TECHNOLOGY IN MODERNISATION OF AGRICULTURE: A CASE STUDY OF KABALORE DISTRICT

BY

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A RESEARCH REPORT SUBMITTED TO THE COLLEGE OF HUMANITIES AND SOCIAL SCIENCES DEPARTMENT OF JOURNALISM AND MASS COMMUNICATION IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF BAHELOR'S BACHELOR'S DEGREE IN MASS COMMUNICATION OF KAMPALA NTERNATIONAL UNIVERSITY

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DECLARATION

I **Atuhaire Ronald**, declare that to the best of my knowledge, the information in this piece of work is original and a result of my own effort. The research work has not been published or tendered to any university or institution of higher learning for any academic award.

Signature: _____ **Date:** 14th/09/2019.

(STUDENT)

APPROVAL

This is to certify that **Atuhaire Ronald** research proposal entitled, *"The role of the Electronic Media in Promotion of Democracy in Uganda. A case study of NBS Television"* was done under my supervision and is now submitted with my approval.

Signature: _____ **Date:** _____

(SUPERVISOR)

DEDICATION

I dedicate this work primarily to the Almighty God, 'the life giver and protector, wisdom provider for without his intervention, this wouldn't be completed.' I also dedicate this work to my father Mr. Sanyu Moses, my brother Muhimbo Bruno and the entire family for the support, love and care they have given me throughout my studies.

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LIST ACRONYMS

FAO	Food and Agriculture Organization
GIS	Geographical Information System
GPS	Global Positioning System
ICT	Information Communication Technology
Kiu	Kampala International University
MDGs	Millennium Development Goals
RFF	Radio Farm Forum
RS	Remote Sensing
TV	Television
UN	United Nations
VEO	Village Executive Officer

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ABSTRACT

The aim of the study was to examine the application of ICT tools in agriculture sector at the District level. The study found out the role of ICT in agronomic practices, constraints and issues of implementing the ICT in agriculture in Kabalore district. The researcher used qualitative and quantitative methods. The study went on unveiling various applications of ICT tools in agriculture sector which were Geographical Information System, Handheld Personal Computer, Mobile Phone Applications, Internet, Web-Based Applications, Community Radio Stations and Global Positioning System. Furthermore, several roles of ICT in agronomic practices were found to include Models for crop variety selection, Key tools for land planning and management, Soil quality assessment is done with some useful technologies, ICTs supported Irrigation, Fertilizers, pesticides and quality of yield management, Identification of nutrient deficiencies, and Tools for Pest and Disease Management. Semi-structured interviews supported with document reviews were used for the data collection. District extension system has identified constraints and issues of implementing the ICT tools in agriculture which included lack of hardware and software infrastructure, prevalence of inadequate training and skills, shortage of research priorities, people/community issues, inadequate training and research, political issues, and adoption barriers and their alleviation. The district government has to address the above constraints and issues in order to implement the ICT tools in agriculture and to increase the produce.

CHAPTER ONE
GENERAL INTRODUCTION

Introduction

The content in this chapter covers the background of the study, problem statement, research objective and specific objectives, research questions, s*cope, significance of the study* and the conceptual framework of the study.

1.1Historical perspective

Technology generally means the well combination of energy, tools, knowledge and skills whereas technological intervention means adaptation of modern agriculture technology to improve productivity. The adaptation modern agriculture technology such as farming tools, improved varieties of seeds and inorganic fertilizers can foster agriculture. Interventions of modern agricultural technology become long run equilibrium when the farmer has full information about the new technology and it is potential (Feder & Zibleman, 1985). Sociologists have indentified many sociological factors such as; characteristics of rural countries, the personal and situational characters of farmers and their families, such as farmers' age, educational level and their perceptions on agricultural transformation (Hotter, 1958).

ICT can play a significant role in rural development by helping the rural farmers to access new knowledge, up-to-date information and entrepreneurship skills. There are different ICTs including computers, internet, geographical information systems, mobile phones and traditional media (radio, television) which are used in delivering agricultural information to the farmers (Stienen et al., 2007). In different parts of the world ICTs are seen to have positively contributed towards rural development. Stienen et al., (2007) indicated that extension workers use ICTs to gather, retrieve, adapt, localize and disseminate a broad range of information needed by rural families. A study conducted by Fu and Acter (2010) in India found that the amount, speed and quality of the extension services delivery have been improved significantly through the use of mobile phone technology. Also Singh (2006) indicated radio and TV programs to have helped the farmers in South Korea to receive support for improved crop production, quality control methods, processing, packaging and marketing.

African countries have seen decades of futile attempts to shift from the agricultural sector. Based on experiences from western countries, poorly developed countries, were being pushed to strive for economic diversification through the transformation of their economies with decreased dependence on the indigenous sector (Ansoms, 2008). However, these economies remain agrarian, with the sector accounting for 15% of the continent's GDP, employing 90% of the rural workforce and 60% of the total labor force (urban and rural), contributing as much as 40% of export earnings and providing over 50% of household incomes (UNECA,2007; McKinsey,2011). With this low contribution to growth, however, Africa's arable land makes 40% of arable land globally, while only 10% is cultivated (EIU, 2012). The agricultural sector is faced with a big challenge of enhancing massive production to feed a growing and prosperous population in an environment of decreasing availability of natural resources. Water shortages, declining soil fertility, effects of climate change and rapid decrease of fertile agricultural lands due to urbanization, shortage of critical rural infrastructure, inadequate access to advanced technologies, limited access to affordable financing, markets and unfair market conditions, high production and transport costs, low skills etc.,. Often there is 30% or fewer shares in GDP for agriculture which shows low productivity in the sector. (OECD, UNDP, AfDB and UNECA, 2012).

For many years in Uganda, farmers have been accessing agricultural information from extension workers through interpersonal communications. In the current situation, this seems to be inefficient given that the ratio of extension staff to farmers is increasing (UN, 2005). Factors such as poor infrastructures have also contributed to this inefficiency. For example most of the roads in rural remote areas are not passable during wet season; and this prohibits communication between farmers and the extension staff. According to United Nations (UN, 2005) access to information and knowledge for farmers in remote villages is restricted due to the lack of infrastructure. This situation calls for an alternative approaches for agricultural information dissemination such as use of ICTs in extension service delivery. The need for use of ICTs in agricultural extension is further justified by the fact that the farmer-extension officer ratio in Uganda exceed 10,000:1 (Rukonge et al., 2008) and this complicates face-to-face interactions.

1.2 Theoretical perspective

Reflecting upon theoretical propositions, developed countries are applying modern agriculture technology. They are producing crop a lot in a limited plot of fields and with limited manpower for mass grain production with limited production components whereas least/developing countries are still suffering from large amount of food deficits. Nepalese economy for example, is still dominated by agriculture sector and agro-based industries. More than 80 percent people depend on agriculture (i.e. 4.2 million) and agriculture provides net employment to 60 percent people and the bulk of the country's export earnings (WB, 2010). However, food items and animal products import during the first eight months of current fiscal year 2015/16 is estimated to fall by 13.9 percent to Rs. 435.8 billion as compared to that of previous fiscal year (MoF, 2016). In fiscal year 2015/16, Nepal expensed NRs. 39 billion only for importing good grains from different countries (Trade and Export Promotion Centre [TEPC], 2016).

1.3 Conceptual perspective

The widespread use of ICT and its importance for innovation and Economic growth has been recognized widely (EUI, 2006). Nowadays application and use of Information and Communication Technologies in day to day life of the people has become common (Zahedi SR, 2012). As we look on from the past, then, only television and radio were the electronic broadcasting technologies that were used to reach the rural communities. However, in recent years, there was a rapid emergence of internet and mobile based technologies (Balaji V, 2007). As the result an easy and fast mode has emerged to reach the urban as well as rural communities. In Sri Lanka, so many strategies have been developed and being executed with the aim of developing the Agriculture sector which is one of the main source of income in the north eastern and some of the north western parts of Sri Lanka. The traditional methods used in Agriculture have been in practiced by farmers for a long period. With the emergence of new technologies and its widespread use, the use of those technologies in Agriculture sector will probably create a positive effect on the growth and development of Agriculture. There are so many ways to incorporate the emerging trends in ICT with Agriculture that will aid on the enhancement of rural development and Agriculture sector via efficient information and communication processes (Singh K, 2015).

1.4 Contextual perspective

Kabalore district is rich of ICT infrastructures such as radio station and mobile phone service providers. The area is also reached with television broadcast. The presence of these ICT infrastructures can help the farmers, extension workers and others in rural development to effectively use their combination to make contact. According to Heeks and Molla (2009), farmers need to access market information, land records, accounting and farm management information as well as management of pests and diseases. Most farmers in Kabalore are smallholders cultivating maize, millet, cassava, sorghum, paddy and/or legumes as food crops. Cash crops grown include Sugarcane, Sisal, Oilseeds and coconuts; they are also engaged in livestock keeping such as cattle, pigs, goats and local chicken (URT, 2007). Individuals can also benefit from the availability and use these ICTs in many ways. For example; substituting phone calls for travel which is costly in terms of time and money, also using them to acquire information on prices of which radio, television and mobile phones can provide, to sell their agricultural produce and make purchases (Mwakaje, 2010). In these various ways, ICTs can have a significant impact on a country's ability to achieve the Millennium Development Goals (MDGs) (Yonazi, 2009).

1.5 Purpose of the study

The purpose of this study is to examine the application of ICT tools in agriculture sector in Kabalore district.

1.6 Problem statement

The potential of ICT in the improvement of lives is a human-given that is yet to be fully realized in developing countries in general and Uganda in particular. Gunga (2008) states that one of the major challenges to the realization of the power of ICT potential in human livelihoods is the relative unawareness of the majority of the populace about the role ICT plays in socio-economic and cultural environment. A key observation by Gitau, Plantinga, & Diga, (2010) in a study about research by African is that the African contribution to international academic research in Information Communication Technology for Agriculture modernization (ICT) is very low, typically between 1% and 9% percent of publications across sub-disciplines. Gitau et al further observe that the low output of African authors in the ICT field suggests that theories around the

appropriate design, mechanisms of adoption, and impact of ICTs in developing countries are being formed without significant influence by African scholars. Heeks (2007) points out that most research on ICT has a bias to action and not knowledge, therefore most of the ICT research being produced is therefore descriptive not analytical. It might make some interesting points but it lacks sufficient rigor to make its findings credible and it can often be repe titive of earlier work. Heeks suggests that to make it more analytical, ICT research contribution is generally possible only where the research draws on some pre-existing conceptual framework. A review of literature suggests that several initiatives have been undertaken to use ICT such as computers, internet, mobile phones, TV and radio media to increase information access and dissemination to fanners in recent years (Gitau, 2010; Gunga, 2008; Muriithi et al, 2009; World Bank, 2011). Though this achievement, sufficient findings lubricant the impact of these in Uganda have not been fully explored. With agriculture being a key economic pillar and a robust ICT sector, the knowledge gap of the impact of ICT adoption on agricultural modernization and improvement needs to be further explored. This study aims to address this problem and contribute its findings for further research.

1.7 Research objective

- To examine the application of ICT tools in agriculture sector in Kabalore district
- To find out the role of ICT in agronomic practices in Kabalore district
- To identify constraints and issues of implementing the ICT in agriculture in Kabalore district

1.7.1 Research questions

- To examine the application of ICT tools in agriculture sector in Kabalore district?
- What is the role of ICT in agronomic practices in Kabalore district?
- What are the constraints and issues of implementing the ICT in agriculture in Kabalore district?

1.8 Scope of the study

1.8.1Content scope

The study will focus on examining the application of ICT tools in agriculture sector in Kabalore district. Continuously, technology is the independent variable covering Geographical Information System, Handheld Personal Computer, Community Radio Stations while agriculture is the dependents variable covering holistic view of the production system, access to information, mobile mapping and other data gathering activities, voice to farmers, Crop yield, soil moisture and remote.

1.8.2 Theoretical scope

Agricultural modernization theory seeks to transform the land system, relations of production, promote the transformation of agricultural industrial organization and promoting the spontaneous revolution in agricultural production (Tang, 2011). More so, there must be interdependent relationship between agricultural organization, transformation in agricultural industrial organization and agricultural technology for agriculture modernization in Uganda.

1.8.3 Time scope

The study will take a period of 1year that is to say from; 2019–2020. This period is selected to enable the researcher come up with coherent information from the respondents as it would enable respondents to give responses that are typical of their opinion from the observations made over this period.

1.9 Definition of key terms

Information Communication Technologies (ICTs); refer to hardware, software, networks and media for collection, storage, processing, transmission and presentation of information in the format of voice, data, text and images (World Bank, 2002).

Technology; sometimes abbreviated as tech, is the knowledge or a set of tools that helps make things easier or resolve problems.

Agriculture; as defined by International Labour Organization as the science and art of cultivating plants and livestock.

CHAPTER TWO
LITERATURE REVIEW

Introduction

This chapter reviews the literature through theoretical framework, conceptual framework, and the related literature focusing on what other authors and scholars have talked about in regard with the role of the electronic media in promotion of democracy and specific research objectives that is to say; to find out the role of media in promoting democracy, to examine the challenges of the media in promoting democracy, and to examine the measures of the media in effective promotion of democracy in Uganda.

2.1 Theoretical framework

Agriculture transformation theory of Schultz

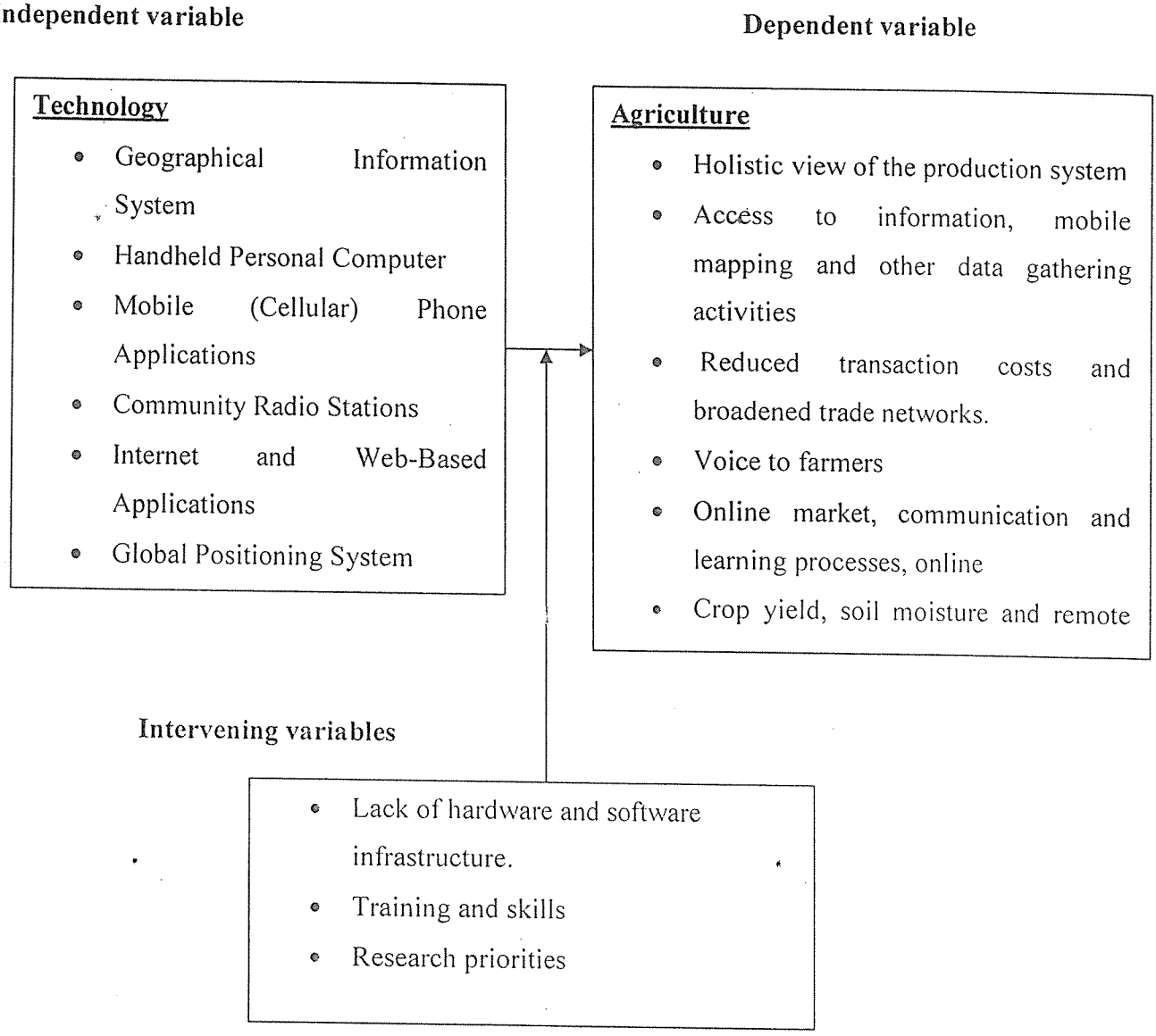
Theoretically, agriculture transformation theory of Schultz (1979) emphasized that key to agricultural transformation lies in emphasizing technological change in agriculture. He argued that peasants are poor but efficient, they can bring about productivity increases and improvements provided they are given access to modern technologies. Therefore according to Schultz, government need to accelerate output growth through technological intervention and raising domestic demand for agriculture output for making agriculture as tool for employment generation strategy (Author & Lekhi, 2008). Likewise, technology transfer theory claimed that technology transfer is the reciprocal process that involves not only the product but also a set of practices. Technology transfer is widely affected by the culture, which dictates a particular way of constructing, interpreting, and communicating meaning of technology, about what constitutes the knowledge about technology among government, experts, technicians and ordinary users (Cummings, 1990). However, according to Rogers & Shoemakers (1971), the degree of adaption or rejection of technology depends upon the individuals' passes through five steps; awareness stage, interest stage, evaluation stage, trial stage and adoption stage.

2.2 Conceptual framework

Farmers require production and marketing and information to support their business operations. These farmers use the information obtained from a source or combination of sources for their activities. They utilize ICT and Non-ICT sources to obtain agricultural information for the farm

activities. The conceptual framework for this study hinges on the differences between farmers' access to production and marketing information based on the sources of the information.

Figure 1: Conceptual framework



(Source: Researcher's construct, 2019)

2.3 Review of relevant literature

2.4 Related studies

2.4.1 Application of ICT tools in agriculture sector

Geographical Information System

A Geographical Information System (GIS) makes visual comparisons between different types of data possible. It helps to establish relationships between different data sets and is important in the production of maps, and charts and additional information associated with coordinates and time. It helps in the analysis of post-harvest variation in crop yield measures, and provides a holistic view of the production system (GIS Development, 2006). GIS is a computerized data storage and retrieval system, which can be used to manage and analyze spatial data relating crop productivity and agronomic factors. It can integrate all types of information and interface with other decision support tools. GIS can display analyzed information in maps that allow (a) better understanding of interactions among yield, fertility, pests, weeds and other factors and (b) decision-making based on such spatial relationships (Singh K, 2015).

Handheld Personal Computer

Handheld Personal Computers are small, light, and robust and have been used for providing access to information, mobile mapping and other data gathering activities (GIS Development, 2007).

Mobile (Cellular) Phone Applications

The cellular phone has provided market links for farmers and entrepreneurs. Growth in mobile phones has been explosive and now reaches more than a third of the population. This has reduced transaction costs, broadened trade networks and facilitated searches for employment (Guislain P, 2006). Bertolini (2004) observes that the „telephone is the only ICT used (if any) by the majority of farmers in Africa". Some of the respondents in the study considered the cellular phone applications such as the SMS to be one of the most important emerging ICT applications.

Community Radio Stations

Community radio is one of the important tools of ICT that offer farmers and the people a voice and help development of the community. Community radio is owned and operated by a community or members of a community (Kumar A. & Singh R. 2015). Radio is an important mechanism for disseminating knowledge and information in different languages and formats (Girard B., 2003), especially to poor people (Harris RW., 2004). In Zambia, the Radio Farm Forum (RFF), a government initiative, has shown that radio is important in addressing the common needs and problems of resource-deficient rural farmers by giving them an opportunity to listen to a radio discussion programme on agricultural problems and techniques (Bobbili R, 2006).

Internet and Web-Based Applications

The Internet, e-mail, web sites and web-based applications are becoming increasingly important in sharing and in disseminating agricultural information and there are many ongoing web-based application initiatives in worldwide. The FAO and partners are implementing e-Agriculture aimed at the intersection of agricultural informatics, agricultural development and entrepreneurship, focusing on agricultural services, technology dissemination and information delivered through the internet. E-Agriculture is intended to promote the integration of agricultural stakeholders and technology with multimedia, knowledge and culture, and aims to improve communication and learning processes (FAO, 2014).

Global Positioning System

The Global Positioning System (GPS) is a satellite-based navigation system that can be used to locate positions anywhere on the earth. GPS provides continuous (24 hours/day), real-time, 3-dimensional positioning, navigation and timing worldwide in any weather condition. More recently farmers have gained access to site specific technology though GPS. GPS makes use of a series of satellites that identify the location of farm equipment within a meter of an actual site in the field. The availability of GPS approaches to farming will allow all field-based variables to be tied together. This tool has proven to be the unifying connection among field variables such as weeds, crop yield, soil moisture and remote sensing data (Singh K, 2015).

2.4.2 Role of ICT in agronomic practices

Crop Variety Selection

This sub-system advises the users about the most suitable variety for his/her plantation based on the specific circumstances of the farm and the user requirements. The domain knowledge of this subsystem contains two models, namely: suggestion, and selection. The inference knowledge contains three inference steps namely: specify, select, and count. The suggestion model contains a relation between the environmental conditions and the suitable varieties that is used by 'specify' inference step to suggest the paddy varieties suitable for the surrounding environments. The selection model contains a relation between user requirements and the corresponding varieties that is used by 'select' inference step to select, the most suitable varieties reflecting the user requirements. The 'count' inference step just counts the specified varieties (El-Azhary., 1998).

Land Use Planning and Management

Among the various ICT tools, Geographic Information Systems (GIS) and Remote Sensing (RS) techniques represent two key tools for land planning and management. GIS offers the opportunity to gather multiple layers of information, drawn from different sources, into one spatial representation. This can be particularly useful in reaching consensus over land planning when users have different values and preferences linked to a given territory. Similarly, RS techniques are a valuable tool for monitoring land resources (e.g. Vegetation, water bodies, etc.), especially when a single institution is in charge of monitoring a wide area ((E-Agriculture, 2017). Land Preparation and Planting Land preparation gives specific advises to the user about how to prepare specific land for paddy cultivation, while planting gives the suitable planting methods according to user specific inputs data. The domain model of this subsystem contains two models namely: establishment plan and assignment. The inference knowledge contains three inference steps namely: establish, assign, and select. The establishment plan model contains a relation between farm description and strategic plans that are used by establish inference step to generate a recommended plan and an alternative plans (Edrees S, 1999).

Soil Quality Assessment

Assessment of soil quality can be done in farm level and also in regional level. In regional level it can be done based on soil, climate and land uses. Some useful technologies aid to understand nature of soil and its problems due to management practices. ICTs have developed several folds in the recent past. Soil quality assessment is being done with some useful technologies, like remote sensing. Remote sensing is a process that collects data about an object from a remote location (Singh K, 2015).

Water Management Technology

Information and Communication Technologies (ICT) supported Irrigation is demonstrated here as "application of water to a tree based on monitoring each tree's needs to optimize its yield". ICT monitors each tree's real time water and nutrient consumption and needs. The system in turn remotely activates an ongoing, optimized supply of water and nutrients suited to the current climate, soil conditions and the farmer's production plan (Lakso &Goldschmidt, 2007). ICT is one of the most effective means in upgrading of land and water management and increasing food production. Since the middle of the 20th century, automation and ICT are increasingly employed in water supply and irrigation management. Adoption of ICT and automation enhanced water use efficiency in irrigation by 10% - 50%, increased yield per land and water unit by 20% -100% and improved produce quality (Moshe Sne.,2005). Conceptually, ICT and automation triggered the adoption of volumetric approach in water application. These achievements enabled expansion of the irrigated area, increased food production and higher profits for farmers (Moshe Sne., 2005).

Fertilizer Management

Fertilizers, pesticides and quality of yield were the major factors of concern in agriculture. Most of the time the expertise were required to analyze the problems and which may be time consuming and costlier issue in developing countries. Image processing was one of the tools which can be applied to measure the parameters related to agronomy with accuracy and economy. Applications of image processing in agriculture can be broadly classified in two categories: first one depends upon the imaging techniques and second one based on applications (Vibhute A, 2012).

Identification of Nutrient Deficiencies

The software has revolutionized the method to find nitrogen content in Maize leaves. Approach was to turn the manual process to a software application using image processing. Image of the Maize leaf is captured and preprocessed to remove the noise of source image. The color and texture characters of maize leave are extracted. Color characteristics analyzed using the RGB and the HSV model. A relationship between extracted features and nitrogen content was developed (Sunagar VB, 2014). A new technique based upon a commercially available hand-held scanner which overcomes the problems. They proposed algorithm to determine chlorophyll content, which non-linearly maps the normalized value of G, with respect to R and B, using a Logarithmic sigmoid transfer functions (Ali M, 2012).

Pest and Disease Management

Latha (2014) developed a method by which we can detect weed by using image processing. Then we gave the input of the weed blocks to the automatic sprayer which sprays only in these blocks. By doing so we can reduce the usage of weedicides, thus saving the environment. Rastogi, *et al.*, (2015) presented scenario of image processing and computer vision in agriculture field as innovative and important problem solving techniques since these techniques are more accurate and quicker than manual methods. For solving agricultural image processing problems in efficient and effective way authors of this paper also suggested to use artificial neural network for agricultural plant leaf disease recognition and classification.

2.4.3 Constraints and issues of implementing the ICT

The uses of computers in agriculture do have some real constraints such as, the lack of hardware and software infrastructure, training and skills, and research priorities. However, once these are overcome, the use of computers goes past automation and software application. In fact, it could be instrumental in bridging the digital divide and bringing prosperity to agriculturists not only in the United States, but also in other developing and emerging economies around the world (Kaur Grewal G,. 2015).

Key issues of implementing the ICT in agriculture. Specifics comments and insights were collated under the following groupings: people/community issues, training and research, political issues adoption barriers and their alleviation (Mahant M. 2012).

2.5 Gaps in literature

The above platforms and programmes meet several objectives. They increase awareness about the role of ICTs in agronomic practices and strengthen the focus on the need to build an enabling environment for digital technologies to facilitate agricultural growth and rural development. They promote and facilitate the exchange of information and knowledge on ICT applications, provide a forum for discussions among practitioners, contributing towards scaling-up successful projects. They also enhance coordination and collaboration among international organizations, the private sector and the civil society and boost e-agriculture capacity building efforts.

In spite of these efforts, many innovations fail to scale up, especially in developing countries and particularly Uganda where fee-based ICT services are characterized by weak take-up (World Bank Group, 2016). In developed countries, the private sector, such as large suppliers of seed and agrochemicals and machine manufacturers, engages in innovative ICT applications, providing commercial services to their clients who have access to the Internet and mobile devices. These companies have made significant investments on ICT services, leveraging on economies of scale and their market shares. Through their ICT services they collect information on the farming practices of their clients, process and analyze it, and relay the knowledge they produce back to them, thus enhancing production efficiency and in many cases providing wider benefits, such as preserving natural resources as in the case of Precision Agriculture. The sale of innovative inputs and the provision of specific know-how to farmers through ICTs generate returns for these companies which often are protected by patents and copyright otherwise business would have no incentive in engaging in research and development.

CHAPTER THREE
METHODOLOGY

Introduction

This chapter sets out to bring in various stages and phrases that were carried out to bring out the study. The chapter describes the research design, the target population, sampling procedure, sampling techniques, data collection and methods, data quality control data processing and analysis, measurement of variables of ethical considerations and the limitations of the research.

3.1 Research Design

A cross-sectional research design will be employed in the process of data collection. The design has been adopted on the basis that it allows collection of data from different groups of respondents at one point in time (Devaus, 2002) as cited by Ruheza *et al.* (2012), and determines the relationship between and among variables (Babbie, 1990). The mixed approaches, both qualitative and quantitative will be used for the study. According to Crotty (2003), the distinction between qualitative and quantitative research occurs at the level of methods.

3.2 Study Population

Population is aggregate of people or things that researchers have in mind from which one can obtain information and draw conclusions (Fraenkel and Wallen, 2000). In this case, the study population is all the farmers and the key informants in Kabarole District. According to Kothari (2004) and Wooldridge (2008) a sample or sub-sample of 30 respondents is the minimum for studies in which statistical data analysis is to be done.

3.3 Sample Size

With a study population of 45 in mind, the researcher applied Morgan's table for sample size determination to obtain a sample. In this respect, the sample size was 40. The respondents will constitute farmers and the key informants which are Extension workers, Village Executive Officers (VEO) and Radio presenters from the two local radios (i.e HITS radio and Better FM). The research will apply the Slovene's Formula of calculating the sample size which states that; given a population, the minimum Sample size is given by:

$$n = \frac{N}{1+Ne^2}$$

Where;

n the sample size

N total population of respondents, that is 40

e the level of significance, that is 0.05

Sample size is 26 respondents

Table 3.3.1 shows the distribution of the number of respondents in their respective categories, population and size.

Category of the respondents	Population	Sample
Farmers	15	15
Village Executive Officers	9	8
Agriculture Extension workers	12	10
Radio presenters	4	3
Total	**40**	**36**

Source: Morgan and Krejcie, (1970), sample size determination table.

3.4 Sampling method

The researcher will randomly select fifteen farmers from 5 sub counties where three farmers will be selected from each village of the selected sub counties, a total of 15 farmers are only counted exceeded number is left behind. The key informants are 8 Village Executive Officers, 10 Agriculture Extension workers, and 3 Radio presenters who will be selected purposively.

3.5 Research Instruments

3.5.1 Questionnaires

A questionnaire will be prepared in such a way as to capture important primary information for the study. The question wording is made as simple as possible and sensitive questions are simplified. Questionnaire is designed in English, but questions will be translated in Rutooro and Luganda for easy understanding. Questions are organized according to the objectives of study and responses are rearranged based on Likert scale of 1 - 5 where; 1 - Strongly Disagree (SD), 2 - Disagree (D), 3 - Agree (A) and 4 - Strongly Agree (SA) with assertion. This is meant to establish the extent to which respondents agreed with the statements.

3.5.2 Interviews

Here interviewees are questioned by the interviewer to obtain information. For example the researcher will interview the District Agricultural Extension Officer on the level of technology adoption in agriculture sector by the farmers in the district. This method suite the research most appropriately as the researcher is able to collect data through in-depth semi structured interviews consisting of few open ended questions which allow a two-way communication between the interviewer and interviewee. In addition, the researcher will interview all the respondents to avoid language constraints and misinterpretation for approximately 15 to 20 minutes in order to analyze and provide the researcher with deeper understanding of the subject and enable accurate understanding.

3.5 Validity and Reliability

3.5.1 Validity

Validity refers to the degree to which a study accurately reflects or assesses the specific concept that the researcher is attempting to measure (Golafshani, 2003; Barribeau *et al.*, 2004). The clearly defined process helps to ensures that what is meant to be measured is actually measured. Miller and Salkins (2002) argue that in order to ensure validity in a sample survey, the researcher will utilize techniques for scaling, pay careful attention to questionnaire wording and presentation and include questions on personal background and other potentially useful.

However, in order to ensure that the sample is a true representation of the population, respondents who will be interviewed differ in terms of age, sex, marital status and income levels.

3.5.2 Reliability of data

According to Barribeau *et al.* (2004) and Miller and Salkins (2002), reliability is the extent to which an experiment, test, or any measuring procedure yields the same result on repeated trials. In order to ensure that there is consistency in measurement, all measurement instruments like the questionnaire are pre tested on 5 farmers, and 5 extension agents respectively, then necessary changes are made before the actual work has started. Changes include question wording and inclusion exclusions of some questions that are not relevant to the study. Furthermore, in order to ensure that answers are consistent, the questions are organized logically to ensure that there is an association between questions.

3.7 Data Analysis

3. 7.1 Qualitative data analysis

Qualitative data are analyzed using content analysis technique (Holsti, 1968). The data are interpreted and organized into different themes based on the conceptual description of ideas which are expressed by respondents during discussions. For the data analysis information is drawn from all the interviews and supporting documents to present a view of the factors that are relevant for the study.

3. 7.2 Quantitative data analysis

Collected institutional data, survey data and numerical data from observation will be reviewed for accuracy, completeness and consistency and entered into the Microsoft office excels. Data are coded and statistically analyzed, descriptive statistics such as frequencies and percentages are calculated to determine distribution and relation of the study variables. Results will be displayed in the form of Tables.

3.9 Limitations of the study and probable solutions

In this research work, the researcher may account the following limitations;

- Financial constraint may hinder the scope of the study. However, the researcher may use his little finance in printing, consulting, accommodation and transport in collecting data that led to him success.
- Secondary, the researcher may not able to investigate through all the selected villages in Kabarole district while carrying out research.
- Time constraint; the researcher may not have enough time to administer questionnaires and collect all of them which might result into non-response errors in the data. However, the researcher is to set appointments with the respondents, such that they can participate in the study at their appropriate time but within the set period of time.
- Limited information; the researcher may face a problem of limited information from the different sources like journals, textbooks that are hard to access. Even some or most of the departments might not be willing to disclose some information. Information asymmetry may be solved by the researcher explaining to the respondents the relevancy of the information that it is for education.

CHAPTER FOUR
PRESENTATION AND ANALYSIS OF THE FINDINGS

4.1 Introduction

This chapter presented the results from the facts, which the research discovered. The findings were presented in with the objectives of the study whereby the raw data in form of questionnaires and interviews were edited and interpreted which ensured uniformity, legibility and consistency. The data-filled questionnaires were copied and analyzed by tabling in frequency tables while identifying how often certain responses occurred and later evaluation was done. The information was then recorded in terms of percentages and presented in this study as illustrated below.

4.2 Background information about respondents

Relevant information about the respondents that participated in the study relates to their gender, age and education level, since they could influence the extent to which the respondents were knowledgeable about the variables that were involved in the study and the extent to which the data that they provided can be generalized to the population. Information pertaining to these variables was elicited and the findings are summarized.

4.2.1 Gender

Table 1: Showing the findings of Gender in Kabarole district

Gender	Frequency	Percentage (%)
Male	26	72
Female	10	28
Total	36	100

Source: Field data, 2019

The table 1: Shows the gender distribution of selected respondents, who participated in this research, was 26 males and 10 females representing 72% and 28% respectively. This implies that regardless of the most of the respondents being male scoring highly, the issue of gender sensitivity was considered by few female who were selected.

4.2.2 Age Range

Table 2: Showing the Age range of the respondents in Kabarole district

Gender	Frequency	Percentage (%)
25-30yrs	8	22
31-34yrs	10	28
35-40yrs	14	39
41& above	4	11
Total	**36**	**100**

Source: Field data, 2019

The results in table 2 also show that an overwhelming majority of the study respondents were below 41years of age while only 4 people were above 41 years of age. This indicates that the majority of respondents in Kabarole district are in their most productive age group. This mean that they were mature enough to give the rightful information for the study and on the other hand such respondents were likely to perform better in producing agriculture products if provided with first hand ICT tools.

4.2.3 Educational level

Table 3: Showing the educational level of the respondents in Kabarole district

Gender	Frequency	Percentage (%)
Diploma/ Certificate	12	33
Bachelor	16	44
Masters	6	17
PhD	2	6
Total	**36**	**100**

Source: Field data, 2019

In table 3, it is apparent that majority of the respondents; held Bachelor 16(44%), Diploma/ Certificate 12(33%), Masters had 2(17%). And the least of the respondents held PhD as they were represented by 2(6%). This implied that majority of the respondents knew how to read and understand the questionnaires and could also easily understand the role of ICTs in agronomic practices in Kabarole district.

4.2.4 Years of Experience in Agriculture Activities

Table 4: Showing the Years of Experience in agriculture activities by respondents in Kabarole district.

Gender	Frequency	Percentage (%)
1-3yrs	6	17
4-6yrs	10	28
7-9yrs	16	44
10yrs and above	4	11
Total	**36**	**100**

Source: Field data, 2019

From table 4 above, 17% of the respondents had been carrying out agriculture for less than 3years, 28% had the experience in the field for 6years, majority of the respondents as represented by 44% had spent 9years while carrying out agriculture activities, and 11% of the respondents carried agriculture for 10 and more years. This implies that the majority of the respondents surely understood the challenges and key issues associated with the implementation of the ICT in agriculture.

4.3 Applications of ICT tools in agriculture sector

Table 5: Applications of ICT tools in agriculture sector

Responses	SD		A		NS		D		SD		Total	
	F	%	F	%	F	%	F	%	F	%	F	%
Geographical Information System	18	50	10	28	6	16	0	0	2	6	36	100
Handheld Personal Computer	12	33	16	44	4	11	2	6	2	6	36	100
Mobile Phone Applications	20	56	12	33	1	3	1	3	2	6	36	100
Internet, Web-Based Applications	10	28	14	39	4	11	4	11	4	11	36	100
Community Radio Stations	20	56	6	17	2	5	4	11	4	11	36	100
Global Positioning System	22	61	5	14	7	19	1	3	1	3	36	100

Source: Field Data, 2019

Results in the above table revealed that 18 (50%) of the respondents strongly agreed that Geographical Information System is one of the applications of ICT tools in agriculture sector, 10 of them represented by 28% agreed, 6 (16) respondents who were not sure of the view, None of the respondents disagreed and 2 (6%) strongly disagreed. Briefly, the findings guarantee the application of Geographical Information System in agriculture sector.

Handheld Personal Computer is also applied the agriculture sector in the district as majority of the respondents 16(44%) agreed, those were followed by 12 (33%) who strongly agreed, 4 of them (11%) were not sure, the respondents who both disagreed and strongly disagreed were 2 (6%).

Mobile Phone Applications in agriculture sector was also observed existing as 20 of the respondents (56%) strongly agreed, 33% (12 of them) agreed, only 1 respondent (3%) was not sure with the view, another 1respondents (3%) disagreed, and 2 (6%) strongly disagreed.

The findings from above table further revealed that the application of Community Radio Stations in agriculture sector is in existence whereby 20 (56%) of the respondents strongly agreed, 6 of them (17%) agreed, there were 2 respondents (5%) who were not sure, 4 (11%) of the respondents both disagreed and strongly disagreed.

According to the findings from the table, there was Internet, Web-Based Applications in agriculture sector; where 10 (28%) strongly agreed, 14 of them (39%) agreed, the rest of the respondents were not sure, disagreed and strongly disagreed and they all constituted to 4 (11%).

The findings also revealed that 22 respondents (61%) strongly agreed that Global Positioning System is applied in agriculture sector, 5 (14%), 7 (19%) were not sure, 1 (3%) of the respondents both disagreed and strongly disagreed. Basing on the findings, there was application of the ICT tools in agriculture sectors as observed above.

4.4 The role of ICT in agronomic practices

Table 6: The role of ICT in agronomic practices

Responses	SD		A		NS		D		SD		Total	
Roles	F	%	F	%	F	%	F	%	F	%	F	%
Models for crop variety selection	8	22	18	50	8	22	2	6	0	0	36	100
Key tools for land planning and management.	20	56	5	14	4	11	4	11	3	8	36	100
Soil quality assessment is done with some useful technologies.	15	42	10	28	8	22	3	8	0	0	36	100
ICTs supported Irrigation	9	25	17	47	3	8	5	14	2	6	36	100
Fertilizers, pesticides and quality of yield management	18	50	7	19	9	25	0	0	2	6	36	100
Identification of nutrient deficiencies	23	64	8	22	0	0	2	6	3	8	36	100
Tools for Pest and Disease Management	10	28	15	42	4	11	7	19	0	0	36	100

Source: Field Data, 2019

Information from the table 6 revealed that ICTs are models for crop variety selection whereby 8 (22%) strongly agreed, 18 of the respondents (50%) agreed, also 8 of them (22%) were not sure, 2 respondents (6%) disagreed and none of the respondents strongly disagreed. Generally, this implies that ICTs are essential in agronomic practices.

According to the results, ICTs had been observed as key tools for land planning and management when 20 respondents as represented by 56% strongly agreed, 5 of them (14%) agreed with the view, those who were not equaled to the respondents who disagreed by 4(11%), and 3 (8%) of the respondents strongly disagreed.

In addition from the table, 15 (42%) of the respondents strongly agreed that technologies are useful in soil quality assessment, 10 (28%) of the respondents agreed, 8 of the respondents as represented 22% were not sure, the statement was disagreed by 3(8%) of the respondents and none of the them strongly disagreed.

It is further observed that ICTs supported Irrigation when 9 (25%) of the respondents strongly agreed, 17 of them (47%) agreed, 3 (8%) of the respondents were not sure with the statement as 5 (14%) of them disagreed. Finally, there were 2 (6%) of the respondents who strongly disagreed.

The results also revealed that technologies contribute to the quality of fertilizers, pesticides and yield management. 18 (50%) of the respondents strongly agreed, 7(19%) of the respondents agreed, 9 (25%) were not sure, none of the respondents disagreed, and 2 (6%) strongly disagreed.

Through technologies nutrient deficiencies are easily identified. This was strongly agreed by 23 (64%) of the respondents, 8 of them (22%) agreed. None of them respondents were not sure, the respondents who disagreed with the statement were 2 (6%) and 3 (8%) were strongly disagreed.

The findings from the table indicated that 10 respondents as they were represented by 28% strongly agreed that ICTs are tools for Pest and Disease Management. 15 (42%) of the respondents agreed with the statement, 4 of them (11%) were not sure, also 7(19%) disagreed and lastly none of the respondents strongly disagreed.

4.5 Constraints and issues of implementing the ICT in agriculture

Table 7: Constraints and issues of implementing the ICT in agriculture

Responses	SD		A		NS		D		SD		Total	
Constraints	F	%	F	%	F	%	F	%	F	%	F	%
Lack of hardware and software infrastructure	20	56	5	14	4	11	4	11	3	8	36	100
Prevalence of inadequate training and skills	8	22	18	50	8	22	2	6	0	0	36	100
Shortage of research priorities	15	42	10	28	8	22	3	8	0	0	36	100
Key issues												
People/community issues	9	25	17	47	3	8	5	14	2	6	36	100
Inadequate Training and research	18	50	7	19	9	25	0	0	2	6	36	100
Political issues	23	64	8	22	0	0	2	6	3	8	36	100
Adoption barriers and their alleviation	10	28	15	42	4	11	7	19	0	0	36	100

Source: Field Data, 2019

Regarding the challenges, it was clearly observed from table above that lack of hardware and software infrastructure had become an obstacle for implementing the ICTs in agriculture where 20 (56%) strongly agreed, 5 respondents (14%) agreed with the view, and 5 other respondents with the same percentage disagreed. It is further observed that 3 (8%) strongly disagreed.

Prevalence of inadequate training and skills was strongly agreed by 8 (22%) as a challenge of implementing the ICT in agriculture. 18 of the respondents (50%) agreed, also other 8 (22%) were not sure, 2 respondents (6%) disagreed with the statement and none of them strongly disagreed.

The findings from above table indicated that shortage of research priorities was strongly agreed by 15 (42%) of the respondents as one of the constraints of the implementation of the ICT tools in agriculture. 10 of them (28%) agreed, and 8 (22%) of the respondents were not sure. It was seen from the above findings that 3 (8%) of the respondents disagreed and none of them strongly disagreed.

As far as key issues are concern, 9 (25%) of the respondents strongly agreed with the people/community issues. 17 (47%) agreed, other respondents 3 (8%) were not sure. In addition, 5 (14%) of the respondents disagreed, and 2 (6%) of the respondents strongly disagreed.

When respondents were asked about the inadequate training and research as a key issue of implementing ICT in agriculture, 18 (50%) strongly agreed, 7 (19%) agreed, 9 (25%) were not sure, none of the respondents disagreed, and other respondents strongly disagreed 2 (6%).

Furthermore, the researcher asked the respondents on the political as a key issue of implementing ICT in agriculture, 23 (64%) strongly agreed, 8 (22%) of the respondents agreed, none of the respondents were not sure, 2 (6%) of the respondents disagreed and the rest strongly disagreed by 3 (8%).

Lastly, responses on the issue of adoption barriers and their alleviations, were 10 (28%) strongly agreed, 15 (42%) agreed, 4 (11%) were not sure, other respondents disagreed by 7 (19%), and none of the respondents strongly disagreed.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

This chapter provided the summary of findings, the conclusions and recommendations of the study, and the areas for further research, as captured in from the analysis of the study objectives which were to examine the application of ICT tools in agriculture, to find out the role of ICT in agronomic practices, to identify constraints and issues of implementing the ICT in agriculture in Kabalore district. The findings on each objective were as follows.

5.1 Summary of findings

The summary of the findings were based on the tabulations in chapter four about the personal data and the questionnaire responses from respondents of Kabarole district.

Results from the table 4 showed that the Years of Experience in agriculture activities by the respondents who participated in this research; were 6 respondents of less than 3years represented by (17%), 10 respondents worked for 6years and represented by (28%), 16 respondents worked for 9years represented by (44%), and 10 respondents worked for more than 10years by (11%). This indicates that the researcher approached rightful people who are already in position to give the correct information for the study.

In regard to the results on the application of ICT tools in agriculture sector, geographical information system was agreed upon by 78%, handheld personal computer scored 77% (agreed), mobile phone applications was agreed upon by 89%, internet, web-based applications had 67% (agreed), community radio stations was agreed upon by 73%, and lastly global positioning system had 75% (agreed). This indicates that the majority of the respondents clarified that there is application of application of ICT tools in agriculture sector in Kabalore district.

The analysis on the role of ICT in agronomic practices; 72% of the respondents agreed with the models for crop variety selection, key tools for land planning and management was agreed upon by 70%, soil quality assessment is done with some useful technologies was also represented by 70%, 72% of the respondents also agreed with ICTs supported Irrigation, fertilizers, pesticides and quality of yield management scored 69%, while 86% agreed with the identification of nutrient deficiencies, and tools for pest and disease management had 70%. This implied there are roles of ICT in agronomic practices in Kabarole district respectively.

The study on the identification of constraints and issues of implementing the ICT in agriculture; 60% of the respondents agreed with lack of hardware and software infrastructure, 72% represented the prevalence of inadequate training and skills, shortage of research priorities had 70% in agreement, People/community issues was also represented by 72%, 69% of the respondents agreed with inadequate training and research, while political issues had 86% in agreement, and Adoption barriers and their alleviation agreed with 70%. These responses, in brief, when adopted by the agriculture extension workers and other authoritarians district and by the help of the government as raised by the research, it will reduce both constraints and issues of implementing the ICT in agriculture in Kabarole district.

Conclusion

The main aim of this research focused on technology in modernization of agriculture in Kabarole district. The study objectives were to examine the application of ICT tools in agriculture sector in Kabalore district, to find out the role of ICT in agronomic practices in Kabalore district, and to identify constraints and issues of implementing the ICT in agriculture in Kabalore district. The study concluded that there were applications of ICT tools in agriculture sector through geographical information system, handheld personal computer, mobile phone applications, internet, web-based applications, community radio stations, and lastly global positioning system. Secondly, this was also brought by various roles of ICT in agronomic practices and these were; models for crop variety selection, key tools for land planning and management, soil quality assessment is done with some useful technologies, ICTs supported Irrigation, fertilizers, pesticides and quality of yield management, identification of nutrient deficiencies, and tools for pest and disease management respectively. Finally, the study further concluded by identifying

constraints and issues of implementing the ICT in agriculture. These issues were; lack of hardware and software infrastructure, inadequate training and skills, shortage of research priorities, People/community issues, inadequate training and research, and Adoption barriers and their alleviation agreed with 70%.

5.3 Recommendations

The researcher made the following recommendations basing on the study findings as raised in the research;

As raised in research on the study objectives, the researcher recommends that Agriculture Extension workers should emphasize the application of ICT tools in agriculture on the village level to as to increase on the high quality and quantity of the produce. This should be done by the help of radio presenters through community radio stations to host agriculture developmental programs. In addition, the farmers should adopt and different ICT tools in their day-to-day running of agricultural business. Village Executive Officers should conduct different meetings with the aim of discussing the constraints and key issues of implementing ICT in agriculture in district.

5.4 Areas for further Research

When provided with time and resources, the researcher suggests that next researchers will make further research on:

The role of radio stations in reducing unemployment.

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APPENDICES

Appendix I: Questionnaire for Employees

Dear Respondent,

My name is **Atuhaire Ronald** a student at Kampala International University. I have designed this questionnaire for the sole purpose of collecting data on "*Technology in modernization of agriculture.*" The data collected will be treated with a very high degree of confidentiality and it is meant for academic purpose only. I have chosen *Kabalore District* as the case study. This is a requirement from my university for the award of Bachelor's Degree in Mass Communication. On this note therefore, I kindly request you to support me in providing data pertaining the topic in the space provided in the below questionnaires.

Section A: General Information about respondents

1. Gender (please tick appropriately)

Male	Female

2. Age range

25-30yrs	31-34yrs	35-40yrs	41& above

3. Educational level

PhD	Masters	Bachelor	Diploma/ Certificate

4. Years of Experience in agriculture activities

1-3yrs	4-6yrs	7-9yrs	10yrs and above

Indicate your level of agreement or disagreement by ticking one of the given statements using the following 5 points Linker scale (1-5) where necessary.

1. SA - Strongly Agree, 2. A - Agree, 3. N – Not sure, 4. D - Disagree, 5. SD - Strongly Disagree

i) What are the applications of ICT tools in agriculture sector

Statements	SA	A	N	D	SD
Geographical Information System					
Handheld Personal Computer					
Mobile (Cellular) Phone Applications					
Community Radio Stations					
Internet and Web-Based Applications					
Global Positioning System					

ii) What is the role of ICT in agronomic practices

Statements	SA	A	N	D	SD
Models for crop variety selection					
Key tools for land planning and management.					
Soil quality assessment is done with some useful technologies.					
ICTs supported Irrigation					
Fertilizers, pesticides and quality of yield management					
Identification of nutrient deficiencies					
Tools for Pest and Disease Management					

iii) **What are the constraints and issues of implementing the ICT in agriculture**

Statements	SA	A	N	D	SD
Challenges					
Lack of hardware and software infrastructure					
Prevalence of inadequate training and skills					
Shortage of research priorities					
Key issues					
People/community issues					
Training and research					
Political issues					
Adoption barriers and their alleviation					

Appendix II: Interview Guide to Extension workers and Farmers

Dear respondents,

My name is **Atuhaire Ronald** and you have been purposively selected to be interviewed because of your knowledge about the application of ICT tools in agriculture sector. This interview is designed to assist me to complete an academic research project on the topic entitled "*Technology in modernisation of Agriculture. A case study of Kabalore district.*"

This research is a partial fulfillment for the award of a Degree of Mass Communication. The interview will take about 15 minutes. All responses will be kept with utmost confidentiality and will purely be for academic purposes.

i) Which category of the respondents do you belong?

ii) For how long have been carrying out agriculture activities?

iii) What is your highest level of education?

iv) What are the applications of ICT tools in agriculture sector?

.....

.....

v) What is the role of ICT in agronomic practices?

.....

.....

vi) What are the constraints and issues of implementing the ICT in agriculture?

.....

.....

vii) What recommendations do you make on *Technology in modernization of agriculture in Kabarole district*?

.....

.....

"I appreciate your cooperation"