobile phones too to consult on market prices through peers, which is true as the results have reflected.

5.3 What are the factors influencing use of ICTs by onion farmers?

From the logit regression model results, Education, Training in use of ICTs tool, Farming plots, on farm income, access to agricultural loans, access to ICT tools and Knowing sources of agricultural program were found to be positively significant in determining the decision to use ICT tools by farmers. While Age, number of people living in farmers household and distance to nearest market were found to have a negative influence on farmers decision to use ICTs tools to access agricultural information.

For factor that show a positive influence on use of ICT tools and holding all other factors constant for each of the positive variable, an increase in education level by one year is estimated to increase

use of ICT tools to access agricultural information by a factor of 1.807, hence the likely that the more educated a farmer is the more likely to use ICT tools to seek agricultural information. These results are in line with Amos *et al.,* (2017) who found out in their study that the more educated a farmer is the more like they are to adopt to using ICT tools to search for market information from the Kenyan commodity Exchange systems.

The study also revealed that the frequency of extension contacts with the farmer was not statistically significant, perhaps an indication of a weakening value of extension services to farmers and this could be attributed to the rather erratic contact between extension workers and the farmers. The finding are in line with Mittal *et al.,* (2010) who found out that the deficiency of extension staff and poor access to information has impeded the transfer of technology at the farm level.

Further analysis shows that gender was not statistically Signiant to influence use of ICT to access agricultural information and these finding are deviation from Amos *et al* (2017), who found out that gender had an influence on technology use, where men were found likely to use ICT tools as compared to women while accessing agricultural information.

The study also revealed that age had a negative influence on use of ICT tools to access agricultural information, implying that onion farmers who are advanced in age may not be interested in using new technologies to access agricultural. The findings concur with Amos *et al.*, (2017 who found out in their study that age had an inverse relationship to the likelihood of using of ICT tools to access market information from the KACE system. The is also in line with Okello *et al.*, (2011), who urged that it young farmers who embrace use of ICTs to access agricultural information.

The showed that the many farming plots an onion farmer had, it positively impacted on use of ICT tools to access agricultural information. This implies that a farmer who had more than one plots for farming was likely to have more incomes and a better perception to using ICTs for agriculture. Similarly, It has been established that farm size exerts a positi1ve influence on the adoption of improved technologies which may in turn increase production (Yenealem, 2006; Kacharo, 2007). Farmers with large farms are likely to be better informed and are able to take risk associated to experiment with new practices (Nkonya *et al*., 1997).

The study reveals that distance of a farmer's homestead from an onion market has a negative influence on farmers use of ICTs to access agricultural information at a P value of less than 0.05. The result shows that onion farmers who leave a distance from any potential onion market pauses challenges for them to access farmer inputs from the market and this makes travelling to markets costly.

Farmer homestead distance from an onion market reflected an odd ratio of 0.258 which reflected that as the distance to the market increases by a factor of 0.258 the likelihood to use ICTs reduces. These findings deviation from Amos *et al.*, (2017) who found out that there was no demonstrated relationship, between the extent of use of ICT tools and distance to the nearest market travelled by farmers.

However, some other studies suggest an inverse relationship between distance to the market and number of mobile phone calls by farmers for agricultural transaction purposes (Okello *et al.*, 2011). The difference in the results could be attributed to the fact that the previous studies focused on using mobile phones with interest in making calls. While this study was based on different ICT tools.

In the study, ownership of a phone or radio (ICT tools) showed a positive influence to using ICTs tools to access agricultural information by farmers ($P<0.01$). This implies that if has a high chance of using ICT tools to access agricultural information, they possess the tools. In one of the studies it was found out that mobile ownership increases the likelihood of intensifying access to information (Amos *et al.,* 2017). Although some researches have argued that farmers use mobile phones for mostly non-agricultural transactions, such as money transfer (Kirui *et al.,* 2010).

CHAPTER SIX: CONCLUSION AND RECOMMENDATION

6.0. Introduction

This chapter covers the overall study summary, conclusions and recommendations that may inform policy development in provision of agricultural extension services using ICT tools.

The study sought to find out the use of ICT tools in accessing agricultural extension information by onion farmers at Harungongo Sub county, Kabarole District, Western Uganda. Specifically, the study looked at; a) finding out the information communication tools (ICTs) readily available to farmers for use in accessing agricultural information? b) to evaluate how well the available ICT tools are being used to relay agricultural extension information and, c) to determine the social-economic factors that influence the use of ICT tools to access agricultural extension information.

In the study, data was collected by use of questionnaires and conducting key informant interviews with a total of 162 respondents and three agricultural officers respectively. After a thorough review of the collected data, a total of 144 respondent's questionnaires were verified as valid and included in the analysis. Data was analyzed using descriptive statistics to characterize the population and to characterize how well the ICT tools are being used as well as use of logit regression to determine factors influencing use of ICT tools to access agricultural extension information.

6.1 Summary of the Findings

The study found out that 80% and 70% of the respondents have access and own a radio respectively, followed by 73% and 66% who have access and own mobile phone respectively. Interestingly, more than 66% of onion farmers have access to either a radio or mobile phones, but are not able to utilize the tools to access agricultural extension information mainly due to not knowing the sources of agricultural information.

Study results revealed that majority of the respondents consisting of 70% use mobile phone to consult about agricultural programs occasionally, 51% mentioned using a radio occasionally and 19% use TV as well but occasionally. While 66% of the Farmers reported that agricultural extension programs on radios are run during wrong hours, when farmers are busy in their gardens not favoring them to listen the programs. Below is a quote from one of the respondents;

> …in this district, we have 6 radio stations and all of them are always playing music from morning to evening …at night time they discuss politics and I wonder why they do not fix teaching programs for agriculture like from 8:00pm to about 11:00pm… Respondent, Nyantobooma village, August 2017.

Study also revealed that most farmer mentioned that prices of inputs is the type of agricultural extension information commonly received through radios and phones.

From the logit regression model, results showed that, Education, Training in use of ICTs tool, Farming plots, on farm income, access to agricultural loans, ownership of ICT tools and listening to agricultural program have a significant ($P<0.05$) positive influence on use of ICT tools to access agricultural information. While Age, number of people living in farmers household and distance to nearest market were found to have a negative influence on farmers decision to use ICTs tools to access agricultural information. It is important to note that the frequency of extension contact with the farmer and gender were found not statistically significant ($P<0.05$) in influencing ICT use.

6.2. Conclusion

It was established that the most used ICT tool in Harugongo is a mobile phone and sometimes a radio because of these tools being available and easy to access by most respondents and this implies that most onion farmers have access to ICT tools, but rather the challenge is how to use the tools to access the agricultural information. The study further established that the number of agricultural programmed put on radios are also limited, and are aired at wrong times to favor farmers, this implies that farmers miss on agricultural programs due to them being aired at wrong hours of the day and if they are aired, the number of programs aired are so minimum to be tracked by the farmers.

Most farmers in Harugongo have limited access to Television and this means, it not wise for the district to air agricultural programs through television since they reach few farmers.

The study found out that age, education, household size, Market distance from home, number of farming plots, on farm income and training in use of ICT tools, significantly influence the decision by farmers to use ICT tools. Farmers who are considered more educated, are more outgoing and willing to know what is going on in their environment as compared to the less educated and therefore more likely to use ICT tools to access agricultural extension information.

The study also revealed that age is likely to be a hindrance in technology adoption, with young people being more likely than older people to embrace new ways of doing things. Adoption models have shown that ease of use influences acceptance of technology (Snowden et al., 2006).

6.3. Recommendation

Based on the logit regression model, on farm income was found to have a strong influence on farmers decision to use ICT tools therefore, it can be suggesting that the Government, should put in place systems that facilitate farmers to get genuine inputs and markets for their products such that farmers can begin appreciating and realizing the benefit on increased incomes.

The amount of airtime given to agricultural programmers on both radios and televisions should be increased such that farmers can get enough information and all the district needs to recognize the key crops grown in the area and used as cash crops by farmers for income such that the right information about agronomic practices is given about each of those crops.

Given that a lot of farmers are using a mobile phone to consult their peers or extension office or input suppliers about agricultural extension information, the Ministry of Agricultural should consider establish hotline contact phone in each ecological zone, where farmers can all and consult about agriculture extension information.

The government of the republic of Uganda through the ministry of agriculture should take the initiative to sensitize the public on the sources of agricultural information which farmers can always utilize at their convenience.

Given that age has a negative influence on use of ICT tools to access agricultural information, there is need to design technologies that takes care of the interest of the older people involved in agriculture, such as use of radios and having the programs played at right time that favor farmers to listen in.

As study finding have indicated, that most farmers do not know where to access agricultural information with exception of consulting one another, therefore there is need to sensitize

smallholder farmers on the sources/portals providing agricultural extension information and which information need to be provided at the time that also suits farmers schedules of farming.

Since training in use of ICT has been found to influence use of ICT tools to access agricultural information, therefore, it can be recommended that ICT education should be built into the extension delivery package of extension agents to farmers particularly the use of the mobile phone since this is capable of eliminating the series of wasteful trips to get at the extension workers

Since the study revealed that family size influence use of ICT by farmers negatively and significantly. This implies that there is need to integrate extensions services with some messages on family planning, that could probably encourage people to use family planning.

6.4. Suggestions for Further Research

- A study should be conducted to understand the intensity of utilizing the various tools while accessing agricultural extension information. Such a study will facilitate in revising the agricultural extension policy where extension officers can potentially engage more in use of ICT tools rather than conducting community visits.
- A study should be conducted to understand the readily available sources of agricultural extension information, if they exist and why farmers are not utilizing those sources.
- A quasi experimental study should be conducted by the ministry of agricultural to compare the traditional extension service delivery model used by NAADs and the Wealth creation team against the use of ICT based extension services to compare the two approaches how they compliment each other.

REFERENCES

Ajani, E.N. and Agwu, A.E. (2012) Information Communication Technology needs of small scale farmers in Anambra state, Nigeria. *Journal of Agricultural and Food Information,* 13(2):144-156., doi: 10.1080/10496505.2012.663694

Alenea, Arega D. and V. M. Manyong. 2006. "Farmer-to-farmer technology diffusion and yield variation among adopters: *The case of improved cowpea in northern Nigeria." Agricultural Economics*. 35: 203-211.

Amos W. W, Sabina M. W and Julius J. O, (2017). Determinants of Use of Information and Communication Technologies in Agriculture: *The Case of Kenya Agricultural Commodity Exchange in Bungoma County, Kenya. Canadian Center of Science and Education*: Journal of Agricultural Science; Vol. 9, No. 3

Anderson, Jock R. and Gershon Feder. 2007. "Handbook of Agricultural Economics." *Agricultural Extension.* 3: 2343-2378

Baryamureeba, V. (2004). ICT as an Engine for Uganda's Economic Growth: *The Role of and Opportunities.* Growth (Lakeland), 468–483.

Bell M (1979) The exploitation of indigenous knowledge or the indigenous exploitation of knowledge: *whose use of what for what*? IDS Bulletin, 10 (2), 44-50.

Cieslikowsk, D.A., Halewood, N.J., Kimura, K., and Zhen-Wei Qiang.C (2009), Key trends in ICT development, *World Bank Report.* Retrieved on August 7, 2010, from the Communication.

Chabossou, A., Stork, C., Stork, M., & Zahonogo, Z. (2009). *Mobile telephony access and usage in Africa*. Paper presented at the Information and Communication Technologies and Development (ICTD), 2009 Proceedings of the Third International Conference on Information and Communication Technologies and Development, Carnegie Mellon Qatar, Doha, Qatar, April 17-19, 2009.

Diao, X., P. Hazell, D. Resnick, J. Thurlow. (2007). *The role of agriculture in development: Implications for Sub-Saharan Africa*. IFPRI Research Report No. 153. Washington, DC: IFPRI.

District Development Plan 2015/2016- Kabarole District

District Annual Report, 2016 – Kabarole District

Duncombe & Heeks, (1999). Information, ICTs and small enterprise: Findings from Botswana. *Development Informatics Working Paper No. 7*. Manchester: Institute for Development Policy and Management.

FAO (2014). *The State of Food and Agriculture: Innovations in Family Farming.* Communication for Development Group, Sustainable Development Department. Rome: FAO.

FAO (2001). *Knowledge and information for food security in Africa from traditional media to the Internet.* Communication for Development Group, Sustainable Development Department. Rome: FAO.

FAO. (2000). *Agricultural Knowledge and Information Systems for Rural Development* (AKIS/RD). Strategic Vision and Guiding Principles. Food and Agriculture Organization of the United Nations.

Farm Radio International (2008). *The economics of rural radio in Africa*

Fafchamps, M., B. Minten, E. Gabre-Madhin, (2005). *Increasing returns to market efficiency in Agricultural Trade.* Journal of Development Economics 78(2):406-42.

Gollin, D., & Rogerson, R. (2010). *Agriculture, Roads and Economic Development in Uganda.*

Jensen's, (2007). *The digital provide: Information (technology), market performance, and welfare in the South Indian Fisheries Sector*. The Quarterly Journal of Economics.

Kacharo, D. K. (2007). *Agricultural Information Networks of Farm Women and Role of Agricultural Extension:* The Case of Dale Woreda, Southern Nations, Nationalities and Peoples' Region. Msc Thesis in Rural Development and agricultural Extension, Haramaya University Ethiopia.

Kameswari, V.L.V., Kishore, D. and Gupta, V. (2011) *ICTs for Agricultural Extension: A study in the Indian Himalayan region.* The Electronic Journal on Information Systems in Developing Countries. 48(3):1-12.

Karen Vignare, (2013). *USAID Options and strategies for information and communication technologies within agricultural extension and Advisory services.* Michigan State University

Kirui, O. K., Okello, J. J., & Nyikal, R. A. (2010). *Awareness and use of m-banking services in agriculture:* The case of smallholder farmers in Kenya. Paper presented at the 2010 AAAE Third Conference/AEASA 48th Conference.

Kiplangat, J. and Ocholla, D. N. (2004). *Diffusion of Information and Communication Technologies in communication of agricultural information among agricultural researchers and extension workers in Kenya:* SAJnl Libs & Info Sci 2005, 71

Kibazo, P and Kanaabi, H. 2007. *FM stations in Uganda: Quantity without quality*. Kampala: EAMI.

Local Government Budget Framework Paper, Vote 513, Kabarole District, 2016/2017

Mabe, L.K. and Oladele, O.I. (2012). *Awareness level of use of Information and Communication Technologies among Extension Officers in the North-West Province.* South -Africa.

Munyua, (2007). ICTs and small-scale agriculture in Africa: a scoping study. Final Report.

MAUNDER, A. (1973) Agricultural Extension: A Reference Manual (1st Edition). FAO.

Mazammel, M. (2012). *Development Communication: Challenges in an Empowered Information Environment*. Accessed November 6, 2012.

Mugenda, O.L., and A.G. Mugenda. (1999). *Research Methods: Quantitative and Qualitative Approaches.* Nairobi: African Centre for Technology Studies (ACTS)

Munyua, H., & Adera, E. (2010). *Emerging ICTs and Their Potential in Revitalizing Small-Scale Agriculture*. Agricultural Information Worldwide, 2(1), 3-9.

Ministry of Agriculture (2012). *Sector Assessment and Opportunities for ICT*. Deloitte: Transform Africa.

Mittal, S. and Mehar. M. (2012). *How mobile phones lead to growth of small farmers? Evidence from India*. Quarterly Journal of International Agriculture 51 (3):227-244.

Mittal, S.and Mehar. M. (2013*). Agricultural information networks, information needs and risk management strategies: a survey of farmers in Indo-Gangetic plains of India.* Socio-economic working paper. Mexico

Mtega, W.P and Msungu, A.C. (2013). *Using Information and Communication Technologies for enhancing the accessibility of agricultural information for improved agricultural production in Tanzania.* The Electronic Journal on Information Systems in Developing Countries 56 (1):1-14.

Mittal, S., Gandhi, S., & Tripathi, G. (2010). *Socio-economic impact of mobile phones on Indian agriculture*. Indian Council for Research on International Economic Relations New Delhi.

Nkonya, E., Schroeder, T. and Norman, D. (1997). *Factors Affecting Adoption of Improved Production Technologies and Interface of Out-Reach Efforts with Farmers*. Journal of Agricultural Resources, 46(1).

Nakweya (2013). Radio, mobile phones could boost African farm yields. http://www.scidev.net/sub-saharanafrica/icts/news/radio-mobile-phones-could-boost-african-farm-yields.html.

Narender, K. and Anandaraja, N. (2008). *Information and Communications Technology for women experience of women managed internet kiosks at Melur, Tamil Nadu*. In: extension of technologies from lab to farm. Ed.

Nazari M.R.and Hasbullah, A.H. (2008). *Farmers approach and access to information and communication technology in the efficient use of modern irrigation methods*. European Journal of Scientific Research,. 21(1): 38-44.

Okello, J. J., Okello, R. M., & Ofwona-Adera, E. (2010). *Awareness and the use of mobile phones for market linkage by smallholder farmers in Kenya*.

Ozowa, V. N. (1995). *Information Needs of Small Scale Farmers in Africa: The Nigerian Example.* Quarterly Bulletin of the International Association of Agricultural Information Specialists, IAALD/CABI, 40(1).

Oyeyinka, R.A. and Bello, R.O. (2013). *Farmers Use of ICTs for Marketing Information Outlets in Oyo State, Nigeria*. Journal of Agricultural Science, 5 (11):150-158. ,doi: 10.5539/jas.v5n11p150

Richard Williams, 2015, Multicollinearity in logistic regression analysis. University of Notre Dame, https://www3.nd.edu/~rwilliam

Richardson Don, (2006*). ICTs – Transforming Agricultural Extension. The ACP-EU Technical Centre for Agricultural and Rural Cooperation* (CTA)

Snowden, S., Spafford, J., Michaelides, R., & Hopkins, J. (2006). *Technology acceptance and m-commerce in an operational environment. Journal of Enterprise Information Management,* 19(5), 525-539.

Simrin Makhija and David J. Spielman. (2016). *Digital Green's Video-based Extension Approach in Ethiopia: Promises for Gender Inclusive Extension. International Food Policy Research Institute:* Addis Ababa, Ethiopia; b International Food Policy Research Institute, Washington, DC, USA; c LAREFI, University of Bordeaux

Saravanan Raj and Rebekka Syiem(2004). *Access and Usage of ICTs for Agriculture and Rural Development by the tribal farmers in Meghalaya State of North-East India Asian Development Bank:* Building e-Community centers for rural development: Report of the regional workshop, Bali, Indonesia.

Soysa, (2007). *Traceability in agricultural markets: Using ICTs to improve traceability of Gherkins:* Presentation of initial learnings.

Sulaiman, R.V., A. Hall, N.J. Kalaivani, K. Dorai And T.S.V. Reddy, (2011). *Necessary but not Sufficient:* Information and Communication Technology and its Role in Putting Research into Use. RIU (Research in Use) Discussion Paper 16. UK.

Yamane. Toro (1967). Statistics: An introductory Analysis. 2nd ED, New York:Harper and Raw.

APPENDIX 1: QUESTIONNAIRE

Introduction

My name is …… a student of Uganda Martyrs University. I am undertaking an MSc in Monitoring and Evaluation. My research topic is to examine the use of ICT tools to access agricultural extension information by onion farmers in Harugongo sub-County Kabalore District.

I have chosen to include you in my study and promise to keep information prevailed to me with confidentiality. I therefore seek for your consent to ask you questions on this topic. I also request to record this session for further reflections on what shall be said to be able to accurately analyze and interpret my data later on.

Request for your consent I ……

(Name & signature) agree to take part in the study conducted by Businge Richard.

Questionnaire Code	_____	Interview Date	_____
Enumerator's Name:	_____	Place of interview:	_____
Telephone:	_____	Sub County	_____
Parish	_____	Village	_____

Please tick √ in the box and give comments where applicable.

SECTION A: FARMER PROFILE

A1: Gender: *1) Male* *2) Female*	***A2: What is your Age;*** 1) Married 2) Single 3) Divorced 4) Widow
A3: Level of education; 1) No formal education, 2) Primary 3) O' Level - Secondary 4) A' Level - Secondary 5) Vocational Education 6) College Education 7) University	***A4: Family Size;*** 1) Less than or equal to 6 people in the house (=<6) 1) More than 6 people in the house (>6)

SECTION B: INFORMATION COMMUNICATION TOOLS READILY AVAILABLE

FOR ACCESSING AGRICULTURAL EXTENSION INFORMATION

B1). Which of the following ICTs do you posses/have?(Check all that apply)

☐ Mobile Phone ☐ Radio ☐ Television set

B2). If you don't posses any of the above tool, which one do you access? (Check all that apply)

☐ Mobile Phone ☐ Radio ☐ Television set

B3). Do you use any of the above tools for receiving agricultural information?

☐ Yes ☐ No

B4). If yes, which of the ICT tool do you use most for receiving agricultural related information?

☐ Mobile Phone ☐ Radio ☐ Television set

B5). For the tools list below, which one do you prefer?

☐ ☐ ☐

Mobile Phone Radio Television set

B6). Give the reasons for preferring the above tool of communication?

……

……

……

B8). What is the ratio of radios to family members in your family?

☐ 1:2 1:3 ☐ 1:4 ☐ Only one

B9). What is the ratio of phones to family members in your family?

☐ 1:2 1:3 ☐ 1:4 ☐ Only one

10). What is the ratio of television sets to family members in your family?

☐ 1:2 1:3 ☐ 1:4 ☐ Only one

11). Do you think your family needs more ICT tools to be able to get enough agricultural information?

☐ Yes ☐ No

SECTION C: HOW THE AVAILABLE ICT TOOLS USED TO ACCESS AGRICULTURAL EXTENSION INFORMATION

C1). *How often do you use the radio to access agricultural programs on local radios*?

☐ Frequently ☐ Occasionally ☐ Rarely ☐ Never

C2). *How often do you use a phone to access agricultural information by either calling a friend or an extension officer?*

☐ Frequently ☐ Occasionally ☐ Rarely ☐ Never

C3). *How do you use the mobile phone to in your day to day business?*

a) Communicating with friends and relatives through making calls
b) Use the mobile phone to listen to radio or music
c) Use the phone to consult about farming activities
d) Use the phone for sending and receiving mobile money

C4). *How often do you use a TV access agricultural information?*

☐ Frequently ☐ Occasionally ☐ Rarely ☐ Never

C5). *How many hours do you spend on Radio listening to agricultural programs in month*?

☐ Less than 1 ☐ Btn 2 to 3 ☐ Above 4

C6). *What time of the day are agricultural programs shared on the radio during the day?*

a) Midnight -6:00am
b) 6:00am – 9:00am
c) 9:00am – 5:00pm
d) 5:00pm – Midnight

C7). *How many agricultural programs do you listen using a radio in a month*?

☐ One ☐ Two ☐ Above Three

C8) *Do you think the time given for agricultural information program on radio/TV is convenient?*

☐ Yes ☐ No

C9). *If not, what suggestion can you make for adequate time?*

……

……..

C10). *Are the any reasons you think watching TV programs is better than radio?*

☐ TV is Audio visual
☐ TV is Interesting to watch
☐ Due to the languages TV present information
☐ Demonstration
☐ Timely transmission

Others specify ……

C11).*What kind of Agriculture information do you normally receive through the ICTs tools*?

☐ Agronomic practices ☐ Price of inputs

☐ Seed quality ☐ Sources of inputs

☐ Pest and disease control ☐ Out market information

☐ Others Specify……

C12). *Which agricultural programs do you prefer to receive through the ICT tools but you don't?*

☐ Agronomic practices ☐ Price of inputs

☐ Seed quality ☐ Sources of inputs

☐ Pest and disease control ☐ Out market information

☐ Others Specify……

C12). *Why would you consider using either of the ICT tools listed below when listening to agricultural extension information? (Select more than one if necessary)*

Reason	**ICT Tool**		
	Radio	**TV**	**Phone**
Affordable/cost			
Portability			
Vernacular Language			
Effective Interact with program presenters through phone			
Can perform other duties while I listen to programs			
No training is required in accessing			

SECTION D: Factors influencing access to Agricultural information

D1. *How many farming plots do you grow on your food for either home consumption or sale?*

#_____

D2. *Do you own your own land for farming?*

#_____Yes, _____No

D3. *What is the distance of your home from the nearest market where you sell your harvests?*

#_____

D4. *How much income do you get from sale of your harvests in season?*

#_____

D5. Do you have any other sources of income other than income from sale of your harvest?

#_____Yes _____No

D6. *Have you ever accessed an Agricultural loan in the last one year?*

#_____Yes, _____No

D7). Do you know where to access agricultural information if you need to consult on anything about farming?

☐ Yes ☐ No

APPENDIX II: INTERVIEW GUIDE FOR DISTRICT EXTENSION OFFICERS

Research questions for farmers and extension officers

a. What ICTs tools are accessible in this area of Harugongo?
b. Does the office of the district Agricultural office share agricultural extension information using ICTs and if yes which ICT tools does the office use?
c. For the mentioned ICT tools you use for sharing Agricultural information, why do you prefer to using that tools?
d. What challenges to you have in using the mentioned tool?
e. What is the attitude of most families towards the use of Radio in accessing agricultural information?
f. What is the attitude of most families towards the use of mobile phones in accessing agricultural information?
g. What kind of information do you normally share with farmers while using the mentioned tools.

APPENDEX III: Budget Expectation for dissertation Research Work: 2017

Number	Description	Quantity	Rate	Amount
1	Printing of tools	1	40,000	40,000
2	Data collection	1	800,000	800,000
3	Transport	1	100,000	100,000
4	Data Entry	1	40,000	40,000
5	Printing of Report	1	50,000	50,000
6	Transport to collect corrections	1	50,000	50,000
7	Transport Nkozi	4	20,000	80,000

Source: Field 2017

Appendix VI: Logit Regression measurement variables disaggregation/grouping

Variable	Measure	Disaggregation's considered
Age	Number	a) Above 56 Years b) 46-55 Years c) 36 -45 Years d) 26 – 35 Years e) Below 25 Years
Education level	Number (Years in school)	a) No formal school 0yrs b) Primary 7yrs c) O'Level - Secondary 11yrs d) A'Level - Secondary 13yrs e) Vocational Training 13yrs f) College Education 15yrs g) University 18yrs
Household size	Number	a) Less or equal to 6 people =<6 b) More than 6 people >6
Number of Farming plots	Number	a) 1-2 plots b) 3-4 plots c) 5 and above plots
Nearest Market Distance	Kilometers	a) 1-5km b) 6- 10km c) 11km above
On Farm Income	Uganda Shillings	a) 3,500,000 Above b) 3,100,000 – 3,500,000 c) 2,600,000 – 3,000,000 d) 2,100,000 – 2,500,000 e) 1,600,000 – 2,000,000 f) 1,100,000 – 1,500,000 g) 600,000 – 1,000,000 h) Less than 500,000