# DESIGNING AND DEVELOPING AN E-AGRICULTURAL INFORMATION SERVICE AT THE LIBRARY OF CHINHOYI UNIVERSITY OF TECHNOLOGY (CUT): A SURVEY

by

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# DECLARATION

Student number: 53258827

I, Benhildah Mabika,declare that the dissertation with the title title “Desinging and developing an e-agricultural information service at the library of Chinhoyi University of Technology (CUT): a survey”, is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

Bnobel 12/11/2015

Signature Date

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Lastly, my appreciation goes to the Almighty God for His gift of life and strength which saw me completing this study which was conducted during a period of economic instability in Zimbabwe.

# DEDICATION

To my dear parents, my husband Steven, my sister Jenipher and my beloved daughters Zuvarashe and Ruvarashe I dedicate this research.

## Summary

The topic of this study done in Chinhoyi, Zimbabwe was to explore the viability of designing and developing an e-agricultural information service at the Library of Chinhoyi University of Technology (CUT).The aim of the study was to determine the feasibility of designing and developing a web based information database for answering farmers' queries. It also aimed to identify ways in which agricultural information can be transferred to farmers using ICTs available to the farming community and CUT.

The findings indicated that an effective and efficient e-agriculture information service can be established at CUT using cell phones as the main communication medium.

The research design was a survey and a questionnaire was used for data collection. SPSS was used for data analysis form which interpretations and recommendations were made.

**Key Terms**

Agriculture; e-agriculture; e-agriculture community; eco-farmer; e-farm; information communication technologies; information dissemination; information needs; information dissemination system; survey.

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| | |
|---|---|
| AGRITEX | Agricultural Technical and Extension Services |
| ARENET | Agricultural Research and Extension Network |
| AREX | Agricultural Rural Extension |
| CA | Current Awareness |
| CELAC | Collecting and Exchange of Agricultural Content |
| CPF | CafeDirect Producer Foundation |
| CUT | Chinhoyi University of Technology |
| CTA | Technical Centre for Agricultural and Rural Cooperation |
| EGF | Evergreen Farming Group |
| FADECO | Family Alliance and Development Cooperation |
| FAO | Food and Agricultural Organisation |
| GA2 | General Assembly2 |
| GIS | Geographic Information Systems |
| GPS | Global Positioning System |
| HPC | Handheld Personal Computer |
| ICRISAT | International Crops Research Institute for the Semi-Arid-Tropics |
| ICTs | Information and Communication Technologies |
| IDS | Information Dissemination System |
| IFAD | International Fund for Agricultural Development |
| ILRI | International Livestock Research Institute |
| IVR | Interactive Voice Response |
| KACE | Kenya Agricultural Commodity Exchange |
| M&E | Monitoring and Evaluation |
| NADC | Nemakonde Agricultural Company |

| | |
|---|---|
| NAFIS | National Farmers Information Service |
| NALEP | National Agricultural and Livestock Extension Programme |
| NGO | Non-governmental organization |
| NLIS | National Livestock Identification system |
| PA | Precision Agriculture |
| PDAs | Digital Personal Assistants |
| PAFID | Philippine Association for Intellectual Development |
| RFID | Radio Frequency Identification Devices |
| SDI | Selective Dissemination of Information |
| SMS | Short Message Service |
| SPSS | Statistical Package for the Social Sciences |
| TIST | International Small Group and Tree Planting Alliance |
| UK | United Kingdom |
| UNESCO | United Nations Educational, Scientific and Cultural Organization |
| VCD | Video Compact Disc |
| WISIS | World Summit on the Information Society |
| UZ | University of Zimbabwe |

# Chapter I: Introduction

## 1.1 Introduction

This chapter covers the introduction to the study, background to the study, statement of the problem, research questions, significance (or importance) of the study, the scope (delimitations) of the study, a definition of terms and the chapter outline of the study.

Agriculture which is an important sector in the global environment has been defined as a system of raising useful plants and livestock under the management of man (Rimando 2004). Agriculture takes up more than one-third of the world's land (The World Bank. n.d.). Agriculture is especially important as it is the major source of income, for the majority of the rural world population (The World Bank. n.d.). It is an indispensable sector because it is the source of every human being's daily food. In addition, many of the products we use in our daily lives are derived from plants and animals that are produced in the agricultural sector. This includes pharmaceuticals, detergents, books, lotions and cosmetics.

According to the Ministry of Agriculture, Mechanisation and Irrigation (http://www.moa.gov.zw/index.php/2-uncategorised/8-welcome-to-our-ministry) agriculture is the backbone of the Zimbabwean economy It accounts for 23% of formal employment in the country and contributes 14-18.5% to the gross domestic product (GDP). In addition, it earns approximately 33% of the country's foreign earnings. Zimbabwe's future therefore depends on the development of a diversified, vibrant and efficient agricultural sector.

Rukuni, Eicher and Blackie (2006) stated that the extension worker to farmer ratio in Zimbabwe stands at 1: ≥1000 for Natural Region IV. According to the Ministry of Agriculture Development and Irrigation (2015) telephone interview the current status for the farmer-extension worker ratio for Zimbabwe is three extension workers per Ward, where as a ward is comprised of eight to ten villages. In developed countries 200 farmers have access to one extension officer while in Africa one extension officer attends to almost 4000 farmers in need of technical advisory and information services. Stakeholders in agriculture and ICT agree that Information Communication Technologies (ICTs) could fill agriculture extension gaps. This ratio of extension workers to farmers is an obstacle to effective transfer and exchange of knowledge and information to farmers. ICTs can close the gap by improving delivery of extension services particularly to rural farming communities. In Zimbabwe 4800 extension workers are available for the 1.6 million farmers in Zimbabwe (Agritex as cited in Chikulo 2013).

Mugwisi, Ocholla and Mostert (2014) highlighted that Zimbabwe's Ministry of Agriculture, Mechanization and Irrigation do not have a 'visible policy' regarding the management of information generated by its departments. Although a fair amount of information is being captured, that information is not readily accessible to farmers because of the absence of a central database. Information is generated electronically but circulated in hard copy thereby restricting circulation as the shortage of resources limit the amount of material printed.

Although agriculture is an indispensable sector there are several barriers which hinder the dissemination of agricultural information to farmers. Such problems include access to reliable, timely and relevant

information and a lack of information packaged in the way preferred by farmers (Diekmann, Loibl & Batte 2009). Packaging involves all aspects that play a role when information is being disseminated. It includes the communication channel(s) used, the language in which the information is disseminated and the way in which verbal text and visual portrayals are used for communication.

In developing countries the use of ICTs in transferring agricultural information is growing slowly. The key factors influencing the slow growth are a lack of information on the specific information needs of stakeholders, the format in which the available information is packaged and disseminated, the technological literacy of the information seekers, the unavailability of the appropriate ICT tools and a lack of infrastructure.

Using ICTs effectively for the dissemination of agricultural information to communities with similar problems than those who live in Zimbabwe has been described in studies

In Senegal, an agricultural market information system under the name, Xam Marse, has been in operation since 2001. From Xam Marse, Senegalese farmers receive information via SMS messages on their mobile phones or the web on the prices and availability of fruits, vegetables, meat and poultry on any of Senegal's markets (Manobi South Africa http://www.manobi.sn/sites/za/index.php?M=9&SM=20&Cle=54).

Pastoralists in the Sahel have also put e-agriculture into practice by operating a project known as Sustainable Management of Pastoral Resources in the Sahel, also referred to as the Cyber Shepherd Initiative (ICT Update 2004). This project enables Sahelian pastoralists to access information on grazing lands to help them manage their activities on grazing land and water sources during the dry season.

Agricultural extension workers in Honduras offer technical advice and solve farmers' problems on their farms (Adegite 2006).They use computer laptops, digital cameras, portable printers, cell phones, portable weather stations, global positioning system devices to map farm boundaries, topography, irrigation systems and deliver information. This is an improvement on the traditional technical assistance programmes where field staff record information and deliver it a week later after returning to their office. As a result of the use of ICTs, farmers are receiving direct services on technical advice, production, post-harvest systems, market linkages, and infrastructure. Palmer (2012) also listed other e-agriculture activities which are taking place worldwide. They included Agrinet in Uganda which uses cell phones and e-mails to communicate agricultural information. There are also CafeDirect Producer Foundation (CPF), an international mobile platform for disseminating agricultural information; Digital Green in India which uses short videos to communicate agricultural information; Frontline SMS an international platform where the internet is used to communicate agricultural information; KUZA Doctor in Kenya, a mobile facility used to communicate agricultural information to farmers and WeFarmit a United Kingdom (UK) initiative.

This study wants to contribute to advancing the use of e-agriculture to disseminate much needed agricultural information to Zimbabwean farmers. It wants to explore the viability of designing and developing an e-agricultural information service at the Library of Chinhoyi University of Technology (CUT), situated in Mashonanland, a province of Zimbabwe. It wants, in other words, to investigate whether repackaging agricultural information using e-technology is feasible in Zimbabwe.

## 1.2 Background to the study

E-agriculture refers to a new field in which information and communication technologies (ICTs) are being applied to improve agriculture and rural livelihoods (Mangstl 2008). E-agriculture was one of the key issues covered at the World Summit on the Information Society's (WSIS) Plan of Action in 2003 (WSIS 2003). It is during this summit that an e-agriculture community was formed. This e-agriculture document states that e-agriculture should apply ICTs to the dynamic dissemination of accessible, up-to-date information on agriculture, particularly in rural areas. These technologies should be used as instruments to increase food production, both in quantity and quality (WSIS 2003).

E-agriculture can therefore be seen as an emerging field within agricultural information dissemination, agricultural development and business. "E-agriculture, involves the conceptualization, design, development, evaluation and application of innovative ways to utilize existing or emerging information and communication technologies" (Mangstl 2008).

The ICTs used in e-agriculture include mobile phones, digital personal assistants (PDAs), smart cards, CD-ROMs, Geographic Information Systems (GIS), radio, Radio-Frequency Identification Devices (RFID), imaging and acoustic technologies, websites and weblogs, and email-based information sources (Mangstl 2008).

Since the formation of the e-agriculture community in 2003, many countries, especially developing countries, combined different types of ICTs to improve the provision of information to farmers in order to

improve agricultural practices and consequently increase the income of farmers.

In Zimbabwe e-agriculture is, however, still in its infancy stages of implementation. Currently most of the information dissemination initiatives that use e-agriculture are still experimental. Zimbabwe has very few facilities or services that are addressing the issue of e-agriculture. These facilities, however, cater for specific groups of people and not for the whole agricultural sector. Because the programmes are still in the experimental phase, they are only found in certain areas of the country. They, furthermore, are still to be evaluated to see if they are successful. Access to agricultural information is therefore a challenge for the farming communities of Zimbabwe. This is especially true in the case of the rural farmers as compared to peri-urban farmers.

In Zimbabwe, ICT based information dissemination services for the agricultural sector still need to be developed. This necessity is long overdue. Research, therefore, needs to be conducted to determine how ICTs can be used in the Zimbabwean agriculture. Similarly the ways in which agricultural communities can make use of ICTs to meet their information needs and the perceptions of agricultural communities towards the use of ICTs in agriculture need to be researched.

In Zimbabwe Chinhoyi University of Technology (CUT) is the only university located in Mashonaland West Province of Zimbabwe. Mashonaland West Province is one of the main farming regions of the country and is an ideal place in the province where an e-agriculture service for both the province and the country can be developed. The introduction of e-agriculture in this province may help to overcome the geographical barriers to agricultural information access in the province. Apart from being the only university in the province, CUT has the School

of Agricultural Sciences and Technology as one of the biggest schools in this university. This school offers both undergraduate and post graduate degrees in agriculture. Makuza (2014) highlighted that the School of Agricultural Sciences and Technology at CUT has highly qualified and experienced staff which can produce innovative and skilled graduates to meet the requirements of the ever changing needs and demands of the agricultural industry. The school encompasses two sections, namely Livestock and Crop. The Livestock section rears cattle, sheep, goats, chicken (indigenous, broilers & layers), guinea fowls, rabbits and pigs. The Crop section grows maize, soybeans, sorghum, sunflower, bird eye chillies, pastures trees, grasses and legumes. The mission of the School is to produce innovative graduates through the creation of knowledge and enhancement of entrepreneurship. It also aims at providing community services through quality teaching, training and technologically-oriented research Makuza (2014).Since the staff is qualified to answer agricultural questions CUT is the ideal place to house an e-agricultural service for Mashonaland West Province.

## 1.3 Research problem

Recent researchers such as Adegite (2006), Diekmann, Loibl and Batte (2009), Palmer (2012), Mugwisi et al (2014) and others indicate studies that reviewed the dissemination of appropriate and suitably packaged information for farmers who are in similar situations as those in Mashonaland West Province of Zimbabwe. The position of CUT as a possible centre for establishing such service provided the possibility or investigating the following research problem:

What is the viability of establishing an ICT based information dissemination service that can be used to improve and sustain the agricultural sector through the use of ICTs?

Following the execution of this problem more light might be shed on a procedure which can be used to create a web-based agricultural information dissemination system in the province.

## 1.4 Research aim

In order to solve the problem described above, this research focused on the feasibility of creating an electronic-agriculture (e-agriculture) information dissemination service in Mashonaland West Province at CUT. It is foreseen that this will be a service which should focus on the dissemination of agricultural information to the farming communities using ICTs.

## 1.5 Goals/specific objectives of the study

CUT as the only university in the province and one which has both physical and personnel resources; is in a position to help with the planning and establishment of such a service. CUT Library may be used to house the database for agricultural information and have the responsibility of communicating this information to the farming community in the province.

Based on the research aims formulated above the following objectives of this research project were identified:

- to determine the language in which the farming community would like to access agricultural information;
- to determine how the farming community would prefer to access agricultural information?;
- to determine the technological literacy of the farming community; and
- to determine which ICT tools are available to the farming community.

## 1.6 Research questions

In their different studies Mangstl (2008), Ali (2012), Palmer (2012) and Mugwisi et al (2014) stated that the biggest problems experienced by agricultural communities, especially those in rural areas, is a lack of agricultural information which is accessible to their communities and available in their local languages. Therefore, this study focused on answering the following question:

- What are the prerequisites for designing a needs-based e-agriculture information service at Chinhoyi University of Technology for farmers in the Mashonaland West Province?

In order to answer this question the following sub-questions need to be addressed to the broader farming community in Mashonaland West. This community includes farmers, academics and students in the school of agricultural sciences at CUT, non-academic staff at CUT involved in the dissemination of agricultural information and agro-dealers in the province.

- What information is needed by the broader farming community in the province
- In which language and format does the farming community require the information
- How would the farming community prefer to access the information?
- How technologically literate is the farming community?
- Which ICT tools are available to the farming community?

## 1.7 Scope/delimitations

The research covered only one province (Mashonaland West) out of the ten 10 provinces of the country. This was due to limited resources and

time frame of the research project. The research participants were chosen from stakeholders of the agricultural sector in the province that is farmers, agro-dealers, services providers, lecturers and student of the School of Agricultural sciences at CUT. Include these stakeholders in research aim/questions and objectives above

Most of the participants came from the farmers' stratum. Farmers in Zimbabwe are classified in three categories which are communal farmers, small scale and large scale commercial farmers depending on the size of land possessed by each farmer. For the purpose of this study all farmers had equal probability of being selected to participate in this study as participants were selected from farmers who were exhibiting at the provincial agricultural show.

Data was collected using the same questionnaire for all participants in the view that both farmers and other stakeholders' information needs are the same in the sense that the same information required by the farmers to increase production is the same information required by other stakeholders to achieve different goals. For example academics may need same information for research purposes while agro-dealers, ICT staff and librarians may need the same information in order to provide services that are based on end-user needs.

The questionnaire addressed participants' information needs regarding the need of using ICTs to get agricultural information, in which languages, using which communication medium, accessibility to ICT tools, awareness of available e-agriculture information services, how often participants search for agricultural information and which information do they frequently need updates on.

## 1.8 Justification of the study

This research provides prerequisites which can be used to design and develop an electronic-agricultural information service at CUT. These expected findings of this research could benefit policymakers at CUT because they will provide basic prerequisites of how to create such a service for the whole province; this may lead to a national e-agriculture information service at the library of CUT.

The research also provides answers on the information needs of stakeholders in the farming community of Mashonaland West Province. This information can be used to provide agricultural information for the whole nation and help the country of Zimbabwe to:

- Participate and promote the WSIS objective of ensuring the systematic dissemination of information using ICTs in agriculture in order to provide ready access to comprehensive, up-to-date and detailed knowledge and information in rural areas.
- Increase the literature for researchers focusing on e-agriculture in the province and country.

## 1.9 Research methodology

In order to establish e-based agricultural information dissemination service it is necessary to assess the information needs of the farmers and other stakeholders involved so as to prepare and deliver a service which relates to the needs of the clientele. In this section the research methodology used to obtain the goals is summarised. It gives an overview of the research design, target population, sample and sampling techniques that were applied, data collection and data analysis methods used.

The research approach was quantitative. Primary data was collected and analysed specifically for the purpose of this research.

Fieldwork was carried out in Mashonaland West Province. Mashonaland West is one of the ten provinces of Zimbabwe. It covers an area of 57,441 km² and has a population of approximately 1.5 million. The province is divided into 11 major districts (Zimbabwe National Statistics Agency 2012:49). Chinhoyi is the capital of the province.

The target population for this study was all farmers in Mashonaland West Province, all members of staff and students from CUT's School of Agricultural Sciences, all staff members from the Library and ICT departments at CUT and all Agro-dealers in Mashonaland West Province. The selection of the population sample for the purpose of this study was done using stratified random sampling. A sample of 300 was selected from the target population. There were three strata in the sample namely farmers, CUT and agro-dealers which consisted of other employees from other agricultural stakeholder organizations in the province.

Questionnaires were used to gather primary data for the survey. Self-administered and interviewer administered questionnaires were used to collect data from the sample population.

A pilot questionnaire was send for verification and evaluation to five of the 15 professors and doctors from the School of Agricultural Sciences and Technology at CUT, and a pilot survey was conducted amongst the farmers as well. The pilot survey was done during one of the Zimbabwe Farmers' Union (ZFU) provincial meetings where farmers and representatives from agricultural stakeholder organizations usually meet. Twenty questionnaires were completed for the pilot survey. The questionnaire was finally sent for final verification to the project supervisor.

The analysis of data generated by closed-ended questions from the questionnaire was done using the computer statistical software Statistical Product and Service Solutions (SPSS) where descriptive statistical measures such as tables, percentages, frequencies and graphs was used and final conclusions were drawn.

## 1.10 Definition of terms

The following terms are defined in the context they are used in this research.

### 1.10.1 Agriculture

Rimando (2004) defines agriculture as a system of raising useful plants and livestock under the management of man. For the purpose of this research agriculture was defined as, the growing of crops and keeping of animals for human consumption and other economic gains.

### 1.10.2 Information needs

Information is important in our daily lives and should be disseminated to its target audience at the right time and in the right format. An information need is “a basic requirement for information that is of value for one’s private or social life”(Chisita 2010:3). In other words, for information to be of value, it should meet the requirements of its target group.

### 1.10.3 Information dissemination

The term has been frequently used in the information field and it refers to the process of giving information seekers what they want to know (Sturges & Sturges 1997: 217).

### 1.10.4 Information and communication technologies (ICTs)

This refers to technologies that enable the communication, the processing and transmission of information by electronic means (Salau & Saingbe 2008).

### 1.10.5 E-agriculture

This is a new field in which information and communication technologies (ICTs) are being applied in agriculture to improve agriculture and rural livelihoods (Mangstl 2008).

### 1.10.6 Information dissemination system (IDS)

A number of Information dissemination systems are being designed and implemented internationally for specific purposes. An IDS is defined as a computer based information system which contains related information targeted to a particular group of users (Namisiko & Aballo 2013). E-agriculture is being designed to disseminate agricultural information mainly to farmers in remote areas.

### 1.10.7 The e-agriculture community

This is a global initiative established in 2003 with the intention of enhancing sustainable agricultural development and food security through the use of ICTs in the sector (Mangstl 2008). The e-agriculture community brings together people internationally to exchange information, ideas, and resources concerning use of information and communication technologies (ICTs) for developing the agricultural sector (Mangstl 2008).

## 1.11 Outline of chapters

The first chapter outlined the background to the study, the research problem, the research focus, the research questions, scope and

justification for the study. It also justified why this research was carried out and of what benefit it is. It also includes the definition of the terms used in the study.

Chapter two is a literature review. This chapter reviews and assesses other studies which has been carried out which are related to the topic of research. It covers what other scholars or writers say concerning the designing and developing of e-agriculture information services.

Chapter three presents the research methodology of the study. It provides a description and justification of the specific steps followed in doing this study. It covers the research philosophy or approach used in this study, the research design used, the research population, the sampling methods, the data collection instruments and the data analysis procedure.

Chapter four presents the analyses and interprets the findings of this research. Graphs and tables are used for an enhanced presentation of the findings.

Chapter five discusses the research findings by research questions and objectives. It also provides conclusions drawn from the findings and includes recommendations made based on the findings.

## 1.12 Conclusion

This chapter has outlined the background of the study, the research problem, research focus, research questions, scope and justification for the study. In other words this chapter acts as a summary of what is going to be covered in this research project. It has also justified why the research was carried and of what benefit it will be to both the Mashonaland Province and Zimbabwe at large.

The following chapter is the literature review. This chapter assesses other studies carried out by various researchers which are related to the topic of study. It reviews what other scholars say concerning the designing and developing of e-agriculture information dissemination services.

# Chapter 2: Literature Review

## 2.1 Introduction

Information dissemination in agriculture is changing. It is moving from the traditional information dissemination methods where information was mainly communicated by extension officers, the radio and television. In many areas agricultural information is now being communicated to farming communities using Information Communication Technologies (ICTs). The use of ICTs in agriculture which is termed e-agriculture has received global attention. However, recent research has proven that the successful development and design of information systems are heavily dependent on human aspects of information provision. Aspects in this regard include information needs, wants, demands, preferences and varying perceptions of the end user.

This chapter discusses several studies carried out by different scholars regarding these human aspects of information provision and how they influence the way agricultural information must be communicated to the farming communities using ICTs. The chapter also discusses e-agriculture's background. This include what e-agriculture entails, the evolution of e-agriculture, the e-agriculture community and its objectives as well as several ICT tools which can be used in e-agriculture. It also discusses various e-agriculture information dissemination systems,

success stories, benefits of using ICTs in disseminating agricultural information and the barriers and challenges associated with designing and implementing electronic agricultural information systems.

### 2.1.1 Information needs/wants/demands/preferences

According to Kemp (as cited in Bachhav2012) “information has been described as the fifth need of man ranking after air, water, food and shelter”. This indicates that information is a basic need in our daily life. Information touches everything we do. To be of value, however, information should be disseminated to the relevant people at the right time. Only then can it help individuals, organizations and groups of people to make the correct decisions.

Information is defined as processed data that reduces uncertainty and helps in decision making (Faibisoff & Ely, 1974). Easdown and Starasts (2004) are of the opinion that, for information to be worth seeking it must have value. This value is, however, not uniform. Individuals have different perceptions of the value of agricultural information which depends on the policy environment and the social and individual context (Easdown & Starasts 2004). Information that is considered valuable by a given society or an individual may be considered useless in another environment. In their study on designing of an e-based agricultural (IDS) in Iran, Ommani and Chizari (2008) noted that two of the five key factors required for designing IDS are that the communication among all stakeholders should be mutual and information must be based on farmers’ needs.

The term information need is used as an umbrella term which has a variety of interpretations. These interpretations include information demands, requirements, wants or desires (Faibisoff & Ely, 1974). Chisita (2010:3) defines an information need as “a basic requirement for information that is of value for one’s private or social life”. Chisita (2010) highlighted that the information needs of farmers are shaped by the socio-economic activities of the group they belong to. Any information

produced should meet the requirements of its target group for it to be of value. Simon (1971) noted that:

> What information consumes is rather obvious: it consumes the attention of its recipients. Hence a wealth of information creates a poverty of attention, and a need to allocate that attention efficiently among the overabundance of information sources that might consume it.

This means that information is only considered to be of importance if it is able to meet the needs or requirements of its target audience.

Meite and Devi (2009) and Bachhav (2012) noted that the information needs of farmers are not uniform but differ according to state of development in a given area. Meite and Devi (2009) classified information needs of farmers into six groups namely:

- Field acquisition: information about agricultural land types and how to purchase it.
- Agricultural inputs: information about seed varieties, pesticides, agricultural equipment, weather conditions, harvest and post-harvest technology.
- Agricultural technology: information regarding innovative technology in farming.
- Agricultural credit: information about loan and credit facilities available for farmers.
- Agricultural marketing: information about prices and markets for agricultural products.
- Food technology: information on post-harvest food technology is required to get maximum profits out of agricultural produce.

Diekmann and Batte (2011) investigated the information needs of agricultural consultants in Ohio and they classified their information needs in seven categories namely:

- Crops
- Livestock
- Agribusiness/economics
- Small farms/beginning farmers
- Environment/conservation
- Business management
- Farm machinery

The findings of this research show that respondents' primary information demands are related to the environment/conservation and crops, followed by agribusiness. Information about farm machinery and livestock are last on the list.

Mugwisi, Ocholla and Mostert (2014) noted that the information needs of researchers, extension workers and farmers in Zimbabwe cover the major disciplines of agriculture such as crop and animal science, agricultural engineering and agricultural economics.

Information needs and use in agriculture play an important role in decision making. When information about a topic is communicated to farmers, as for instance updates on weather conditions, they gain knowledge and with that knowledge they can make informed decisions on when and where to plant their crops.

Scholarly articles on information needs and preferences show that the factors that influence information searches by individuals generally differ from country and region (Babu, Glendenning, Okyere & Govindarajan 2011). The "identification of information needs is essential to the design of information systems in general and to the provision of effective information

services in particular, but it requires an investigative work in order to identify information needs" (The Information Society Library 2003).

One can therefore, assert that in order to develop information systems which will disseminate relevant information to its target group, it is necessary to determine the information needs of the target population first.

Understanding the information needs of a target population helps in designing appropriate policies, rules, regulations, systems and programs in organizations. These needs can be identified by conducting surveys which may use primary and/or secondary sources of information.

### 2.1.2 Information dissemination/communication

Information communication involves the transfer of current information among senders, receivers and intermediaries according to their varying perceptions of information needs of the end user. The communication or dissemination of information is one aspect that received less attention in the field of information science.

Information dissemination is a process of giving information seekers what they want to know before they come to ask (Sturges & Sturges1997:217).The process works together with current awareness (CA) and selective dissemination of information (SDI). Published studies on the communication of agricultural information show that different channels are used to transfer agricultural information. Traditionally farmers relied on getting information from personal contact with extension workers, radio, television (Bhagat, Nain & Narda 2004) and progressive farmers (Singh, Narwal & Malik 2003). Meite and Devi (2009) assessed the farmers' information needs in rural Manipur and they found that the most preferred channel of communicating agricultural information was the radio followed by the television and newspapers However, more recent studies Churi, Mlozi, Tumbo and Casmir (2012), Diekmann and Batte (2011) and

Ango, Illo, Abdullahi, Maikasuwa and Amina (2013) show that farmers prefer radio, television, the internet, personal communication with extension personnel, extension newsletters and mobile phone as channels to communicate agricultural information.

Mugwisi et al (2014) noted that “researchers and extension workers play a significant role in the dissemination of agricultural information to the farmers” in Zimbabwe. They communicate with farmers through radio, television, newspapers, telephones mobile phones, pamphlets, posters and public gatherings such as agricultural shows and field days.

Effective information dissemination in the agricultural sector facilitates the adoption of new farming technologies and better practices in farming, thereby increasing yields.

For information to be effectively and efficiently used by the farming communities it needs to be delivered on time, hence e-agriculture information dissemination services can play the role of providing timely information to the farmers. Through different ICTs in e-agriculture current information can be disseminated to remote areas at the same time.

## 2.2 Definition and uses of ICTs

ICT is defined as any device, tool, or application that allows the exchange or collection of data or information through interaction or transmission (The General Assembly second (GA2) agriculture Committee 2013). Dewan and Kraemer (2000) defined ICT as a collection of hardware, software, telecommunication networks, people, and procedures that can help in data collection, processing, storage and dissemination of information. The CTA (2003) referred to ICT as technologies that enable the communication and the processing and transmission of information by electronic means. Namisiko and Aballo (2013) noted that ICT is a set of

tools used for the collection, dissemination and storage of information to help in decision making.

After having considered the definitions of ICT given by different scholars as mentioned above ICT in this study is defined as technologies that allow the collection, processing and dissemination of stored information by electronic means.

## 2.3 How are ICTs used in e-agriculture?

ICTs have the potential to transform agriculture into profitable businesses as they have the ability to deliver relevant and timely information that facilitates the making of informed decisions by farmers (Ali 2012; Ommani & Chizari 2008).Thus, Unwin (2009) reported that, because of changes being brought in by ICTs, new opportunities arise to improve usage and performance of livelihood technologies in agriculture and other sectors. Arokoyo (2005) listed the following as potential applications of ICTs in agricultural extension:

- It has the capacity to reach a large audience using the radio, television and the Internet.
- It can be effectively used for training and demonstrations using television, video, VCD and CD-ROM.
- It can be effectively used for searching and packaging information on demand.
- It can be used for networking among and between stakeholders.
- It can be effectively used for community mobilization.

ICTs can play an essential role in agriculture because of a number of reasons. In agriculture it can be used to improve agricultural production,

because farmers can access information on good farming practices through ICTs. But ICTs can also improve communication among stakeholders through using different devices to share agricultural information. ICTs can also make market information easily available. Information can be uploaded on individual devices as often as the farmer wants it. In this way it can increase easier buyer-trader communication links. ICTs may be used for weather forecasting and as a warning system for outbreaks of diseases which can enable farmers to act in a preventative manner.

These applications of ICTs in agriculture are referred to as e-agriculture and are seen as one tools to help the agricultural sector to increase production.

In summary, ICTs are being used in agriculture to enable easy access to information among stakeholders, to allow easy dissemination of information in the sector, to enable stakeholders to make informed decisions and to facilitate remote access of information to the majority of rural farmers.

## 2.4 E-agriculture

E-agriculture is a recent term in ICT that describes a global practice where people exchange information, ideas and resources related to the use of ICTs for sustainable agricultural and rural development(Mangstl 2008).

> E-agriculture offers the rich potential of supplementing traditional delivery of services and channels of communication in ways that extend the agriculture organisation's ability to meet the needs of farmers(Namisiko & Aballo 2013).

In their study Meera, Jhamtani and Rao (2004) defined e-farming as the incorporation and utilisation of information technology in farming related

activities. Namisiko and Aballo (2013) indicated that e-agriculture focuses on improving the agricultural and rural sectors through improved information and communication processes. They further say e-agriculture is today recognised as a means of empowering farmers to make informed decisions.

E-agriculture has proven to be an area of focus especially in developing countries as the global world is viewing it as an answer to poverty reduction in the third world. Both Mangstl (2008) and Barnabas (2013) agreed that the introduction of e-agriculture is changing the traditional methods of farming and other agricultural activities for the betterment of agriculture and rural livelihoods.

## 2.5 The e-agriculture community

The e-agriculture community is a global initiative established in 2003 with the intention of enhancing sustainable agricultural development and food security through the use of ICTs in the sector (Mangstl2008). The community unites people internationally to exchange information, ideas, and resources related to the use of ICTs for sustainable agriculture and rural development (Mangstl 2008). According to the e-agriculture Community's website (http://www.e-agriculture.org/e-agriculture)the community currently have over 11,000 members from 160 countries. The individuals that form part of this community are information and communication specialists, researchers, farmers, students, policy makers, business people and development practitioners, who have interest in improving policies and processes regarding the use of ICTs in support of agriculture and rural development, to improve rural livelihoods (http://www.e-agriculture.org/e-agriculture).

The mission of the e-agriculture community is to serve as a catalyst for stakeholders in the agriculture and rural development sectors to share

knowledge, learn from others, and improve decision making about the role of ICTs in building sustainable agriculture and food security (http://www.e-agriculture.org/e-agriculture). The e-agriculture community's document states that e-agriculture should apply ICTs to the dynamic dissemination of accessible, up-to-date information on agriculture, particularly in rural areas, and to use these technologies as instruments to increase food production, both in quantity and quality (WSIS 2003).

## 2.6 Tools that can be used in e-agriculture

There are a number of ICT tools that can be applied to enhance e-agriculture. The tools differ in accordance to the purpose it aims to achieve or the availability of enabling infrastructure**.**

Richardson (1997) argued that any ICT intervention that improves the livelihoods of poor rural families will play a direct or indirect role towards improving agricultural production, marketing and post-harvest activities which contribute to poverty reduction. Richardson (1997)also pointed out that ICT interventions do not have to be specific to agriculture for them to enhance rural development or to improve agricultural production. Simple ICTs such as the introduction of a payphone in a community can play a significant role in improving the lives of rural communities and enabling them to contribute towards national agriculture. However, Bertolini (2004) refers to the 'digital gap' between those with and those without access to ICTs, and the skills that are necessary to take advantage of ICT services and the ability to pay for ICT services. Although ICTs can be introduced in poor communities there are some people who still might not be able to use them due to this digital gap. This emphasises the need for establishing services which suit the needs of the target community.

There is little doubt that e-agriculture is an emerging field within the agricultural sector which involves the application and utilization of existing

and emerging information and communication technologies (ICTs) for agricultural sustainability, and that there are a variety of ICT tools which can be applied for e-agriculture(Mangstl 2008; Munyua, Adera & Jensen2008;Richardson1997). These ICTs used in e-agriculture include mobile phones, digital personal assistants (PDAs), smart cards, CD-ROM, Geographic Information Systems (GIS), radio, Radio-Frequency Identification Devices (RFID), imaging and acoustic technologies, websites and weblogs, email-based information sources, precision agriculture (PA), world space satellite radio and community radio stations.

The uses of mobile phones, Internet and web-based applications, GIS-based decision support systems, handheld personal computer or personal digital assistants (PDAs), radio frequency identification (RFID), precision agriculture (PA), community radio stations and world space satellite radio in agriculture are explained below.

### 2.6.1 Mobile (cellular) phone applications

Bertolini (2004) observed that the cellular phone sms-application is the most important emerging ICT application being used to transfer information in Africa. There are a number of factors that contribute to why mobile phones are considered important for development, some of these factors were cited by different scholars as, their mobility and security to owners(Donner 2006);a good leapfrogger which works using radio waves. Therefore, no need to rely on physical infrastructure like roads and phone wires; they require basic literacy skills (Rashid & Elder 2009); they allow data transfer and are affordable to even the poorest rural population(Bertolini 2004; Rashid &Elder 2009).

In Benin the food security surveyors are using the Internet and the SMS mobile application to monitor rural markets on the prices of the 25 most important staple foods. This service is known as ONASA. After business

hours, prices are supplied to an Internet café where the data is then processed and then sent to subscribers via sms messages with the prices of important products from the six most important markets. Subscribers can also request for information via sms.

According to the website of the National Farmers Information Service (NAFIS) (http://www.nafis.go.ke/), NAFIS, through the National Agricultural and Livestock Extension Programme (NALEP) in Kenya, provides information to farmers using English and Kiswahili languages by telephone and cellular phone. The service provides market information and electronic trading platforms to both farmers and traders on prices of agricultural products.

There is also Kenya Agricultural Commodity Exchange (KACE) which offer market information through mobile phone short message service and Interactive Voice Response (IVR). IVR facilitates the use of voice mail to deliver agricultural information to farmers. Its main activities involve linkages of farmers and buyers providing market prices of agricultural products on a daily basis (Karugu 2011).

In Zimbabwe a platform called E-farming was developed by the University of Zimbabwe Library. It is through this platform that farmers can access solutions to farming problems via short message service (SMS) on their mobile phones. The E-farming database provides agricultural information relevant to farmers in Zimbabwe. The agricultural information contained in the database includes inputs access, market prices, animal and crop diseases and research based information meant to provide timely and automatic responses to farmers via SMS. This agricultural database is accessible to all who have access to mobile phones (UZ Weekly2013).

The concept was developed in view of the:

- the high tele-density in Zimbabwe with almost more than 5 million people having access to mobile phones;
- wider mobile network coverage with most areas in Zimbabwe being serviced by one of the three mobile operators;
- abundant agricultural information resources and research agricultural information specific to Zimbabwe at the University of Zimbabwe; and
- high demand for instant agricultural information by the farming community in Zimbabwe yet the country has no readily available publicly accessible agricultural information domain(UZ Weekly 2013).

EcoFarmer is another e-agriculture platform that is also available in Zimbabwe. It was developed by Econet Wireless Zimbabwe. This is a weather-indexed drought insurance service which enables smallholder farmers in Zimbabwe to buy insurance for eight cents per day. This amount is deducted from the farmers' prepaid phone account during the agricultural season. The service allows farmers to make a financial claim if their crops fail because of either inadequate or excessive rainfall. If drought occurs farmers receive US$100 for every 10kg seed pack planted. The system is an innovative weather monitoring network, which enables Econet to know exactly how much rain fell on the farmer's field. However, the EcoFarmer project is in a pilot stage. It has only provided service to farmers in Mashonaland East province and only for the period of November 2013 to March 2014. It still has to be expanded to other provinces if the results are seen to be a success (African farming and Food Processing 2013).

### 2.6.2 Internet and web-based applications

The internet and web-based applications are becoming important in sharing and disseminating agricultural information. FAO and partners are engaged in e-agriculture that focuses on the integration of agricultural services, technology dissemination and information delivered through the internet to the agricultural communities (Munyua et al. 2008). Munyua et al. (2008) also mentioned other electronic-based information dissemination projects which are taking place in other parts of Africa for example the ARENET web portal information provider in Uganda which is explained below:

The Agricultural Research and Extension Network (ARENET) in Uganda use a web portal facility to disseminate agricultural information to small scale farmers. The portal has a question and answer service through which farmers send their queries and get answers through the web. The farmers use Internet cafes, telecentres, information kiosks and market information centres to send their queries and receive answers from agricultural information providers who disseminate information through the web (Munyua et al. 2008).

The Collecting and Exchange of Local Agricultural Content (CELAC) in Uganda also uses a web-based platform to share local agricultural information using ICTs. Through resource centres with ICT facilities CELAC has a service where farmers ask agriculture related questions using Yahoo and SkypeCELAC (http://www.kiwanja.net/database/project/project_CELAC.pdf).

### 2.6.3 GIS-based decision support systems

Geographic information system (GIS) is another ICT tool that is being used in e-agriculture. A geographic information system (GIS) integrates hardware, software, and data for capturing, managing, analysing, and

displaying all forms of geographically referenced information" Geographic Information Systems (http://www.esri.com/what-is-gis-old/overview) It facilitates viewing, comprehension, interrogation, interpretation and visualization of data in many ways that reveal relationships, patterns and trends in the form of maps, globes, reports, and charts Geographic Information Systems (http://www.esri.com/what-is-gis-old/overview; Munyua et al. 2008). The following are listed top five benefits of GIS. GIS reduces costs, improves efficiency, enables sound decision making, and enhances communication and recordkeeping (Geographic Information Systemshttp://www.esri.com/what-is-gis-old/overview).

The above mentioned benefits are achieved through GIS's ability to map where things are, map quantities, map densities, find what's inside, find what's nearby and change map. (Geographic Information Systemshttp://www.esri.com/what-is-gis-ld/overview).

The other GIS facility is the mobile mapping component that can facilitate the collection of field data, such as geospatial time tags and attributes, for integrating into GIS. GIS also has the capacity to provide an effective forum for disseminating research information and assessing natural resources variability such as soil and landscape variability, weather forecasting and remote sensing (Munyua et al 2008).

### 2.6.4 Handheld Personal Computer (HPC) or Personal Digital Assistants (PDAs)

"HPCs or PDAs are handheld organisers used to store contact information, manage calendars, communicate by e-mail, and handle documents and spreadsheets, through communication with the user's personal computer" (Encyclopaedia Britannica 2013). Encyclopaedia Britannica highlighted that the first PDAs were established in the early 1990s. This development came up as a way of improving on the traditional

pen-and-paper organisers. Munyua (2007) defined HPCs or PDAs as small, light and robust devices that can be held in one hand and operated by the other and are compatible with personal computer synchronization. HPCs or PDAs t is possible can use wireless technology to communicate. Today HPCs or PDAs are being used for providing access to information, mobile mapping and other data gathering activities. The International Small Group and Tree Planting Alliance (TIST) in Kenya and Uganda trains farmers to use PDAs to gather reforestation information, this is then uploaded on an online database for use by farmers (TIST 2011).

According to the Agricultural Extension and Advisory Services Worldwide (http://www.worldwide-extension.org/africa/Zimbabwe) a programme referred to e-Hurudza in Shona or Umtshayi in Ndebele or Electronic-Farm (e-Farm) Manager in English is in operation. This is an agricultural planning software package designed by the government of Zimbabwe to support the farming activities of the country. The package uses personal computers and printers to access its database. This provides agricultural information for all farming regions of Zimbabwe. The package comes with a tutorial on how to grow crops, planting methods, information on inputs, farm equipment and livestock production. The Agricultural Technical and Extension Services (AGRITEX) are responsible for the distribution of this software and training of users.

### 2.6.5 Radio Frequency Identification (RFID)

RFID is an ICT which can be used to identify an object automatically and uniquely using electromagnetic radio waves. It can store large amounts of data over a period of time. The data can later be retrieved and used as information when required. RFID is an efficient method of identifying animals and collecting animal-data more quickly (Kelepouris, Pramatari & Doukidis 2007)

With RFID, animal management processes like drafting, feeding, and sorting can be done automatically with no or less human involvement (Trevarthen & Michael 2007).In Africa RFID is being used in Botswana, Namibia and South Africa for livestock identification purposes. This is done in compliance with the European Union livestock regulations (Munyua et al. 2008).

In 1999 Australia the world's second largest beef exporter introduced an RFID-based animal identification system called the National Livestock Identification System (NLIS) and made it mandatory in July 2005 for all cattle (Tonsor & Schroeder 2006). NLIS use RFID to identify and trace livestock from birth to slaughter. This is done by tagging an animal from birth with RFID devices which have a microchip encoded with a unique identification code (Patent & Fluharty 2006; Tonsor & Schroeder2006).

### 2.6.6 Precision Agriculture (PA*)*

PA is that kind of agriculture that increases the number of (correct) decisions per unit area of land per unit time with associated net benefits(McBratney, Whelan &Ancev2004).(Taylor & Whelan 2013) defined PA as:

> an integrated information and production-based farming system that is designed to increase long-term, site-specific and whole farm production efficiency, productivity and profitability, while minimizing unintended impacts on wildlife and the environment.

PA has been described by Munyua et al. (2008:6)as the "next great revolution in agriculture" because of its ability to manage land by the square metre, assess and foretell disease outbreaks and other natural disasters to enable farmers to optimize use of inputs, such as fertilizer

(Munyua et al. 2008). PA has been used to increase production in agricultural activities.

However, Zhang, Wang and Wang (2002) argued that there is limited data available on the adoption of PA in various countries and worldwide. PA has been unevenly adopted in developed countries. It is almost not known in Africa, except in South Africa, Mauritius, Sudan and Zimbabwe. (Munyua et al. 2008).

In Zimbabwe PA is used in land mapping, soil analysis and testing. This has resulted in the production of more accurate information to guide decision making for those providing agro services. International Crop Research Institute for the Semi-Arid Tropics (ICRISAT) has recorded yield increases of 30-50% among farmers adopting PA in Zimbabwe. However, although this is evidence that precision agriculture techniques can work, the challenge is creating appropriate enabling environments to encourage take-up by Zimbabwean farmers (The Guardian 2014).

### 2.6.7 Community Radio Stations

The radio is also being used to disseminate agricultural information globally. In Zambia the Radio Farm Forum (RFF) is a government initiative which uses the radio to provide agricultural information to its rural information and resource-deficient farmers. This is done through radio discussion programmes (Munyua et al 2008).

In a study carried out in Kaduna State, Nigeria, the findings revealed that above 98% of their study population rely on radio agricultural programmes to get agricultural information, while less than 2% use other media like magazines, seminars, extension bulletins and pamphlets to get agricultural information (Ango, Illo. Abdullah, Maikasuwa & Amina 2013)

Also in support of disseminating agricultural information to farmers, UNESCO, FAO, UNDP and CTA have in recent years chipped in to

support African community radio stations through training on the production of rural radio packs on agriculture (Parvizian, Lashgarara & Nejad 2011).

### 2.6.8 World Space satellite radio

World Space is a satellite radio provider that offers digital satellite audio, data and multimedia services globally. It is the only satellite radio company with the rights to broadcast to the world's globally allocated spectrum for digital satellite radio. It offers its services to over 130 countries Guide 2 Satellite Radio website (http://www.guide2satelliteradio.com/satellite-radio-providers/worldspace.aspx). World Space satellite radio enables the downloading and uploading of content where there is no internet connectivity. Non-governmental organisations in Africa use World Space satellite radio to upload, download and disseminate agricultural and developmental information (Munyua et al 2008).

## 2.7 E-Agriculture Information Dissemination Services

IDS can be defined as a computer based information system which contains related information (Namisiko & Aballo, 2013) that targets a particular group of users. Agricultural IDS may contain details of farmers, soil type, crop information, pest control information and livestock production. Building and implementation of e-agriculture information dissemination services require a lot of research and collaboration with relevant stakeholders (Ommani & Chizari 2008). The other challenge in building IDS is not producing or storing information but getting people to

use the information (Ommani & Chizari 2008). Maningas, Perez,Macaraig, Alesna and Villgonzalo (2000) noted that if information is in the hands of a farmer it means empowerment through resources control and decision making as an effective and efficient information technology delivery system enables the farmer to make informed decisions towards improved agricultural production, processing, trading, and marketing. ICTs are capable of producing information channels to deliver the right information at the right time to the information poor rural populations.

### 2.7.1 Reasons for IDS designing

Ommani and Chizari (2008); Bertolini (2004) indicated the following as the reasons why IDS are being designed and implemented:

- There is need to have expert and scientific information on crop and livestock production getting to farmers on time.
- There is a digital divide or information gap between those who have and those who do not have access to ICTs. There is also a gap between the research level and the level at which what has been researched is being put into practice. The establishment of IDS can help to close these gaps.
- Traditional methods for information dissemination that is print and libraries are no longer the only appropriate means of communicating information, ICTs means are becoming more appropriate.

### 2.7.2 Factors to consider when designing e-agriculture IDS

Ommani and Chizari (2008: 3) listed the following as the basic factors to consider when designing e-agriculture IDS**:**

Establish communication between farmers, coordinators (extension agents), agricultural experts, research centres, and community by information technology. The communication between all factors should be mutual. The information must be based on farmers need. Internet used as a facility to transfer the advanced agricultural information to the farming community. Farmers can be illiterate and speak a local language and they are not expected to use the system directly.

Richardson (2008); Joseph and Andrew (2008)noted with other scholars that stakeholders must be involved in the development of ideas and innovations concerned with ICTs for agricultural development and adoption and identified factors to consider when developing IDS. All these factors include aspect of participatory communication by involving target groups in implementation, evaluation, benefit and decision making.

It is a basic requirement that when designing and developing information services stakeholders should be involved in the initial stages, actually they need to be involved up to the end.

### 2.7.3 Benefits of e-agriculture IDS

E-agriculture IDS comes with a number of benefits to the farmers. These benefits vary and include improved access to accurate and timely information. Farmers are empowered to make informed decisions. Quality and quantity of agricultural products is improved and there is an increased information generation and dissemination at a minimum cost, making access to markets easier and faster (Namisiko & Aballo 2013; Ommani & Chizari 2008; Franklyn, Chukwunonso, Mohammed, Abubakar, Nkiru & Obidi 2012).

## 2.8 Barriers/challenges to the effective implementation of e-agriculture IDS

Barriers or challenges are any obstacles that may hinder the implementation and smooth flow of a project. In some cases barriers may cause a project to be discontinued.

While ICTs have the capacity to improve the lives of people in all areas of human development there are a number of challenges which may cause slow implementation especially in most developing countries. Jamwal and Padha (2009) stated that unless ICTS are adopted effectively, existing socio-economic differences in terms of people's access to basic needs may worsen. However, regardless of the challenges, Jamwal and Padha (2009) noted that if ICTs are adopted effectively they have the potential to empower communities with improved access to knowledge networks and services. Ali (2012) suggested that the major barriers to effective implementation of ICT based IDS in agriculture include funding, equipment and infrastructure, connectivity, content language, education level and adoption by both parent organizations and the end users as well as a lack of appropriate technologies. Chauhan (n.d) highlighted that challenges that are hindering proper implementation of e-agriculture in India include:

- Insufficient agricultural infrastructure and support facilities.
- Insufficient institutional capacity to deliver farmers specific services.
- Lack of awareness regarding suitable agricultural methods among the farmers.
- Agricultural content development and its up gradations.
- Ownership issues of the public and government generated data

- Lack of “Common Platforms” for the farmers in India
- Absence of an “Agricultural Think-Tanks”
- Insufficient use of ICT for agricultural purposes

In Zimbabwe lack of access to ICT tools such as computers and limited access to the internet were cited by Mugwisi et al (2014) as major barriers towards the generation and dissemination of agricultural information, from research institutes and libraries.

In order to succeed in implementing IDS it is important to first anticipate the challenges and the barriers before implementation and to ensure how such barriers can be avoided.

### 2.8.1 Education level

This refers to the stage one has attained ranging from primary to tertiary education. The education levels of respondents play a significant role in data collection and in adapting to new things.

The education levels of stakeholders have either a positive or negative role on the adoption of any new technology. An increase in the education level positively influences adoption and vice versa (Ali 2012; Franklyn *et* al. 2012). Ango, Illo, Abdullah, Maikasuwa and Amina (2013) found that attainment of education adds to an individual’s attitude towards change and innovativeness. Okwu, Kaku and Aba (2007) also stated that level of education affect an individual’s access, comprehension and adoption to modern agricultural practices.

In general educational level of respondents is of utmost important as it allows the researcher to deal with individuals accordingly.

### 2.8.2 Adoption, funding, cost and technical expertise

Adoption relates to the acceptance of the parent organizations and the end users of new technologies, while funding refers to the provision of all finances required for the sustainability of a project. Additionally, cost is the charges involved in setting up ICT based services. Technical expertise is the skills required to operate and make use of the service. ICT based agricultural information services were implemented as pilot projects and after the pilot period most of the projects were never implemented on a large scale (Raj 2012).

Most projects are donor funded and eventually when the donor leaves, the implementing organization will not be able to continue to sustain the project because of lack of finance. In most cases these projects either operate at a small scale or discontinued. The other challenge is persuading users to adopt new technologies. In other words both sponsoring organisations and end users can only adopt a new innovation if they see it as being of greater advantage when compared to available alternatives.

The other barrier is high cost of ICTs. Franklyn *et* al. (2012) indicated that high costs of ICTs hinder most organizations and farmers in implementing and using ICT based information services. They suggest that governments should intervene in financing ICT-based services in agriculture. Easdown and Starasts (2004) noted that ICT interventions require leadership which operates at national level where budgetary and strategic decisions are made. ICTs are costly mediums for accessing information since there are many technical tools needed before installation and the need to train end users on how to use the new technology (Churi et al. 2012). Affordability is another aspect related to cost that can affect adoption and use by end users. Ango et al. (2013) stated that farmers with lower income are more likely not to adopt the use of modern farm technologies. This is because

they cannot afford the high costs of modern machinery, ICT tools, and service fees and may lake digital literacy skills. Lake of ICT knowledge and lake of access to ICTs also contribute to adoption of ICTs in agriculture (Franklyn et al. 2012).

### 2.8.3 Infrastructure

Inadequate rural ICT infrastructure hinders ICTs use in most rural communities. Findings of a study carried out by Raj (2012) in India indicated that in three villages where the study was carried out no one had a computer or internet facility.

There are many technical links in the chain needed to connect rural people to the Internet. These include well working telecommunications infrastructure, expensive computer hardware and software and ISP infrastructure (Easdown & Starasts2004).Poor infrastructure is one of the challenges faced by organisations when they want to implement ICT based information services.

Kibet (2011) in a study in Kenya reported that:

> Poor rural roads and other key physical infrastructure have led to high transportation costs for agricultural inputs and products. It also leads to spoilage of perishable commodities during transportation. This causes high losses to farmers.

Cadilhon (2013) visited two districts on a CGIAR and ILRI Water and Food project assignment and observed that poor infrastructure hinder progress in the agricultural sector of Ghana. Because of the poor infrastructure there is poor connectivity whereby downloading and updating of emails can take a day or more on a computer which had internet access. Most of the farmers in the areas have mobile phones and can call agricultural products traders any time to check on market prices before engaging in their own produce sales. However, the mobile phone network at times

could get so congested that phone calls or text messages could not go through. As a general comment Cadilhon (2013)stated that “I have been negatively impressed by the state of infrastructure in this otherwise dynamic mixed crop and livestock production area…… dismal infrastructure can stop the agrifood production and marketing system from working”.

### 2.8.4 Connectivity

Empirical researches recommend that ICTs have a positive impact on the advancement of any nation (Kuhlmann2005). However, connectivity is one of the reasons for the low use of ICTs (Franklyn et al. 2012) especially among rural farming communities. Most of the households in rural areas in developing countries are not connected with electricity and for those connected there are frequent power cuts. Where there is no electricity there will be poor or no connectivity. Also, Purnomo and Lee (2010) argued that the cost of broadband connection is too high for poor rural communities. This contributes to a limited use of ICTs as very few people can afford broadband connection.

### 2.8.5 Language

Mangstl (2008) suggested that one of the basic requirements for strengthening information and knowledge systems for e-agriculture is to invest in the re–packaging of technical information for farmers and make it available in local languages. Mugwisi et al. (2014) pointed out that although researcher and extension workers are translating research input into local languages in Zimbabwe there is still a shortage of materials in local languages Content localisation and customisation is a challenging task but can improve through the usage of ICTs in agriculture (Raj 2012). There is a need for repackaging of agricultural information into local languages. Besides challenges like having limited or no access to information, farmers in Zimbabwe are also faced by the challenge that the

available information is not packaged in local languages. Most of the information available is in English. This creates the possibility that the available information may not be understood by the information seekers. Use of ICTs in disseminating agricultural information can improve multi-language repackaging and remote accessibility of information.

## 2.9. ICTS in agriculture – success stories

Since the establishment of the e-agriculture community, a number of organizations have initiated e-agriculture activities either on a small scale or larger scales. Examples of such initiatives include e-Choupals, Manobi, Gyandoot, Participatory 3D mapping and the Evergreen Farming Group (EGF), just to mention a few. Most of these innovations have the basic objective of providing relevant, reliable, and timely information to farming communities.

### 2.9.1 e-Choupal in India

The word choupal is a Hindi word which means 'village gathering place' and e-Choupal is a commercial network which is used to disseminate agricultural information for Indian farmers (Richardson 1997). The service was designed by ITC Limited (formerly India Tobacco Company) to assist farmers to access agricultural information easily. ITC uploads agricultural information from agricultural organisations and agricultural stakeholders on to e-Choupal's web site. This information is customised into local languages by using a computer. This information is then made available to farmers.

e-Choupal which is an ICT online platform facilitates the flow of information and knowledge through transmitting and transferring agricultural information to farmers. It also facilitates sales of farm inputs

by connecting sellers and buyers of agricultural products(Richardson 1997.

Farmers in the remote villages of India now easily access e-Choupal at village Internet kiosks which are manned by kiosk operators who are farmers. The e-Choupal initiative is a success because of the following results:

Through 1000 kiosks, e-Choupal services reached more than half a million farmers in 6000 villages within two years of its launch. Again ITC sourced soybeans worth $15m in a year direct from farmers through e-Choupal without going through intermediaries. Also, kiosk operators receive a commission for every transaction they process and farmers gain from better prices and lower transaction costs unlike traditionally where farmers had to wait for  longer periods to get markets for their produce and had to pay for storage facilities, loading and unloading of their crops in the local markets(Richardson 1997).

To its credit, ITC is expanding e-Choupal services in areas of credit and insurance. ITC is working on creating a database of credit report profiles, non-cash loans for farm inputs and insurance and risk management services to enable farmers to get loans and insure their products through e-Choupal services (Richardson 1997).

### 2.9.2 Manobi – Senegal

There is also another successful initiative known as Xam Marse which has been in operation since 2001 in Senegal. This provides free access sms and internet-based market information system developed by an organisation known as Manobi. Manobi collects and uploads prices of agricultural products to a database using mobile phones(Richardson 1997; Rashid & Elder 2009). Farmers are able to check prices and find the best offer for their produce and fishermen can now reduce the amount of

spoiled fish while in search for a market. Buyers and farmers realized that there are higher returns in producing for the local markets as compared to the export markets (Rashid & Elder 2009).

### 2.9.3 Gyandoot

Gyandoot is a project which was established in 2000, by the government in Madhya Pradesh, India. The government set up a chain of computer kiosks known as 'soochanalayas' in Dhar district. These soochanalayas provide access to government information and services for a fee (Bhatnagar, Dewan Torres and Kanungo Parameeta. n.d.). Each kiosk is run by a trained operator. It uses intranet and an Indian language font set. The services provided, include land records for farmers who need official maps and land records of their land ownership. Farmers can also find market prices for agricultural goods from the district's wholesale markets, rural email facility for the whole community, a village auctions site, an ask the expert service for farmers, a village newspaper, an e-education site and employment news (Bhatnagar, Dewan Torres and Kanungo Parameeta. n.d.).

### 2.9.4 Participatory 3D mapping in the Philippines

A non-profit organisation,the Philippine Association for Intercultural Development (PAFID) helps the local people to reclaim their ancestral heritage. PAFID uses 3D mapping to identify territorial boundaries for family land, land-use histories and patterns (Richardson, 1997).The locations and features of the territorial boundaries are verified by global positioning system (GPS) ground surveys, in which produce refinements of the rough existing maps. Topographic maps are formed using cardboard, paint, yarn and push-pins to create 3D geographic models. The 3D geographic models illustrate elevations, contours, natural resources, land cover, settlements, infrastructure and administrative

boundaries (Richardson 1997). The 3D geographic models are then photographed digitally and the photographs are joined into a GIS (Richardson 1997).The communities validate the maps, and present them to the National Commission on Indigenous Peoples for review within the ancestral domain claim application process (Richardson 1997).

### 2.9.5 The Evergreen Farming Group (EGF) in Western Australia

The EGF is a network of farmers interested in perennial pastures and summer crops that started in the early 1990s in Australia. The EGF uses the Internet to support its activities in projects that enhance the farmers' use of the Internet. In June 2001, there were 30 farmers in the group, and by mid-2002 the group website had 117 members, 75% of whom had email accounts (Easdown & Starasts 2004).According to the Evergreen Farming website (http://www.evergreen.asn.au/about-us), the Evergreen Farming group has a vision of providing leadership knowledge and developing farming systems which incorporate profitable, resilient pastures. The group uses a group website that provides cheap other websites to facilitate group interactions through discussions and chats, posting notes, sharing documents and photographs to share information about the establishment of perennial pastures, planning field days online and posting notes to develop Internet skills (Easdown &Starasts 2004).

## 2.10. Conclusion

Based on the findings and recommendations from studies mentioned in the literature review above and also on the purpose of carrying out this research the following are conclusions which can be made.

For the successful designing, implementation and sustainability of electronic-based agricultural information services there is need for

integration of all stakeholders. Stakeholders include implementing organization, knowledge providers and those who will use the service. There is also a need to provide content which agrees with the specific needs of the end-users. Their language, specific environments and level of education need to be taken into consideration.

E-agriculture information dissemination services should not only focus on the dissemination of information but should be built in such a way that the knowledge they spread, should be turned into agricultural action. Knowledge alone, without action, will not achieve the intended results. To turn knowledge into action there is need for implementing organizations to follow up on the results of their projects through close monitoring and evaluations (M&E). Demonstration farms could be established in different areas and these can be displayed as examples of transforming knowledge into action.

There is a need for the provision of enabling public infrastructure such as electricity that is needed for ICTs in agriculture. Governments should support by intervening through the formulation and implementation of policies that regulates the use of ICTs in agriculture.

It can also be concluded that in designing an e-agriculture information dissemination services it is important to remember that there is need to provide services which are affordable to the end-users. Use and usage models should be user friendly and appropriate for the environments of the end-users. Community involvement, monitoring and evaluation should be in place to ensure successful systems. It has been noted that the interest of using ICTs in agriculture is growing in Africa, but there are a number of barriers which are causing a slow pace in the implementation of such innovations. Regardless of these challenges there are a number of successful e-agriculture IDS which are operational.

However for such a service to be developed research needed to be done to assess whether the farming community in Mashonaland West was interested in having such a service. The next chapter presents the research methodology which was used to carry out this study.

# Chapter 3: Research Methodology

## 3.1 Introduction

The previous chapter dealt with a literature review of related scholarly articles on designing and developing an e-agricultural information dissemination service. This chapter presents the research methodology used in this study. It provides a description and justification of the specific methods followed in researching this topic.

This chapter commences by describing the research approach used in this study as well as a justification for the choice of the specific approach. This is followed by the research design that was selected and a justification of the design. The research population targeted for the study is described, as well as the sampling methods used, to select the respondents. A justification of why these sampling methods were used is also provided as well as a description of how the sampling method was executed. The data collection instruments, the justification of and the advantages of these techniques, as well as how the collected data was analysed are also explained and described.

## 3.2 Research approach

Three basic research philosophies underlie the quantitative, qualitative and mixed method approach. The three philosophies are positivism (also referred to as realism or objectivism), subjectivism and constructivism (Kothari 2004:5; Gray 2009:17). A research approach must be chosen when commencing with a research project. Kothari (2004:5); Madan, Paliwal & Bhardwaj (2010:7) purported that there are two approaches that one can use to do research: namely the qualitative approach and the quantitative approach. However, Creswell (2009:4); Gray (2009:199-217) mentioned a third approach, namely the mixed method approach.

Saunders, Lewis and Thornhill (2003: 118) defined a paradigm as “a way of examining social phenomena from which particular understanding of these phenomena can be gained and explanations attempted” In other words a paradigm is a standard which can be followed when one is carrying a research by studying human thoughts and beliefs. In contrast to objectivism, constructivism rejects the notion that a universal truth exists in the world. Truth is not real, but is created or constructed through the interaction of people and the external world (Gray 2009:33). Subjectivism is based on the belief that truth and meaning is imposed on the object by the subjects and that subjects construct meaning from dreams, religious beliefs and cultural beliefs (Gray 2009:33). While qualitative research methods are based on the subjectivist and constructivist approaches (Creswell 2009:17; Gray 2009:33).

For the purpose of this research a quantitative research methodology was used.

### 3.2.1 Quantitative approach

Quantitative research methods are based on explaining events by collecting statistical data that are analysed using mathematically based methods (Aliaga & Gunderson 2000). In other words data collection, analysis and findings of quantitative research projects always have a numerical character.

In quantitative research data is generated by using quantifiable data collection methods in quantitative format (Kothari 2004:5). This method is best for questions that can be counted or measured (Green 2005:13). In the quantitative approach research questions ask information about when, which, how many or how much?

The quantitative approach has the following strengths that were pertinently needed in this study. It allows for quantitative predictions to be made, data collection is relatively quick, it provides precise numerical data, it is less time consuming for data analysis, research results are mostly not depended on the researcher and is useful for studying large populations(Johnson & Onwuegbuzie 2004).

### 3.2.2 Conclusive and/or descriptive research

Singh (2007:63) indicated that the quantitative approach can be further divided into two categories, namely exploratory and conclusive approaches. Singh explains that exploratory research is carried out when alternative options have not been clearly defined or is unclear. This gives researchers an opportunity to investigate and familiarise themselves with the problem or concept to be studied. Exploratory research forms the basis of conclusive research and relies on secondary data. Exploratory surveys are most useful as forerunners of larger surveys (Tripathi & Shukla 2005:55). In other words exploratory surveys are most suitable when a researcher wants to find out if a problem really exists. Conclusions drawn from exploratory research can therefore not be relied on as the absolute truth.

Conclusive research, on the other hand is carried out on an already defined problem and its findings can be considered valid and reliable. Conclusive research is carried out where a research problem or concept has already been defined and investigations depend on primary data.

A conclusive approach was adopted for the purpose of this research. This method was chosen because of its advantages as explained in the next section. Singh (2007:64-65) pointed out that conclusive research can be classified into descriptive and causal research. Causal research aims at

establishing relationships between events and wants to establish if such relationships cause specific behaviour. This study did not aim at establishing relationships between events or relationships caused by specific behaviours, hence, a causal research was not adopted. A descriptive research approach was followed.

Descriptive research enumerates descriptive data about the population under study (Singh2007:64). It describes an event or a happening and provides accurate facts about the population. Because it provides the number of times something occurs, averages and frequencies can be easily calculated.

### 3.2.3 Justification for the use of quantitative, conclusive and descriptive research in this study

In the light of the type of data needed, the quantitative approach was preferred over the qualitative approach. This research focused on the feasibility of creating e-agriculture information dissemination service in Mashonaland West Province at CUT. It is foreseen that this will be a service which should focus on transmitting agricultural information to the farming communities using Information Communication Technologies. The nature of the research topic needed to be expressed in quantities, because the researcher needed to investigate how many of the target population is interested in getting an e-agriculture information service in their community and what they needed and wanted so that the feasibility of creating such a service in the province will be ensured.

As already highlighted above in this research a conclusive approach was used. This was chosen because of its merits. According to Malhotra, Birks and Wills (2012:87) conclusive research is most suitable for research

which deals with quantitative data and large surveys with sample which need to be represented. It also deals with specific well defined research with well-defined data sources unlike exploratory which can deal with research which is not well defined in terms of data sources and can be general in its research purpose.

Descriptive research is best for survey types of research and fact finding enquiries such as here. In this research which can also be termed a survey, the researcher wanted to describe the state of affairs as they exist at a moment in time. The researcher had no control over the outcomes and only reported the findings as the analysis indicated (Kothari 2004:2-3).

## 3.3 Research design

According to Saunders et al (2003:136) a research design is a work plan that describes the activities necessary for the completion of the research. Saunders et al. (2003:136) indicated that a research design or strategy provides the general plan of how a researcher will go about answering the research questions. They further emphasised that the strategies should not be thought of as being mutually exclusive that is, at times they complement each other. However, Kerlinger (as cited in Singh 2007:63) defines a research design as “the plan, structure and strategy of investigation conceived to obtain answers to research questions and to control variance”. For the purpose of this research, a research design was defined as a systematic approach used to gather information and obtain solutions to the problem under study. A research design is therefore more than just the data collection methods used to gather data, but it also involves the logic of how and why specific data need to be collected (Green 2005:32).

### 3.3.1 The research design used in this study

The research design of this study was based on the survey method. A survey "is a study design that collects the same data for each case in the sample" (Green 2005:32). Green (2005:32) further indicated that a survey is the process of taking a detailed assessment of a given population in order to come up with conclusions on aspect(s) of concern. Saunders et al.et al.. (2009: 144) said that surveys are most suitable for descriptive research and they allow for collection of data from a large population in an economical way.

### 3.3.2 Justification of the survey design

The researcher preferred a survey study because surveys are suitable in the cases of descriptive research and are most appropriate for larger sample investigations (Kothari 2004:120-121). In a survey, data is also obtained directly from respondents and data collection can take place in any setting. The respondents' responses are furthermore not influenced by researchers or outsiders (Tripathi & Shukla 2005.56) Respondents can also complete the questionnaires in familiar surroundings so as not to be intimidated by the research. This ensures that the respondents are more sincere and unaffected and provide reliable answers. Hence, it thus increases the validity and reliability of the research (Tripathi & Shukla 2005.56). A survey allows the use of a variety of data collection techniques that can be used either alone or in combination. It also allows for easy and speedy data collection (Tripathi &Shukla 2005.67).

The survey method was chosen as the most suitable method for this research because the topic implied a large sample. Data collection for a large sample is financially more viable when using a survey method. It can take place under circumstances and can cope with a variety of respondents in various situations as needed here. Respondents included

farmers, students, lecturers, agro-dealer employees, ICT and Library staff. A survey method has the potential that is can be used for different respondents in different settings (Tripathi & Shukla2005:56; Saunders et al.et al..2009:144).

### 3.3.3 Data collection methods

The most appropriate instruments/research techniques for data collection in surveys are questionnaires and interviews (Singh 2007:69). Questionnaires can be either self-administered or administered by an interviewer. Questionnaires can include structured or unstructured questions. Structured interviews can also be used but they need to be conducted face-to-face, by telephone or email (Singh 2007:69).

In this research a questionnaire was used as the data collection instrument. One structured questionnaire with close- ended questions was used to collect data from all respondents. Both self-administering and interviewer administering for the questionnaire were used in data collection. Interviewer administering was done for the farmers' stratum while self-administering was done for all other strata.

A questionnaire was chosen for this study because of its merits which include the following (Tripathi & Shukla 2005.82):It is a relatively cheap mode of data collection, allows dealing with respondent individually, allows respondents to answer questions independently and can be answered at the convenience of the respondent. In this research all the 300 questionnaires were completed. There was a consequently 100% response rate.

## 3.4 Research population

A research population can be defined as the target group, or a group of individuals, or the total of items from which information is obtained by a researcher through studying one or more of its samples (Tripathi & Shukla 2005:114; Singh 2007:88; Kothari 2004:153). A Research population is therefore a group of individuals from which the researcher would take samples for collecting data.

A research population consists of two types of populations, namely the research or target population and the accessible population. The target population can be defined as the total number of subjects in which the researcher is interested and which could help to answer the questions regarding the research at hand. The accessible population is the populations of subjects available for a particular study often a non-random subset of the target population (Hayes 2011).Fraenkel and Wallen (1996:93) argued that the actual population (the target population) from which the researcher would like to collect data, is in most cases not available. The population from which the researcher is able to take samples is the accessible population. Fraenkel and Wallen (1996: 93) pointed out that the actual population in the ideal option, but the accessible population is a realistic option. Researchers work mainly with the accessible population, because it is often logistically and practically impossible to research the actual population.

The target population for this study was all the farmers in Mashonaland West Province, all members of staff and students from CUT's School of Agricultural Sciences, all staff members of the Library and ICT departments at CUT and all agro-dealers in Mashonaland West Province.

The farmers and agro-dealers will be the potential end-users of the service if it is going to be implemented; hence their views were very important. CUT staff is both end-users and services providers so their views were equally important. Some of the staff members at CUT are also farmers, either in Mashonaland West Province or elsewhere in the country. It was from each of these groups that samples were taken.

## 3.5 Sampling

Singh (2007:89) defined sampling as the process of the selection of research units from populations to estimate population parameters in such a way that the sample truly represents the population. Sampling refers to "the selection of some part of an aggregate or totality on the basis of which a judgment or inference about the aggregate or totality is made"(Kothari 2004:152). A sample, according to Fraenkel and Wallen (1996: 90) is a group in a research project from which information is obtained. A sample is chosen from the accessible population under study. It is a proportion of the whole group that a researcher will investigate to obtain information about the whole group.

> Sampling and samples are used in research because of their merits. Sampling and samples are economical in that they save time and money than investigating the whole target population; are faster as data is collected and summarized from a sampled population; produce more accurate results as smaller numbers allow quality field study; it is more practical to collect data from a sample than from the entire population (Tripathi & Shukla 2005:112-113; Kothari 2004:152).

### 3.5.1 Sampling methods

There are two types of sampling methods namely probability and non-probability sampling (Kothari 2004:60; Doane & Seward2010:36; Gravetter & Forzano 2009:133). In probability sampling the possibility of selecting a member of a sample can be calculated and each individual in the sample have an equal chance of being selected. In non-probability sampling the probability of selecting an individual is not known (Gravetter & Forzano 2009:133). This study used the probability sampling method. This means that every unit of the population has an equal chance of being selected. The major probability sampling methods according to Kothari (2004:60) are:

- Simple random sampling;
- Systematic sampling;
- Multi-stage sampling;
- Cluster/area sampling;
- Sequential sampling; and
- Replicated sampling

In this study the researcher used stratified and simple random sampling. How and why each of these methods was used is explained below. This researcher was motivated to use probability sampling due to its merits which were summarised by Gravetter & Forzano (2009:143).

> The selection process is fair and unbiased. It is an easy method for obtaining a sample from a large population. It guarantees each subgroup have adequate representation through stratified sampling.

Stratified random sampling refers to a sampling design where the entire population is divided into groups called strata in such a way that there is great homogeneity in each stratum (Tripathi &Shukla 2005:119) or the population is divided into mutually exclusive and mutually exhaustive subgroups (Singh 2007:104). Items or individuals are then selected from each stratum using simple random sampling to constitute a sample. Stratified random sampling has the advantages that it facilitates the generation of separate results for each stratum enabling the provision of comparative results between strata (Singh 2007:104). “It enables the researcher to keep the sample small without losing accuracy and distributes the sample more evenly over the entire target population as it ensures representation from all groups” (Tripathi & Shukla 2005:119). In other words stratified sampling results are reliable as it produces detailed information and reduces sampling error (Singh 2007:104) and (Green2005:119).

Simple random sampling is a probability sampling procedure that gives every item or individual in the target population an equal chance of being selected (Daniel 2012).According to Daniel (2012) and Tripathi and Shukla (2005:117) simple random sampling said to be associated with the following advantages;

- Advanced supplementary information on the elements in the population is not required.
- All possible combinations of sampling units have an equal and independent chance of being selected.
- It is easier to understand and communicate to others.
- It gives representative samples.
- Statistical procedures required to analyse data and calculate errors, for example when using computer programmes, are easier.

- Statistical procedures for computing inferential are incorporated in most statistical software.

### 3.5.2 Sampling used in this study

In this study stratified sampling was used by classifying the entire target population into three strata namely:

- Farmers
- Employees and students of CUT
- Agro-dealers in Mashonaland, West Province.

Secondly, simple random sampling was used for selecting groups of people from each stratum. Farmers exhibiting in the farmers' stand during the Chinhoyi Agricultural Show were selected as respondents for the farmer stratum. For the Agro-dealers stratum dealers were selected from those who were exhibiting during the same show. Respondents for the CUT stratum samples came from the following sub strata, School of Agricultural Sciences, The Library and the ICT departments. Finally simple random sampling was used whereby individuals from each stratum were randomly selected for data collection.

### 3.5.3 Research sample

Due to limited time and resources, the researcher did not consider all the members of the farming community in the province. Only those mentioned above were selected to participate in the study. Random sampling technique was used as the final stage of the multi-stage sampling in each stratum as there were many people who were equally suitable to participate in the study in all strata. Stratum sizes, which were fixed prior to data collection, depended on the resources and time that was available, as well as the study's objectives. The sample comprised of 300 respondents who were randomly selected from the three strata. Two

hundred of the respondents were farmers. Seventy-five were staff members and students of CUT. The final 25 respondents were selected from the Agro-dealers and care was taken that all stakeholders, namely banks which give agricultural loans to farmers, suppliers of agricultural equipment, seed firms, farming cooperatives, agricultural training institutions and agricultural extension organizations to stratum who were also farmers, were represented. These respondents were also farmers and their responses were also analysed in the farming strata. With regard to the Agro-dealers stratum which was randomly selected from stands at the show.

## 3.6 Data collection

Data can be defined as facts and figures that are collected, analysed and summarized. In a research there are two types of data that can be used namely primary data and secondary data. Secondary data is data that already exist in published sources, that is already organised and was collected for other reasons and not for the current study's purpose (Tull & Hawkins, 1990:7) Primary data can be defined as data collected by a researcher as a way of investigating the current problem and data is specifically collected for the purpose of the study. For the purpose of this study primary data was collected.

### 3.6.1 Data collection procedure

Field work was carried out in five days during the period fifteen to eighteen August 2014. This was the period in which the 2014 Agricultural Show for the province took place. The researcher collected all the data herself. Primary data was collected using one self-administered questionnaire. For the CUT and the agro-dealer strata respondents were asked to complete the questionnaire while the researcher was waiting. As for the farmers' stratum conducted interviewer administering whereby the researcher

would ask each respondent individually the questions which were on the questionnaire while recording responses.

Anonymity was maintained in the study as respondents were not compelled or required to disclose their identity or names on the questionnaire, except on the consent letter that they signed. Also, for the farmers' stratum, where interviewer administering of the questionnaire was conducted, each respondent was interviewed alone.

### 3.6.2 Ethical considerations

The researcher approached the respondents in a non-coercive manner while trying to maintain their honour and dignity. Respondents were informed by the researcher about the research, the advantages and benefits of the research. This was to solicit their informed consent.

A consent form was given to the respondents. The consent document was given to respondents who took part in the study, to make sure that they were fully informed about what the study is about. Those who were not willing to partake in the study were excused in a friendly manner.

The respondents' confidentiality and privacy were ascertained as the researcher explained to them that their contributions and identities will not be disclosed and the researcher will ensure that the identities of the respondents will not be traceable.

## 3.7 Data analysis

McCarthy and Perreault (1990:128) highlighted that "After data has been collected it has to be analysed and interpreted to decide what it means

and turn the collected data into information. Data analysis can be done through tabulating the data, calculating the responses and summarizing them or through using computer software packages" In other words data analysis helps researchers to understand the research situation and the relationship between variables of the research, enables the researcher to get a solution to the problem that is being studied so that a conclusion and recommendations can be proposed.

### 3.7.1 Data analysis procedure

To analyse the data, measuring the importance, the need, the design, development and how to introduce e-agriculture information service at CUT the researcher used SPSS (The Statistical Package for the Social Sciences) software. This was used to analyse the collected data indicating the appropriate statistical measures like frequencies, percentages and averages. Graphs and tables were used to present the data.

## 3.8 Validity and reliability

Research quality can be measured according to two basic aspects, namely validity and reliability. Research is considered to be valid and reliable when the conclusions are true and when the findings are repeatable (Connaway & Powell 2010:60). Validity refers to the extent to which a measurement procedure gives the correct answer while reliability is the extent to which a measurement procedure yields the same answer when repeated (Gorman & Clayton 2005:54). In other words validity is based on the accuracy and suitability of data collection and data analysis instruments used in the research and it helps a researcher to draw sound conclusions from the collected data. Reliability is based on the probability

of finding the same results if the same measurement procedure repeated in similar study.

Validity and reliability for this research was ensured by following the procedures described below. The questionnaire was first send for verification to academics who are experienced in research. These academics were doctors and professors from the School of Agricultural Sciences and Technology at CUT. After verification by academics the questionnaire was then send for verification by the project supervisor. Thereafter, a pilot survey was conducted. This made it possible to pretest the data collection instrument (questionnaire). The pilot survey was done among stakeholders during one of the Zimbabwe Farmers' Union (ZFU) provincial meetings where farmers and representatives from agricultural stakeholder organizations usually meet. Twenty questionnaires were completed for the pilot survey. Shortcomings of the questionnaire were established and these were corrected. The questionnaire was finally sent for final verification to the project supervisor.

A reliable and approved system of measuring quantitative data in the statistical field was used to analyse data, namely SPSS software. The pilot survey results indicated that both the questionnaire and SPSS measurement system were valid and reliable methods to use for data collection and analysis in the study.

## 3.9 Conclusion

The chapter on research methodology discussed the research approaches, the research design, the sampling of the accessible population, the research instruments, the data collection procedure, the ethical considerations, validity, reliability and the data analysis procedures. It also justified why a survey research design was chosen.

The next chapter presents the results and findings of the research. The result were analysed and interpreted.

# Chapter 4: Data presentation and Interpretation

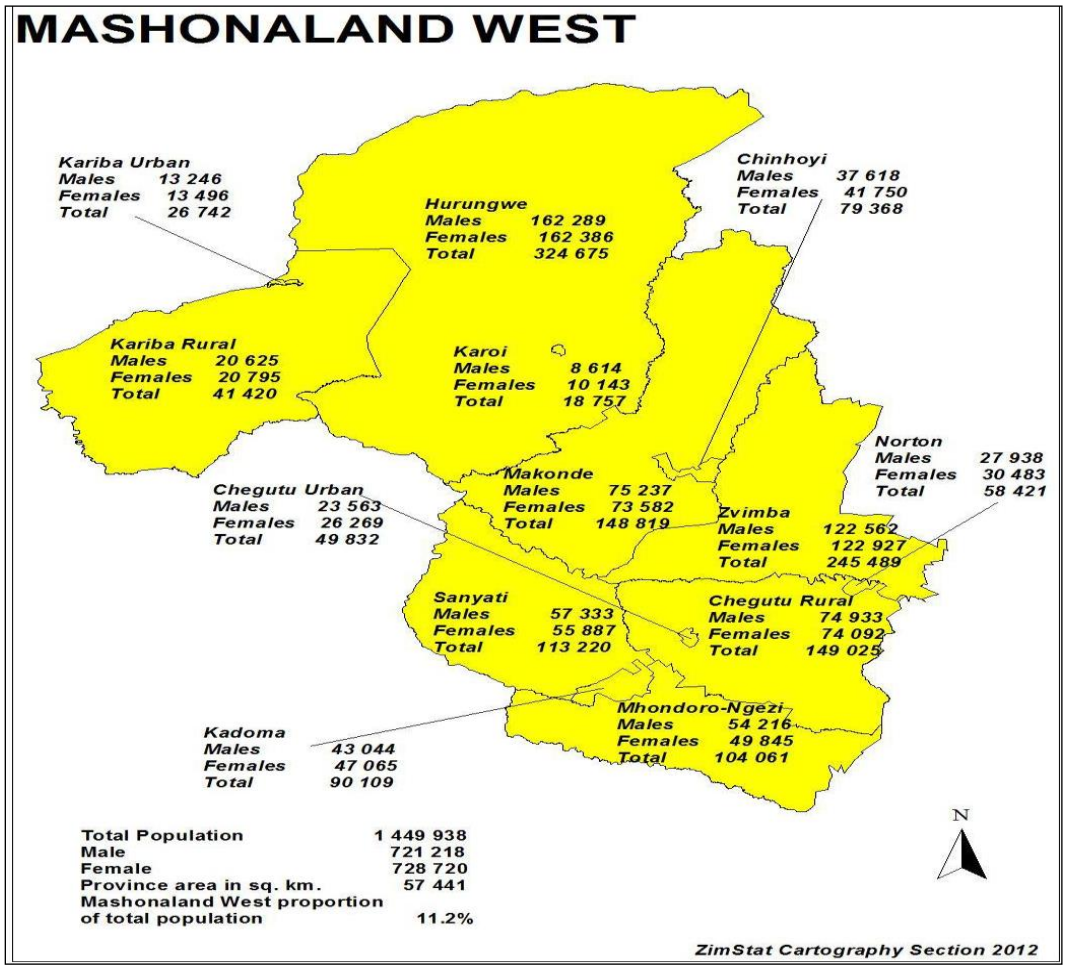
## 4.1 Introduction

This Chapter covers the presentation and interpretation of the collected data as described in the previous chapter. The results of the data collected during the survey are interpreted, discussed and conclusions made. Graphs and tables are used for an enhanced presentation of the findings

## 4.2 Research area

The study area for this research was Zimbabwe's Mashonaland West Province. Mashonaland West Province is one of Zimbabwe's ten provinces. The other nine provinces are Mashonaland Central, Mashonaland East, Manicaland, Masvingo, Midlands, Matabeland North, Matabeland South, Harare and Bulawayo. Mashonaland West Province has a total population of almost 1.5 million. Figure 4.1 below shows a map of Mashonaland West Province and its population distribution by district (Zimbabwe National Statistics Agency 2012:49).

**Figure 4.1: Mashonaland West: population distribution by district**




### 4.2.1 Data collection

Three strata of respondents were selected for the research. It was possible to obtain exactly the same number of respondents as that which was indicated as appropriate in the research design. This was the case in all three strata. The respondents who participated in the survey were 200 farmers, 23 agro-dealers, 15 library employees, 10 ICT employees, 2 extension officers, 14 lecturers, 11 teaching assistants or technicians and 25 students.

Data was collected during the Mashonaland West Agricultural Show days by using self-administered and enumerator assisted questionnaires. The researcher administered the questionnaire to all the intended respondents. The questionnaires were completed by the respondents while the researcher was waiting. In the case of the farmer stratum the researcher acted as an enumerator and asked the respondents the questions on the questionnaire whilst recording their responses.

## 4.3 Presentation of research findings

This section presents the data generated from all the respondents. The data was presented in a systematic way and then analysed. It was compared with the findings of other similar studies. The data was presented according to the order in which the questions appear in the questionnaire. Table 4.1 below presents the number of people who participated in the survey by stratum.

**Table 4.1: Number of survey participants by stratum**

| Stratum | Intended Number of Respondents | Total Respondents | Percentage responded |
|---|---|---|---|
| **Farmers** | **200** | **200** | **100** |
| **CUT Community** | **75** | **75** | **100** |
| **Agro-dealers** | **25** | **25** | **100** |

Table 4.1 above indicates the number of people who participated in the survey according to the predetermined stratum of 300 respondents. They consisted of 200 farmers and 25 agro-dealers. Those respondents who represented the Chinhoyi University of Technology (CUT Community) stratum were divided into the following categories: 15 library employees, 10 ICT employees, 14 lecturers, 11 teaching assistants or technicians and 25students. The response rate was 100% in each stratum, therefore providing adequate data for analysis.

### 4.3.1 Distribution of respondents by district

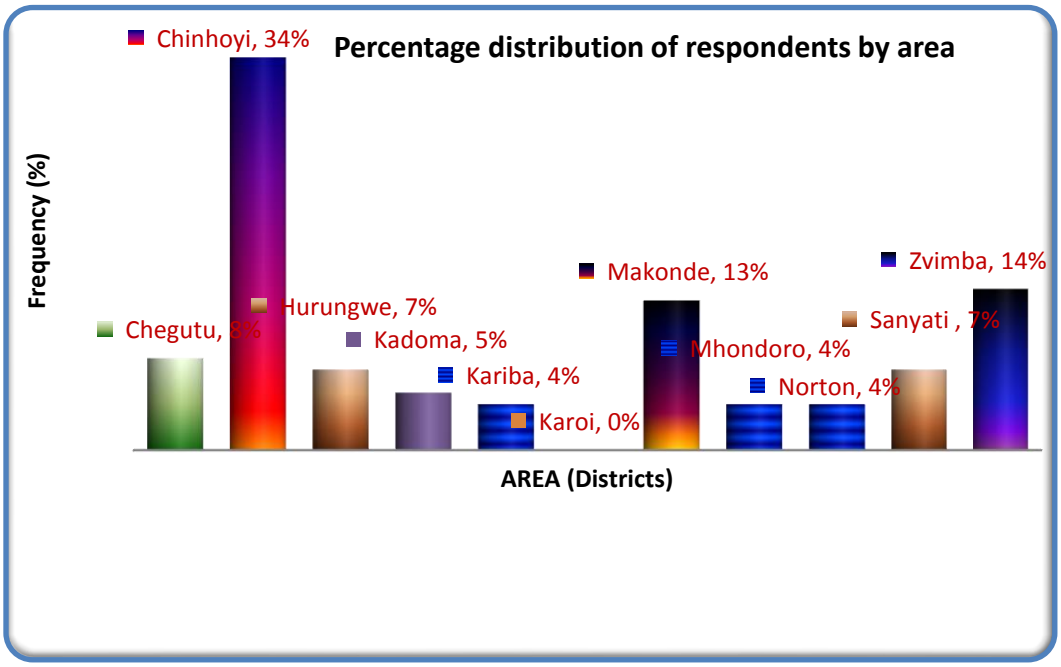
Table 4.2 below shows the respondents' distribution by district. The findings indicate that 100% of the respondents were residents of the eleven districts of Mashonaland West Province. The highest number of respondents came from Chinhoyi with 103 respondents – 34, 3% of all the respondents. Forty-one respondents were from Zvimba (13, 3%) and 40 from Makonde (13, 3%). The least number of respondents came from Karoi district with only one respondent.

**Table 4. 2: Distribution of respondents by district**

| District Name | Frequency | Percent |
|---|---|---|
| **Chegutu** | 24 | 8 |
| **Chinhoyi** | 103 | 34.33 |
| **Hurungwe** | 21 | 7 |
| **Kadoma** | 14 | 4.67 |
| **Kariba** | 13 | 4.33 |
| **Karoi** | 1 | 0.33 |
| **Makonde** | 40 | 13.33 |
| **Mhondoro** | 11 | 3.67 |
| **Norton** | 11 | 3.67 |
| **Sanyati** | 21 | 7 |
| **Zvimba** | 41 | 13.67 |
| **Total** | 300 | 100 |

Also find in Figure 4.2 below a graph illustrating the distribution of respondents by district.

**Figure 4.2: Respondents' distribution by district**




The distribution of respondents shows that each district in the province was represented. The fact that most of the respondents came from Chinhoyi is because the data collection was done in Chinhoyi district during the provincial show days. Those farmers who reside in the province had a better opportunity to attend the show than farmers who came from more remote areas of the province.

### 4.3.2 The age of the respondents

Table 4.3.1 below shows the respondents' age groups.

**Table 4.3.1 Respondents by age**

| Age group in years | Number of respondents | Cumulative frequency |
|---|---|---|
| **18-30** | 41 | 41 |
| **31-45** | 72 | 113 |
| **46-56** | 169 | 282 |
| **57 and above** | 18 | 300 |

The findings as presented in Table 4.3.1 show that the majority of those respondents fell in the age group of 31-56 years.

The average age of the respondents is presented in Table 4.3.2 below.

**Table 4.3.2 Average age of respondents**

| | **Age in years** | | |
|---|---|---|---|
| **N** | Minimum | Maximum | Mean |
| **300** | 19 | 66 | 44.02667 |

Minimum age of respondents as shown in Table 4.3.2 was 19 years and the oldest respondent was 66 years old. The average age was 44 years. Most of the respondents (56.33%) were between 46 and 56 years old. The smallest number of respondents came from the age group 57 years and above (6%). This signifies that most of the respondents are in the middle age group which is the economically active group. Other scholars

found age to play a significant factor in agricultural information accessibility. They say that young and middle aged people are more responsive to adoption and utilization of new technologies than old people (Salau & Saingbe2008 & Ango *et al.et al..* 2013) regarding this it could be concluded that the introduction of ICTs into the province would be easy.

### 4.3.3 The gender and occupation of the respondents

Find Table 4.4 below the distribution of respondents according to gender.

**Table 4.4: Respondents by gender and occupation**

| Gender | Farmer | Agro-dealer | Library employee | TA/Te/ student | Exten-sion offi-cer | Lectu-rer | ICT-employee | Total |
|---|---|---|---|---|---|---|---|---|
| **Male** | 134 | 16 | 7 | 21 | 2 | 9 | 6 | 195 |
| **Female** | 66 | 7 | 8 | 15 | 0 | 5 | 4 | 105 |
| **Total** | 200 | 23 | 15 | 36 | 2 | 14 | 10 | 300 |

The results of this question show that 195 (65%) of the respondents were males and 105 (35%) females. This gives a ratio of 7 females for every 13males. This is an indication that man dominates the agricultural sector in Mashonaland West Province.

The fact that the number of female respondents was so low may have been caused by the fact that the women stayed at home to continue with their household chores while the men attended the agricultural show to gather farming information. This finding corresponds with Salau and Saingbe (2008) who also reported that males dominate the agricultural research and extension in Nasarawa State. The findings also agree with that of Ango *et al* (2013) who reported that main farming activities in Nigeria are mostly practiced by men.

### 4.3.4 The level of education of the respondents

In Zimbabwe, for one to be in formal employment one must have attained at least secondary education, hence it is assumed that the education level of respondents from all other strata is at least secondary education except for the farmers' stratum. Table 4.5 above presents the education level of respondents.

**Table 4.5: The education level of respondents**

| | Highest level of education | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Gender** | Primary education | Secondary Education | Diploma Level | Under graduate | Post graduate | Never been to school | Total | % |
| Male | 24 | 54 | 70 | 29 | 17 | 1 | 195 | 65 |
| Female | 16 | 21 | 37 | 18 | 12 | 1 | 105 | 35 |
| **Total** | **40** | **75** | **107** | **47** | **29** | **2** | **300** | **100** |

The findings indicate that most of the respondents have attained some level of education. Forty of the respondents attended primary school, 75 were reached secondary education and most of the respondents, namely 107 obtained tertiary education. Tertiary education refers here to diploma level. Forty-seven of the respondents obtained an undergraduate degree and 29 were successful at a postgraduate degree level. Only two respondents had no formal education. The fact that only two respondents had never been to school and forty reached primary education indicate that farmers would need basic training in using ICTs

These findings also indicate that most of the population of Mashonaland West Province is literate and accustomed to a learning situation, as only two farmers had no formal education. This means that they can be easily taught how to apply ICTs in their daily lives. This agrees with Ango *et al*

(2013) statement which says that education has a positive impact on an individual's attitude towards change. Education develops a favourable attitude to innovativeness. (Ali 2012) also reported that the level of education is one of the indicators of effective adoption. A higher education level positively influences the adoption of new information that will lead to the application of this information in new farming practices. Farmers with secondary school and above education are 23% more likely to adopt ICT-driven information for overall agricultural decisions than farmers with less than a secondary school education" (Ali 2012).

The next findings discuss the view of respondents regarding the use, or not, of ICT in agriculture

### 4.3.5 The usefulness of ICTs in agriculture.

The usefulness of ICTs in agriculture was measured with the question, What is your perception of the described service? (tick one). Respondents were required to give only one answer out of the two options. The purpose of this question was to find out whether ICTs are considered important if they are used to disseminate agricultural information.

Table 4.6 below discusses the findings obtained from Question**.**

**Table 4.6: Usefulness of ICTs in agriculture**

| **Frequency** | | | | | | **Percentage** |
|---|---|---|---|---|---|---|
| **Response** | **Far-mer** | **Agro-dealer** | **CUT employ ee** | **Ext officer** | **CUT student** | |
| **Useful** | 200 | 23 | 50 | 2 | 25 | |
| **Not useful** | 0 | 0 | 0 | 0 | 0 | |

Table 4.6 illustrates that all the respondents (100%) agrees that ICTs are useful and that would like them to be used in the dissemination of

agricultural information. Even the two respondents who are illiterate responded positively to this question.

This implies that farmers of Mashonaland West Province feel very positive about the use of ICTs in agriculture. It seems that it would not be necessary to engage in any advocacy campaign to convince them that agricultural information can be effectively disseminated by an e-information service.

### 4.3.6 The respondents' view about the establishment of e-agriculture services in their communities.

To measure the respondents' attitude towards the introduction of e-agriculture services in their communities, respondents were asked: Would you recommend for the introduction of this service?

Table 4.7 below shows their responses.

**Table 4.7: The respondents' view about the establishment of e-agriculture services in their communities**

| | Frequency | | | | Percentage | |
|---|---|---|---|---|---|---|
| **Response** | **Farmer** | **Agro-dealer** | **CUT employee** | **Ext officer** | **CUT student** | |
| **Yes** | **200** | **23** | **50** | **2** | **25** | **100** |
| **No** | **0** | **0** | **0** | **0** | **0** | **0** |

All the respondents unanimously indicated that they would recommend the introduction of an e-agriculture service. This is a clear indication of the respondents' need for appropriate and timely information that would help them to earn a livelihood. It also clearly implies that there is lack of e-agricultural services in the in Mashonaland West.

### 4.3.7 Respondent's awareness of available e-agriculture information dissemination services in their environment.

To determine whether the community of farmers in the province was aware of other e-based information dissemination services in the country respondents were asked the following question: What other similar services are you aware of? Respondents were allowed to tick one or more answers.

The three basic e-agriculture information services indicated available to the farmers in Zimbabwe were:

- UZ e-farming service which operates from the University of Zimbabwe in Harare;
- AGRITEXE-Farm service which also operates from the Zimbabwe Farmers' Union head office in Harare; and
- Eco-farmer which operates from Econet Wireless Service head office in Harare.

Tables 4. 8.1 and 4.8.2 below present the findings.

**Table 4.8.1: Awareness of available e-agriculture information services**

| | Stratum Frequency | | | |
|---|---|---|---|---|
| Response | Farmers | Agro-dealers | CUT Community | Total |
| UZ E-farming | 10 | 25 | 51 | 86 |
| AGRITEX e-farm | 30 | 21 | 44 | 95 |
| Eco-farmer | 51 | 24 | 67 | 142 |
| Total | 91 | 70 | 162 | 323 |

**Table 4.8.2: Awareness of available e-agriculture information services**

| | Frequency | Percent |
|---|---|---|
| **UZ e-farming** | 86 | 29 |
| **AGRITEX E-Farm** | 95 | 32 |
| **Eco-farmer** | 142 | 47 |
| **Total** | 323 | 108 |

**Note:** The total frequencies and percentages exceeded 300 and 100 respectively because some respondents were aware of more than one service.

The findings indicate that most of the respondents know about the three existing agriculture information dissemination services:

- 86 respondents were aware of the UZ e-farmer service;
- 95 were aware of the AGRITEX E-Farm service; and
- 142 were aware of Eco-farmer.

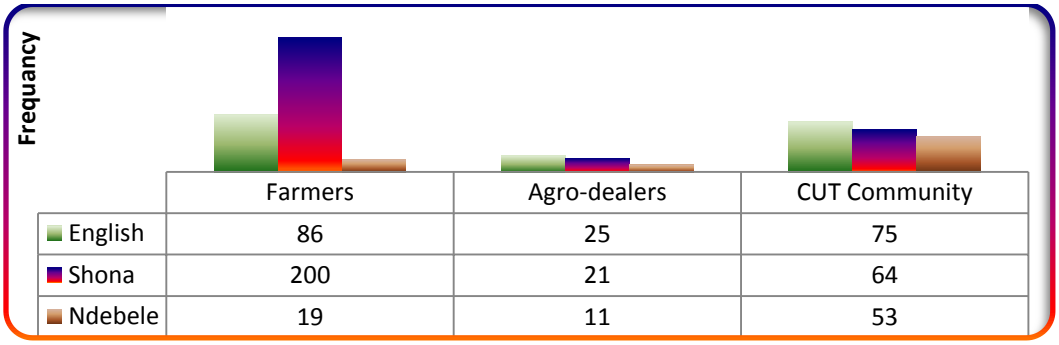
It is interesting to note that most of the agro-dealers and library staff members were aware of more than one of the three services. This could be because of the nature of their job which entails them to always look for current trends in this field. This is indicates that services providers in the province are equipped to provide an e-agriculture information service. The results show that farmers are also aware of the existence of e-agriculture information services with 91 farmers being aware of at least one of the available services.

### 4.3.8 Respondents' language preferences for e-agriculture information dissemination systems

The survey measured farmers' language preferences with the question: In which language(s) would you prefer to get this agricultural information in? (can tick more than one).

Respondents were asked which language/languages they think should be used in the agricultural information dissemination centres. This was language preferences for packaging and communicating agricultural information. In the graph and table 4.9 below the language preferences of the three strata are presented.

**Figure 4.9: Language preferences by stratum**




This graph is based on Table 4.9 below which provides the percentage distribution of language preferences per stratum.

**Table 4.9: Language preferences per stratum**

| | Stratum Frequency | | | |
|---|---|---|---|---|
| **Language** | **Farmers** | **Agro-dealers** | **CUT Community** | **Percent age** |
| **English** | 86 | 25 | 75 | 62 |
| **Shona** | 200 | 21 | 64 | 95 |
| **Ndebele** | 19 | 11 | 53 | 27.67 |
| **Total** | 305 | 57 | 192 | 184.67 |

**Note:** The total frequencies and percentages exceeded 300 and 100 respectively because some respondents chose more than one language. The farmers' stratum had a total of 200 respondents but had a total of 305 respondents who gave their opinion on language preferences while the other 2 strata had totals of 57 and 192, hence the grand total is 554 and that gives a total % of 184.67)

All three languages chosen as medium in the agriculture information centres are the languages that are spoken in the province. There were no other languages mentioned in addition to the three above. However, Shona is preferred by the majority of the respondents. This is especially evident in the case of the farmers. Ninety-five percent of the farmers want the medium to be Shona. The responses from agro-dealers and the CUT community reflected a greater variety with English and Ndebele languages rated at 62% and 27.67% respectively.

This is an indication that farmers prefer to get information in their local languages than in foreign languages. The findings corresponds with those of Raj (2012) who reported that content localization and customization, though still a difficult task, can improve the usage of ICTs in agriculture. There is a need for repackaging agricultural information into local languages.

Also, e-Choupal re-packages information from agricultural organizations and agricultural stakeholders into local languages through a computer and this information is then uploaded on to e-Choupal web site and made available to farmers (Richardson 1997).

Considering all this it can be concluded that the use of local languages is important when designing agricultural information services for farmers.

### 4.3.9 Respondents' interest in using e-agriculture services

The question: Will you be interested in using this service? was asked to determine if respondents will be interested in using e-agriculture information services if introduced in their communities. The responses to this question are presented in Table 4.10 below.

**Table 4.10 Interest in using e-agriculture services**

| | Frequency | | | | | Percentage |
|---|---|---|---|---|---|---|
| **Response** | **Farmer** | **Agro-dealer** | **CUT employee** | **Ext officer** | **CUT student** | |
| **Very interested** | 84 | 18 | 41 | 2 | 13 | 53.67 |
| **Interested** | 116 | 5 | 9 | 0 | 12 | 46.33 |
| **Not interested** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Neither interested nor uninterested** | 0 | 0 | 0 | 0 | 0 | 0 |

Responses show that more than 50% of respondents are “very” interested while more than 45% are “interested” in e-agriculture services. No respondent showed any resistance to this idea.

This implies that many farmers are interested in the use of ICTs in agriculture. This finding agrees with that of Meera, Jhamtani and Rao (2004) who reported that in the study they carried on the Gyandoot project, over 52% of the respondents were using ICT services to find agricultural information.

### 4.3.10 Using e-agriculture services

To measure if the service will be actually used the question: Assuming that the service is introduced, will you use the service? was used in the survey.

This investigated if respondents think they will actually use the e-agriculture service if it is introduced. Table 4.11 below shows the responses.

**Table 4.11: Use of e-agriculture information services**

| | Frequency | | | | | Percentage |
|---|---|---|---|---|---|---|
| **Response** | **Farmer** | **Agro-dealer** | **CUT employee** | **Ext officer** | **CUT student** | |
| **Yes** | 200 | 23 | 50 | 2 | 25 | 100 |
| **No** | 0 | 0 | 0 | 0 | 0 | 0 |

Responses show that all the respondents indicated that they will use e-agriculture information services if it is introduced.

These results agree with other studies mentioned previously in the literature review. There are several successful projects where e-agriculture information services were/are used. These include the e-Choupal project in India, the Manobi project in Senegal, the Gyandoot project in India, Participatory 3D mapping in the Philippines and the Evergreen Farming Group (EGF) project in Western Australia.

The basic objective of the innovations in all these projects is to provide relevant, reliable, and timely information to farming.

### 4.3.11 Factors limiting the use of ICTs by farmers and extension officers

In your opinion, what are the factors limiting the use of ICTs by farmers and extension workers? (Tick more than one). This question investigated if there are any barriers that would prevent or limit the use of ICTs by farmers and extension workers. The findings of this question are indicated in Table 4.12 below.

**Table 4.12: Factors limiting the use of ICTs by farmers and extension officers**

| | Frequency | Percent |
|---|---|---|
| **Lack of access to ICTs** | 205 | 68.33 |
| **High cost of ICTs** | 179 | 59.67 |
| **No interest in ICTs** | 96 | 32 |
| **Other** | 116 | 38.67 |
| **Total** | 596 | 198.67 |
| | | |

Responses shown in Table 4.12 above illustrate that the lack of access to ICTs is the most limiting factor with regard to the use of ICTs in agriculture. Besides the other restricting factors seen in the table above, factors mentioned in the open-ended question which asked of the respondents to indicate "other" factors that are not listed in the questionnaire, provided an interesting view of what would influence the effective use of an e-agricultural service. Hundred and sixteen respondents used this option in the questionnaire.

The other reasons that were mentioned are;

- No connectivity
- No skills in ICTs
- Inadequate ICT infrastructure

Munyua (2008) in their study also mentioned that inappropriate ICT policies in rural communities and rural development, poor ICT infrastructure, inadequate ICT skills and poor connectivity are the factors limiting the use of ICTs in agriculture. In this study the most limiting factor which was mentioned is the lack of access to ICTs which 68.33% of the respondents indicated as a problem. However, regardless of these challenges Unwin (2009)reported that ICT based developments are bringing in new opportunities to improve usage and performance of

livelihood technologies in agriculture and other sectors. Today there are a number of successful e-agriculture information services which are operating.

### 4.3.12. Communication mode for disseminating agricultural information and ICT tool accessibility for Mashonaland West farmers.

The following section presents the findings of questions eight and eleven. These two questions: Which ICT tool would you prefer when receiving agricultural information updates? and Do you have access to any of the following ICT tools? (can tick more than one)were combined because they are related in that they were wanted to elicit response about the same issue, namely which ICT tool is best to use to access information, but the variance tested was the ability to access the tools. For example one can have access to the internet but not having an e-mail address and one might have a cell phone which does not connect to the internet and one might not have access to the internet but can access e-mails from an internet café or an intranet.

Question eight dealt with the mode of communication respondents might prefer to get agricultural information updates. Figure 4.4 and Tables 4.13 below present the findings of this question.

**Figure 4.4 Communication modes for disseminating agricultural information**

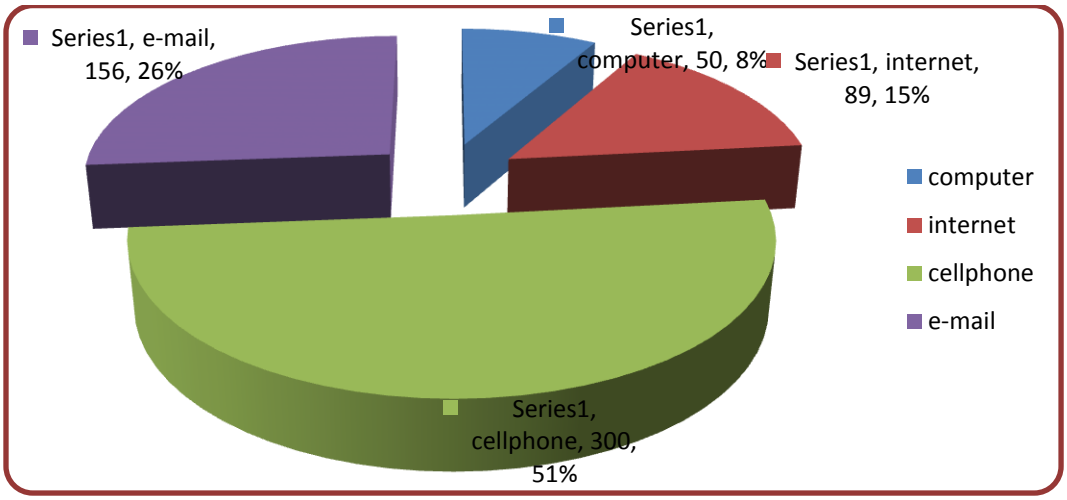



**Table 4.13 Communication mode for disseminating agricultural information**

| Communication Mode | Frequency | Percentage |
|---|---|---|
| **Computer** | 50 | 10 |
| **Internet/www** | 89 | 25 |
| **Cell phone** | 300 | 100 |
| **E-mail** | 156 | 49.33 |
| **Other** | 224 | 74.67 |
| **Total** | **819** | **259** |

**Note:** Total frequencies and percentages exceed 300 and 100 respectively because respondents could give more than one answer.

As shown in Figure 4.4 and table 13 above the preferred mode for the communication of agricultural information is the cell phone. All the 300 (100%) respondents agreed that they prefer to use the cell phone.

The last question wanted to identify the ICT tools that are accessible to the respondents. Table 4.14 below presents the findings of this question.

**Table 4.14 ICT tool accessibility by occupation**

| | Occupation | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **ICT Tools** | **Farmer** | **Agro - dealer** | **Library employee** | **Student** | **Extension officer** | **Lecturer /TA** | **ICT employee** | **Total** |
| **Computer** | 29 | 23 | 15 | 25 | 2 | 25 | 10 | **129** |
| **Internet** | 20 | 14 | 15 | 25 | 2 | 25 | 10 | **120** |
| **Cell phone** | 141 | 23 | 15 | 25 | 2 | 25 | 10 | **241** |
| **E-mail** | 60 | 23 | 15 | 23 | 2 | 25 | 10 | **160** |
| **Other** | 127 | 23 | 15 | 23 | 2 | 25 | 10 | **227** |

**Note:** Respondents could give more than one answer on this question.

The findings of these questions show that a significant number of respondents have access to some form of ICTs. Combatively

- 241 respondents have access to mobile phones;
- 129 respondents have access to computers;
- 120 respondents have access to the internet;
- 160 respondents can use have e-mails and
- 227 respondents have access to other ICT tools not mentioned.

The tools which were mentioned as other included the radio, television and library online chats through social networks. This reflects that the majority of the population in the province has access to some form of ICT.

This is an indication that most of the people is this province have access to ICTs, especially the mobile phone. There is a high probability that each household have access to at least one form of ICTs. It can also be concluded that the mode of communication preferred has got a relationship with the ICT tool most accessible to the respondents. In this case the mobile phone is the most preferred mode and is consequently

the tool within reach of most of the respondents. The findings of these two questions agree with other studies as many success stories of ICTs in agriculture mentioned in previous chapters, indicated that the most popular tool used in communicating agricultural information to farmers are mobile phones. Most of these success stories use the mobile phone sms-facility. Examples of such successful projects using the mobile phone to communicate agricultural information include; Agrinet in Uganda where cell phones and e-mails are used to communicate agricultural information; CafeDirect Producer Foundation (CPF) an international mobile platform for disseminating agricultural information; KUZA Doctor in Kenya, a mobile facility used to communicate agricultural information to farmer (Palmer 2012).

It can be concluded that the findings of these two questions answer the research question about the ICT tool which can be used to transmit agricultural information in Mashonaland West.

### 4.3.13 Information needs

The survey measured farmers' frequencies searching agricultural information by asking: How often do you search for agricultural information? This question wanted to determine the frequency of the respondents' agricultural information need. Possible responses to this question were daily, more than twice a week, ten or more times monthly or never. Table 4.15 below shows the results.

**Table 4.15 Frequency of respondents' agricultural information need**

| | Rate for Information search | Frequency | Percent |
|---|---|---|---|
| How often do you search for agricultural information? | Daily | 183 | 61 |
| | More than twice weekly | 58 | 19 |
| | Ten or more times monthly | 56 | 19 |
| | Never | 3 | 1 |
| | Total | 300 | 100 |

Out of the 300 respondents 183 indicted that they search for agricultural information on a daily basis, 58 more than twice a week, 56 ten or more times a month and only three said they never search for agricultural information.

This signifies that stakeholders of the agricultural sector in the province frequently search for agricultural information. The fact that farmers frequently search for agricultural information implies that the introduction of e-agriculture information services in the province will be of much help as e-based information services have the capability of reaching a large audience in remote areas.

### 4.3.14 Type of information required by the respondents

Question 10 examined the type of information required by farmers with the question: On which type of information would you like frequent updates? (can tick more than one).

Table 4.16 presents the findings.

**Table 4.16 Information requirements**

| Crop/livestock information preferred most | Frequency | Percent |
|---|---|---|
| Maize production and pest control | 259 | 86.33 |
| Tobacco production and pest control | 176 | 58.67 |
| Soya beans production and pest control | 148 | 49.33 |
| Rice production and pest control | 18 | 6 |
| Cattle production and disease outbreaks | 247 | 82.33 |
| Chicken production and disease outbreaks | 251 | 83.67 |
| Goat farming | 62 | 20.67 |
| Sheep farming | 40 | 13.33 |
| Fish farming | 97 | 32.33 |
| Crop insurance | 56 | 18.67 |
| Credit and loans | 176 | 58.67 |
| Seed varieties | 200 | 66.67 |
| Weather forecasting | 124 | 41.33 |
| Agricultural products markets and prices | 245 | 81.67 |
| Agricultural machinery | 158 | 52.67 |
| Planting methods | 153 | 51.00 |
| Pesticides | 151 | 50.33 |
| Other | 190 | 63.33 |

Table 4.16 above shows that the information that is highly required by respondents is information on maize production. Eighty-six percent of the respondents needed this type of information. Respondents also indicated the following topics as highly required information:

- Chicken production (83.67%);
- Cattle production (82.33); and
- Agricultural products markets and prices with 81.67%.

Other information that was also in high demand includes information on sugar bean production, bee keeping and horticulture**.**

This implies that there is big and varied demand for agricultural information in the province. It seems as if the agricultural community will benefit from an e-agriculture information service. Crops mainly grown in Mashonaland West are the crops which were found to have the highest information demand. This shows that farmers in the province do not have enough information on even the crops they are already growing, hence this information gap need to be closed.

## 4.4 Conclusion

The primary purpose of this investigation was to explore the feasibility of creating an electronic-agriculture (e-agriculture) information dissemination service in Mashonaland West Province at Chinhoyi University of Technology. This chapter presented the findings of the survey. The conclusions and recommendations arising from these findings are presented in chapter 5.

# Chapter 5: Findings, Conclusions and Recommendations

## 5.1 Introduction

This chapter presents the summary of the findings, recommendations, suggestions for further studies and conclusion.

## 5.2 Summary of the research findings

This section discusses the research findings according to the research objectives and research questions as outlined in chapter one:

The research objectives were:

- to determine the language in which the farming community would like to access agricultural information;
- to determine how the farming community would prefer to access agricultural information?;
- to determine the technological literacy of the farming community; and
- to determine which ICT tools are available to the farming community.

**The main research question was:** What are the prerequisites for designing a needs-based e- agriculture information service at Chinhoyi University of Technology for farmers in the Mashonaland West Province.

**The sub-questions following on the research question were:**

- What information is needed by the broader farming community in the province
- In which language and format does the farming community require the information

- How would the farming community prefer to access the information?
- How technologically literate is the farming community?
- Which ICT tools are available to the farming community?

The answers that were elicited by this study is summarized and discussed in the sections below.

### 5.2.1 What information is needed by the broader farming community in the province?

To find out the information needed by the farming community in Mashonaland West Province the survey collected data about a selection of farming information. That could be needed by the respondents. The results of the study show that most of the farmers in Mashonaland West Province require diverse agricultural information with the highest demands being for maize production (86.33%), chicken production (83.67%), cattle (82.33%), agricultural products markets and prices (81.67%) and seed varieties (66.67%). Other information which also falls above 50% level of demand include tobacco production, credit and loans, agricultural machinery, planting methods and pesticides. However, more information needs were discovered which include information on sugar bean production, bee keeping and horticulture. The findings also show that the demand for information is lowest on rice production (6.00%), crop insurance and sheep (13.33%), goat (20.67%) and fish farming (32.33%) respectively.

### 5.2.2 In which language and format does the farming community require the information?

The findings of the survey indicate that most respondents preferred Shona (95%) as language for the dissemination of agricultural information. Shone was followed by English (62%) while Ndebele was the least preferred of all the languages (27.67%). These findings agree with Mangstl (2008) who highlighted that one basic requirement for strengthening information and knowledge services for e-agriculture is to re–package information for farmers and make it available in local languages.

### 5.2.3 How technologically literate is the community?

The technological literacy level of the community was measured by the level of education attained by respondents, their age and how easily they can access ICT tools. The findings show that only two people never went to school while 40 people attained primary level education and rest attained high school level and above.

The average age of the respondents was 44 years. Demographic variables such as education level and age have been found to play a significant role in technological literacy with the results confirming that the young and middle aged people are more responsive to the adoption and utilization of new technologies than old people as confirmed by Salau and Saingbe (2008) and Ango *et al.* (2013). Both these studies found that education has a positive impact on an individual's attitude towards change and that young and middle aged people are more responsive to adoption and utilization of new technologies than older people.

The results also indicate that by far the majority of the respondents have access to at least one form of ICT. Cell phones are the most common ICT availably to the respondents.

### 5.2.4 How would the farming community prefer to access the information and which ICT tools are available to the community?

The findings show that the ICT tools available to the community include computers, mobile phones, the internet, the television and the radio. However, the cell phones are the tool mostly available to the community as 241 respondents indicated that they own personal mobile phones.

The research determined that the most preferred medium of communication was the cell phone as all the 300 respondents indicated that they would prefer to get agricultural information update through their mobile phones. There were respondents who also indicated that they would like to use e-mail (156), the internet (89) and the computer (50) and some also indicated the use of television and radio.

These findings are in accordance with Palmer (2012) who indicated that in many of the success stories of using ICTs in agriculture, mobile phones are mostly used to communicate agricultural information to farmers.

In the next section recommendations are provided based on the research findings.

## 5.3 Recommendations

In view of the findings of the survey the following are recommendations which may help in designing and developing an e-agriculture information service at CUT. The recommendations also answer the main research question as outlined in Chapter one, namely what are the prerequisites for designing a needs-based e- agriculture information service at Chinhoyi University of Technology for farmers in the Mashonaland West Province.

1. It is critical for CUT to introduce an e-agriculture information dissemination service for its Mashonaland West Province community of farmers.
2. The service can be stationed and operating from the Library at CUT.
3. Shona and English languages should be used to build the database for the CUT e-agriculture information service.
4. The cell phone is the most preferred tool to be used to communicate agricultural information to farmers and other media should be also accommodated.
5. As a matter of policy, CUT as the only university in the province can seek partnerships that can assist with sponsoring and/ or facilitate training courses in ICTs for members of its community, especially farmers.
6. Agricultural institutions in the province should come together and provide an electronic based platform to link with each other to share agricultural information.
7. All stakeholders must be involved from the beginning of the project beyond the completion stage.

## 5.4 Further research

This study was limited in scope to Mashonaland West Province, only one of the 10 provinces of the country. This means that the other provinces were not catered for. The research was also limited to CUT students and staff and farmers and agro-dealers who attended the Mashonaland West agricultural show only. This means that other stakeholders in the agricultural sector in the province and other provinces who could not attend the show were not represented.

The researcher feels that, due to the limitations mentioned, this research was not exhaustive. More research which covers all the provinces of Zimbabwe needs to be conducted.

In a nutshell, this study explored the feasibility of establishing an e-agriculture information service at CUT. In view of the findings of the study it can be concluded that it is feasible to establish such a service at CUT following the given recommendations.

## 5.5 Conclusion

The study basically surveyed the feasibility of designing and developing an e-agricultural information service at CUT. The findings of the study indicate that the use of ICTs in agriculture in Mashonaland West Province is highly called for. The study found that the majority of the farmers in the community are willing to use ICTs in their agricultural activities. The results also found that most of the respondents search for agricultural information on a daily basis. This is an indication that there is need for the establishment of electronic services that may provide agricultural information in the province.

It is therefore concluded that it is feasible to establish an e-agriculture information service for the Mashonaland West Province.

The findings of the study also shows that most of the farmers in the community have access to at least one ICT tool, with the most common tool being the cell phone. Considering this, it can be concluded that the cell phone is the most suitable ICT tool which can be used to disseminate agricultural information from an electronic-based information service database in the province.

The results of the study also confirmed that Shona is the language preferred by farmers when communicating agricultural information to them. Therefore, it can be concluded that if an e-agriculture service is established at CUT the Shona language must be used. However, in addition to Shona, English should be used as well as it is one of the official languages of communication in Zimbabwe.

As a general conclusion the researcher feels that a viable e-agriculture information service can be established at CUT to serve the Mashonaland West Province's farming community as CUT has all the infrastructure and resources to establish such a service.

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## APPENDIX A

## CONSENT FORM FOR RESPONDENTS TO PARTICIPATE IN A RESEARCH SURVEY

My name is Benhildah Mabika. I am an employee at Chinhoyi University of Technology and I am studying MInfor (General) with the University of South Africa (UNISA)

You are invited to participate in a research study, entitled '**Designing and developing an e-agricultural information service at the Library of Chinhoyi University of Technology (CUT): A survey'**

This study has been approved by UNISA Review Board and I am carrying this research under the supervision of Professor Maritha Snyman.

There are no known risks associated with participating in this survey**.** There will be no costs for participating, nor will you benefit from participating and your participation in this study is voluntary. You must be at least 18 years old to participate.

If you have any questions about the study you can contact the UNISA postgraduate enquiries desk on +27 12 441 5702 or the supervisor Prof M. Snyman (synman.maritha@gmail.com)

If you agree to participate **in this research please indicate by signing below.** Your signature will indicate that you have read the above information, you are at least 18 years of age and you agree to participate in the research '**Designing and developing an e-agricultural information service at the Library of Chinhoyi University of Technology (CUT): A survey'**

Thank you.

Full Name (optional)

_____

Signature (Must sign)

_____

Date_____

## APPENDIX B

## QUESTIONNAIRE

Date: _____

Country: Zimbabwe Province: Mashonaland West District: _____

Sex: _____ Age: _____

Highest level of education attended: Primary/Secondary/Certificate after Secondary/Diploma/Undergraduate/Postgraduate: _____

Occupation Farmer/Extension Officer/Agro-dealer employee/Lecturer Agriculture/Library employee/ICT employee/Student Agriculture: _____

Please read the following description of a new service called the **E-agriculture Information Dissemination System** which the Chinhoyi University of Technology (CUT) Library would like to introduce to the Mashonaland West farming community and use it to complete the questions below.

E-Agriculture which is also known as e-farming is an emerging field within the agricultural sector. It refers to agricultural services and information delivered through the utilization of existing and emerging information and communication technologies (ICTs). The ICTs used in e-agriculture include mobile phones, digital personal assistants (PDAs), smart cards, CD-ROM, Geographic Information Systems (GIS), radio, Radio-Frequency Identification Devices (RFID), websites and weblogs, and email-based information services among others. The idea of **e-agriculture** originated during the World Summit on Information Society (WSIS) Plan of Action in 2003 where an **e-agriculture community** was formed. The overall aim of the Community is to enable the

exchange of knowledge related to agriculture electronically and ensure that the knowledge created is effectively shared and used worldwide. CUT need to follow this global initiative and provide an e-agriculture service to its community of farmers in Mashonaland West Province.

Your feedback is highly appreciated. The entire survey will take less than ten minutes.

1. What is your perception of the described service? (tick one)

   ○ Useful

   ○ Not useful

2. Would you recommend for the introduction of this service?

   ○ Yes

   ○ No

3. What other similar services are you aware of? ( can tick more than one)

   ○ UZ e-farming

   ○ AGRITEX E-Farm

   ○ Eco-farmer

   ○ Other

4. In which language(s) would you prefer to get this agricultural information in? (can tick more than one)

   ○ English

   ○ Shona

- ○ Ndebele
- ○ Other

5. Will you be interested in using this service?
   - ○ Not at all interested
   - ○ Neither interested nor uninterested
   - ○ Interested
   - ○ Very interested
6. Assuming that the service is introduced will you use the service?
   - ○ Yes
   - ○ No
7. In your opinion, what are the factors limiting the use of ICTs by farmers and extension workers? (can tick more than one)
   - ○ Lack of access to ICTs
   - ○ High costs of ICTs
   - ○ No interest in ICTs
   - ○ Other
8. Which ICT tool would you prefer to get agricultural information updates?
   - ○ Computer
   - ○ Internet/www
   - ○ cell phone
   - ○ e-mail
   - ○ other
9. How often do you search for agricultural information?

- ○ Daily
- ○ More than twice weekly
- ○ Ten or more times monthly
- ○ Never

10. Which crop/livestock information would you like to be frequently updated on? (can tick more than one)

- ○ Maize production and pest control
- ○ Tobacco production and pest control
- ○ Soya beans production and pest control
- ○ Rice production and pest control
- ○ Cattle production and disease outbreaks
- ○ Chicken production and disease outbreaks
- ○ Goat farming
- ○ Sheep farming
- ○ Fish farming
- ○ Crop insurance
- ○ Credit and loans
- ○ Seed varieties
- ○ Weather forecasting
- ○ Agricultural products markets and prices
- ○ Agricultural machinery
- ○ Planting methods

○ Pesticides

11. Do you have access to any of the following ICT tools? (can tick more than one)

○ Computer

○ Internet/www

○ cell phone

○ e-mail

○ other

Thank you for sparing time to answer this survey!