THE USE OF MOBILE PHONES IN DISSEMINATING AGRICULTURAL INFORMATION TO FARMERS IN MASHONALAND WEST PROVINCE OF ZIMBABWE

by

Benhildah Mabika
Student Number: 53258827

Submitted in accordance with the requirements
for the degree of

DOCTOR OF PHILOSOPHY IN INFORMATION SCIENCE

at the

UNIVERSITY OF SOUTH AFRICA

November
2019

Promoter: PROF GV. JIYANE

Co-Promoter: DR T. MUGWISI

DECLARATION

Student Number: 53258827

I Benhildah Mabika declare that, **The use of mobile phones in disseminating agricultural information to farmers in Mashonaland West Province of Zimbabwe,** is my personal work and all source citated and utilised in this work were pointed to and recognized by the use of references.

Signature  Date 08 November 2019

Benhildah Mabika

Signature  Date 12 November 2019

Promoter: Prof. GV. Jiyane

Signature  Date 12 November 2019

Co-Promoter: Dr. T. Mugwisi

DEDICATION

This thesis is dedicated to my parents, who conveyed the value of education and hard work; my husband, who has been patient with me throughout my studies; my beloved daughters, Zuvarashe and Ruvarashe- may you be motivated and inspired to work hard as you follow your dreams; and my young sisters, Maria and Jenifa – we will always remain a team.

ACKNOWLEDGEMENT

I sincerely convey my appreciation to my project supervisors, Professor G.V. Jiyane and Dr. T. Mugwisi, for their valued support and guidance; without them the study would not have been a success.

My appreciation as well goes to the management and employees of the Mashonaland West Province AGRITEX department, for allowing me to use their district office premises to collect my research data from farmers. I also thank all the farmers, network providers and all stakeholders in agriculture who participated in this study.

I also thank everyone who assisted me in one way or another in making this thesis a success. Mostly, I thank God who gave me the power, wisdom in addition to the gift of life to follow my vision of becoming a PhD holder.

Glory to God.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS AND ACRONAMES xvii

AGRITEX	Agricultural Technical and Extension Services
AREX	Agricultural Rural Extension
CD-ROM	Compact disk- read only memory
CPF	CafeDirect Producer Foundation
CAPI	Computer-assisted personal interviewing
CTA	Technical Centre for Agricultural and Rural Cooperation
DFID	Department of International Development
DoI	Diffusion of Innovation
GDP	Gross-domestic product
FAO	Food and Agricultural Organisation
GIS	Geographic Information Systems
GMB	Grain Marketing Board
GPS	Global Positioning System
ICTs	Information and Communication Technologies
ITC	Indian Tobacco Company
IVR	Interactive Voice Response
KACE	Kenya Agricultural Commodity Exchange
KTA	Knowledge Transfer Africa
LFSP	Livelihoods and Food Security Programme
LSCF	Large Scale Commercial Farms
MMS	Multimedia message service

NAFIS	National Farmers Information Service
NALEP	National Agricultural and Livestock Extension Programme
PA	Precision Agriculture
PACB	Primary agricultural cooperative banks
PDAs	Digital Personal Assistants
POTRAZ	Postal and Telecommunications Regulatory Authority of Zimbabwe
RFID	Radio Frequency Identification Devices
RML	Reuters Market Light
SCT	Social cognitive theory
SMS	Short Message Service
SPSS	Statistical Package for the Social Sciences
SSCF	Small Scale Commercial Farms
TAM	Technology acceptance model
Unisa	University of South Africa
UK	United Kingdom
VCD	Video Compact Disc
WISIS	World Summit on the Information Society
ZimStat	Zimbabwe National Statistics Agency

APPENDICES

ABSTRACT

The study investigated the use of mobile phones in disseminating information on agriculture to the farming community of Mashonaland West Province of Zimbabwe, with a view to improving the coverage gap created by the available initiatives. Relevant literature on the available and successful mobile phones agricultural information dissemination platforms were extensively reviewed, taking into consideration the Mashonaland West Province farmers' information needs. Formats, channels and sources currently being used to transmit agricultural information to farmers were investigated. Barriers to the use of mobile phones in transmitting agricultural information were as well investigated. Data was gathered on the farmers' access to mobile phones and ownership of mobile phones. The survey research methodology was used for data collection because the research involved a large sample in a widespread geographical area. Quantitative research approach was used and questionnaires were used for data collection. The respondents for the study comprised farmers, network providers and other agricultural stakeholders in the province. A sample of 384 farmers, and 13 network providers and other stakeholders participated in the survey. Quantitative data was analysed using the the SPSS software while the little qualitative data which was available was analysed through content analysis. The findings of the study indicated that farmers in Mashonaland West Province of Zimbabwe were willing to get updates on agricultural information via cell phones. However, majority of the farmers could not afford the high mobile data tariffs being charged by network service providers, and the costs of subscription charged by the available agricultural information dissemination platforms. The study mainly recommended that the government should establish mobile phone agricultural information dissemination platforms that can be accessed by farmers for free or that which will charge affordable rates. The study adds to the existing knowledge on how mobile phones can be used in disseminating agricultural information to farmers.

Keywords: Agriculture; e-agriculture; Information communication technologies; Information dissemination; Mobile phones; Mashonaland West; Zimbabwe

CHAPTER ONE

INTRODUCTION AND BACKGROUND TO THE STUDY

1.1 Introduction and background to the study

Agriculture is that practice of keeping of livestock and valuable plants by people (Rimando 2004). Agriculture is a significant area in the universal setting. The World Bank (2017) states that agriculture is key to fiscal development; it accounted for one-third of global gross-domestic product (GDP) in 2014, covers above a third of universal land, and is the chief supply of revenue for the majority of people who live in rural areas globally. The World Bank (2017) goes further to report that development in the agriculture sector is the most effective way of raising the earnings of the poor when compared to other sectors. The 2016 analysis has it on record that 65% of the poor workforce were making a living through agriculture and 815 million people worldwide were hungry, and agricultural development is among the major tools that can be used to end extreme poverty, worldwide.

Generally, farming is a vital area, but it has a number of obstacles that impede the diffusion of farming information to the farmers, especially in developing countries. Such barriers, according to Diekmann, Loibl and Batte (2009), include lack of agricultural information which is packaged in the manner that is favoured by farmers, poor access to appropriate, dependable and relevant information. Availability of agricultural information is significant in changing the lives of the people who depend on farming (Lwoga 2010). If agricultural information reaches farmers, they can improve their farming skills, which will result in increased production. Frické (2009) indicates that information is linked to knowledge and knowledge is filtered from information. As a result, agricultural knowledge accessibility is influenced by the communication links and resources needed for the dissemination of information.

Mangstl (2008) asserts that e-Agriculture is a terminology referring to the improvement of agriculture through using ICTs (Information and Communication Technologies) thereby upgrading the lives of the majority living in rural areas globally. e-Agriculture was one

important item which was discussed at the World Summit on the Information Society's (WSIS) Plan of Action in 2003 (WSIS 2003). It was at this meeting where the e-agriculture community was created.

According to the e-agriculture website (2017), the aims of the e-agriculture community are to apply ICTs in current agricultural information distribution, especially in poor rural areas, and also use information and communication technologies as mechanisms for increasing foodstuff manufacturing, equally in quality and quantity. The e-agriculture community aims at enabling the exchange of e-agriculture knowledge and ensuring that this created knowledge is efficiently and successfully shared and used globally.

Mangstl (2008) states that "e-Agriculture involves the conceptualisation, design, development, evaluation and application of innovative ways to utilise existing or emerging information and communication technologies". e-Agriculture is, therefore, a concept which is new in the agricultural sector that will enhance agricultural information dissemination and development, if it is properly developed and adopted.

ICTs which are in use in e-agriculture comprise: digital personal assistants (PDAs), imaging and acoustic technologies, geographic information systems (GIS), CD-ROMs, radio, smart cards, radio-frequency identification devices (RFID), mobile phones, websites and blogs and emails (Mangstl 2008).The cellular phone's SMS-application has been seen as the main ICT channel used to transmit information in Africa (Bertolini 2004). This is mostly because of its merits, which are greater than other ICT channels. Aside from being mobile, the mobile phone is simple to safeguard (Donner 2006). The mobile phone does not depend on physical infrastructure, since it is reachable through radio waves, and requires only basic literacy/expertise to operate (Rashid & Elder 2009). The mobile phones allow for data transmission and can be affordable by the majority poor rural people (Bertolini 2004; Rashid & Elder 2009).

From the time the e-agriculture community was created in 2003, several developing countries are incorporating different Information communication technologies to improve

the dissemination of agricultural information to farming communities, and consequently improving agricultural practices and the income of farmers. Ali (2012); Unwin (2009) and Ommani & Chizari (2008) opine that ICTs permit easy access to agricultural information among stakeholders, make it easy for the distribution of information in the agricultural sector, help in information circulation to many farmers who live in remote rural communities and assist agricultural stakeholders to make informed decisions.

The use of Information and Communication Technologies in transmitting information on agriculture is noted to be slowly growing in most developing countries. Diekmann, Loibl & Batte (2009); Ali (2012) are of the opinion that the major factors contributing to this slow growth include: lack of technological awareness of those who seek for agricultural information, lack of an adequate amount of information on the information needs of farmers, lack of suitable Information and communication technologies tools, the available information is packaged and being disseminated in the format which is unfavourable to the farmers, and poor infrastructure. However, in spite of the barriers, there are several success stories on ICTS usage especially cell phones, in the dissemination of agricultural information in Africa.

In Senegal, since 2001, Xam Marse has been circulating information on agriculture to Senegalese farming communities, traders and hoteliers, using the telephone, SMS application and the internet. Information covered is on the availability and prices of, vegetables, fruits, poultry and meat on the markets of Senegal (Manobi South Africa 2013). Pastoralists in the Sahel through the Cyber Shepherd Initiative uses geographic information systems-based maps, mobile phones, global positioning system (GPS) devices and the web, to access information on grazing lands and water sources, in managing their livestock (ICT Update 2004). Adegite (2006) highlighted that agricultural extension workers in Honduras use laptops, portable printers, digital cameras, cell phones, global positioning system devices and portable weather stations to provide technical information and assist farmers in solving their problems.

Palmer (2012), lists Information communication technologies activities which are being practiced globally. These include: Uganda's Agrinet, In this program agricultural

information is being communicated to farmers through the use of e-mails and cell phones; CPF (CafeDirect Producer Foundation), this is a platform which uses mobile phones to disseminate and distribute information internationally; Digital Green, this is a platform which disseminates agricultural information to farmers in India using short videos and these videos are circulated on mobile phones; Frontline SMS, this is a global platform which uses the internet to circulate agricultural information to farmers; and KUZA Doctor, this is a Kenyan mobile phone platform which is used to disseminate agricultural information to farming communities. Drones have recently been of use in the agricultural sector, drones are being used for soil, field analysis, sowing, spraying and monitoring of crops, crop health and irrigation assessment (Mazur 2016).

Recently, the Food and Agricultural Organisation (FAO) has funded the Ministry of Agriculture in Liberia, to teach its extension employees on the use of CAPI (computer-assisted personal interviewing); a mobile application, which uses a computer or a smart phone to collect information from livestock and crop farmers (Malayea 2017).

Information communication and dissemination is the process of transferring up to date information amongst receivers, senders and mediators. Sturges & Sturges (1997:217) opine that information communication and dissemination is the of process providing information to those who will need that information before they come to ask for it. Research on agricultural information dissemination illustrate that channels which are being used in transferring agricultural information vary. Bhagat, Nain & Narda (2004) highlighted that traditionally, farming information was disseminated by extension workers through the radio, face-to-face contact and the television. Successful farmers would also act as examples where other farmers would copy from (Singh, Narwal & Malik 2003). In a study on farmers' information needs in Manipur's rural areas it was established that farmers mostly prefer the radio, the television and newspapers as channels of circulating agricultural information (Meite & Devi 2009). Nevertheless, other current studies by Diekmann and Batte (2011); Churi, Mlozi, Tumbo and Casmir (2012) and Ango, Illo, Abdullahi, Maikasuwa and Amina (2013) indicate that more farmers have preferences in

personal contact with agricultural extension employees, the radio, the television, cell phones, the internet and extension newsletters as means of communicating agricultural information.

Mugwisi, Ocholla and Mostert (2014) note that extension personnel and researchers are of importance in the transmission of agricultural information to Zimbabwean farming communities. Extension officers correspond with the farmers through telephones, the radio, the television, mobile phones, pamphlets, newspapers, posters, public gatherings which include field days and agricultural shows. Effective and efficient agricultural information transfer enables the embracing of new technologies and better practices in agriculture, resulting in increased yields. For agricultural information to be useful to the farmers and for it to be used efficiently and effectively there is need for it to be delivered to the farmers at the right time. e-Agriculture platforms for agricultural information distribution can facilitate for the provision of current and on time information to farmers. Different ICTs in e-agriculture can support the distribution of timely and current information to the farmers who live in remote rural communities.

1.2 Contextual setting

Mashonaland West Province of Zimbabwe was the area of study for this research. Zimbabwe is divided into ten provinces. Mashonaland West Province has an area of 57,441 km², with Chinhoyi as its capital (Zimbabwe National Statistics Agency (ZimStat) 2012). Mashonaland West Province consists of a population of 1 567 449 which is 11.5% of the total population of Zimbabwe (ZimStat 2017). Of its total population 439 687 people live in Communal areas, 60 118 are living in Small Scale Commercial areas, 47 436 are living in Large Scale Commercial areas and 690 429 are staying in Resettlement areas (ZimStat 2017).The province is divided into 13 districts namely Chegutu Rural, Chegutu Urban, Chinhoyi, Hurungwe, Kadoma, Kariba Rural, Kariba Urban Karoi, Makonde, Mhondoro Ngezi, Norton and Zvimba (ZimStat 2017). The literacy rate for the group 15years and above for Mashonaland West Province is 93% (ZimStat 2017).This point out that the majority of farmers in Mashonaland West can read and write, that is they are literate. Zimbabwe also has a high mobile penetration of 103.5% Kabweza (2014), implying that the mobile phone application is an important tool

in reaching out to the farmers in Zimbabwe, in order to alleviate the problem of disseminating agricultural information and marketing agricultural products. Odhunze and Hove (2015) opine that the widespread of mobile phones can improve farmers' access to information. According to Postal and Telecommunication Regulatory Authority of Zimbabwe (POTRAZ) (2017), Zimbabwe's mobile subscription rate currently stands at 94.5% of the total population.

Zimbabwe's Ministry of Lands, Agriculture and Rural Resettlement (2017) website states that agriculture is among the country's most important sectors as it contributes a lot to the country's fiscal growth. It takes up 23% of the country's formal employment, supplies 14-18.5% to the country's GDP (gross domestic product). Adding on to that, it bring in about 33% of the foreign earnings of the country. It can thus be concluded that, the country's future is dependent on the growth and expansion of an efficient, diversified and vibrant agricultural sector.

Zimbabwe's Ministry of Lands, Agriculture and Rural Resettlement does not have an evident policy concerning the supervision of information produced by its branches (Mugwisi, Ocholla and Mostert 2014). Though a reasonable quantity of information is being produced, such information is not being made available to farmers due to unavailability of a primary database. They further indicate that information is produced by electronic means, but disseminated using printed hard copies; in so doing limiting distribution as the scarcity of funds limit the quantity of materials to be printed.

Rukuni, Eicher and Blackie (2006) state that the ratio of extension worker to farmer in Zimbabwe was at 1: ≥1000 for Zimbabwe's Region IV. Agritex (as cited in Chikulo 2013) report that 4800 extension employees are on hand to serve the 1.6 million farmers in the country, meaning that the ration of extension worker to farmer is approximately 1: 3,000. This extension worker to farmer ratio is a barrier to effective and efficient dissemination of information and knowledge to farmers. The use of ICTs in agriculture may help to get rid of the gap by enhancing the distribution of extension services, especially to the farmers living in rural area.

In Zimbabwe, information on agriculture is produced in research institutions, universities and agricultural colleges, but disseminated through libraries, newspapers, and radio/television programmes. However, the agricultural information dissemination initiatives that use ICTs only cater for specified groups of farmers, and not for all farmers in the country. Access to information on agriculture is thus a challenge for the farmers in Zimbabwe. This is particularly more applicable to those farmers in rural areas as compared to peri-urban and urban farmers. Chisita (2010); Odhunze and Hove (2015); Musungwini (2016) and Nyakudya (2017) note that the available ICT-based agricultural information dissemination platforms include: Esoko and Kurima Mari, which cater only for smallholder farmers; EcoFarmer, which caters for farmers who are capable of paying subscriptions; e-Mkambo, which is available to farmers who go to markets to sell their produce; and e-Hurudza, which requires relevant equipment and infrastructure for the software to be distributed to farmers (Chisita 2010; Musungwini 2016; Nyakudya 2017; Odhunze & Hove 2015).

1.2.1 Esoko

Esoko is a mobile platform which was launched in Zimbabwe in 2012. It uses the short message (SMS) mobile phone platform to send agricultural information to farmers. Esoko is currently providing agricultural information on 33 commodities to 17 markets for fresh produce in Zimbabwe. Esoko provides its service to more than 170,000 small holder farmers (Odhunze and Hove 2015).

1.2.2 EcoFarmer

The EcoFarmer mobile phone platform was launched by Econet, a mobile network provider in 2013. EcoFarmer is a farming insurance which provides farmers with agricultural information, it also insures farmers' crops and inputs if affected by drought or by too much rainfall. Farmers are required to subscribe to the platform to be eligible for insurance cover. Subscriptions are paid through EcoCash, a mobile phone payment application facilitated by Econet (Odhunze and Hove 2015).

1.2.3 e-Mkambo

e-Mkambo is a mobile agricultural information dissemination service, which was launched in 2012 by Knowledge Transfer Africa (KTA), in partnership with Afrosoft Holdings (Muza 2013). This service is only accessible to farmers, who go to markets to sell their produce (Musungwini 2016). This highlights that all other farmers who do not go to sell their produce to markets do not have access to this information.

1.2.4 e-Hurudza

E-Hurudza is an electronic farm manager platform, which provides agricultural information to farmers. It was developed by Jawborne Enterprises, a company owned by a Zimbabwean to support the Zimbabwean government's land reform programme (Chisita 2010). However, this platform was developed in the laboratory and no groundwork was done (Musungwini 2016). The Department of Agricultural Extension Services (AREX) distributes the e-Hurudza software to farmers, and trains them on how to use it. E-Hurudza requires a computer, printer and relevant infrastructure.

1.2.5 Kurima Mari

Kurima Mari is a Shona phrase, which means farming for money (Dzenga 2016). This is an agricultural information dissemination platform that was introduced in Zimbabwe in 2015. The platform can only be used on smart phones. The platform run by the Ministry of Agriculture together with Zimbabwe Livelihoods and Food Security Programme (LFSP), a local non-governmental organisation. It is financed by the United Kingdom's Department for International Development (DFID); it is practised in Mutasa, Makoni, Mutare, Gokwe South, Kwekwe, Shurugwi, Guruve and Mt Darwin districts", and it targets smallholder farmers (Nyakudya 2017). The Kurima Mari application can only be accessed on smart phones, which some farmers do not have.

1.3 Problem statement

Musungwini (2016) notes that the main problems being faced by farmers in Zimbabwe comprise of: getting information on prices for agricultural inputs, prices and markets for their farming products, lack of farming knowledge, and failure by the Grain Marketing Board (GMB) to pay in time for their produce. Oladele (2011) observes unavailability of agricultural information is the main reason limiting agricultural development in developing countries. Cellphones can facilitate the mitigation of problems of agricultural information dissemination in Zimbabwe. This is evidenced by the success stories of their use in other countries, and in Zimbabwe. In Zimbabwe, Eco-farmer, e-Hurudza, eMkambo, Esoko and Kurima Mari use mobile phones to transmit agricultural information; however, a number of of these initiatives are still in their infancy and experimental stages, and all of them cover limited areas of the country (Musungwini 2016). The fact that the available mobile phones services are still limited, in terms of their area coverage, which excludes Mashonaland West, is evidence that a lot of research still need to be done in many parts of Zimbabwe, particularly in Mashonaland West, in order to improve the use of ICTs in disseminating information on agriculture.

Even though Zimbabwe has a high mobile penetration of 103.5% as indicated by Kabweza (2014), accessing agricultural information is still a challenge in Mashonaland West Province and other farming communities of Zimbabwe. The available services, which use mobile phones to transmit agricultural information include: Eco-farmer, e-Mkambo and Kurima Mari, all of which are still in their experimental stages. Besides being in their pilot stages, they also do not cover all parts of the country and target only specific groups of farmers or specific farming areas, leaving some groups of farmers and areas untouched (Musungwini 2016). The other major problem with the available mobile platforms is the limitation in accessing them; for example, the Kurima Mari application can only be accessed on smart phones, which some farmers do not have (Dzenga 2016). e-Mkambo is only accessible to farmers who go to markets to sell their produce (Muza 2013: Musungwini 2016). The EcoFarmer platform is available to only farmers that can afford its subscription, leaving those who cannot afford to subscribe with no access (Odhunze and Hove 2015). Esoko services targets only small holder

farmers (Odhunze &Hove 2015). Mashonaland West is one of the areas not covered by these available initiatives. This has resulted to farmers in the province lagging behind in getting information on agriculture and using new technologies to get information on agriculture.

The cell phone SMS platform is the chief ICT function being used to transmit information in Africa; mainly because the application requires basic literacy skills and can be afforded by the poor people living in rural areas (Bertolini 2004; Rashid & Elder 2009).

1.4 Motivation of the study

This researcher was employed to create an agricultural library for a state university. The library was required to support the University's School of Agricultural Science by providing agricultural databases to support the teaching and learning requirements. The library was also expected to provide agricultural information to the farmers in the province in Mashonaland West Province. Being a student, who was supposed to do research, the researcher was motivated to take up the study, which would help to augment the motives of her job.

1.5 Purpose of the study

The purpose of this study was to investigate the use of mobile phones in disseminating agricultural information to farmers in Mashonaland West Province of Zimbabwe, with a view to cover the gaps created by the available initiatives.

1.6 Objectives of the study

To fulfil the research purpose, the explicit objectives of this study were:

1. To establish the kind of information that farmers currently access through mobile phone application.
2. To identify the information needs of the farmers in Mashonaland West Province.
3. To identify how mobile phones can be used to meet the information needs of the farmers in Mashonaland West Province of Zimbabwe.

4. To assess the level of mobile phone access and the brands of mobile phone available among the Mashonaland West farmers.
5. To analyse the sources and channels of disseminating agricultural information available to farmers in Mashonaland West Province.
6. To establish the format(s) in which the information is/are available.
7. To establish the format(s) the farmers would prefer to get the information in.
8. To establish the barriers limiting access to agricultural information through mobile phone application in Mashonaland West Province.

1.7 Research questions

In consideration of the above objectives the study addressed the following questions:

1. What information are farmers currently accessing through mobile phone application?
2. What are the information needs of the farmers in Mashonaland West Province?
3. How can mobile phones be used to meet the information needs of the farmers in Mashonaland West of Zimbabwe?
4. Are mobile phones accessible to Mashonaland West farmers?
5. Which brands of mobile phones do individuals in this community own or have access to?
6. Which information sources and channels are available to the farmers in Mashonaland West Province?
7. In what available format(s) is/are the agricultural information received by farmers?
8. In which format(s) do the farmers prefer to get the information?
9. What are the factors limiting access to agricultural information using mobile phone application in Mashonaland West Province?

1.8 Significance of the study

Since the e-agriculture community's establishment in Geneva in 2003, the accessibility of agricultural information to farmers has been made better as many countries as are

entering into projects which aim at disseminating agricultural information through the use of different ICT tools (Ghogare & Monga 2015). This study is significant in that:

An understanding of the usage of cellullar phones in circulating agricultural information to Mashonaland West Province farming community will help to establish guidelines, which can be referred to, when developing ICT-based agricultural information dissemination services in the province and Zimbabwe in general.

If the recommendations from the study are implemented by policy-makers, and the services are successfully introduced, Zimbabwe will be participating and promoting the e-agriculture community goal of making sure that efficient distribution of information on agriculture, using ICTs, to supply ready access, current knowledge and information, particularly in rural areas. This will add to the existing literature on research focusing on both farmers' information needs and e-agriculture.

Also, knowing farmers' information needs will help in the design of appropriate policies, programmes and organisational innovations that will enhance the practice of agriculture (Babu, Glendenning, Okyere & Govindarajan 2012). The design will be a guideline for setting up mobile phone or other ICT-based agricultural information dissemination services in Zimbabwe.

1.9 Scope and limitations of the study

The study investigated the use of cell phones in circulating agricultural information to selected farmers and agro-dealers in Mashonaland West Province. Zimbabwe is divided into ten provinces but this study focused on Mashonaland West Province only.

1.10 Literature review

In every research, it is essential to be familiar with what has already been done on a topic of study, in order to understand what other scholars have to say about the area under study. This will help identify the gaps that a proposed research can fill (Adams, Khan & Raeside 2014:34). Webster and Watson (2002) note that review of literature is important in any academic study, since it produces a base for increasing knowledge, aids in the development of theory, and discloses the gaps in research.

Considering the above, the literature review for this research covered literature on the subject under study and related areas. The reviewed literature included: published books, journals, web pages, newspapers, magazines, dissertations and theses. The areas covered included: ICTs in agriculture in general, mobile phone ICT application in agriculture, and farmers' information needs and channels of dissemination.

1.11 Ethical considerations

The ethical considerations for this research were guided by UNISA's general guidelines for ethical research, which requires that integrity, transparency, accountability, justice, fairness, respect, confidentiality and informed consent must be complied with in any research (Unisa 2017). To solicit for respondents' consent, respondents were educated on the advantages and benefits of the research, by the researcher. A consent form was then given to each respondent who participated in the study, to confirm that they were totally educated about the study. The respondents' privacy and confidentiality were made certain, as the researcher clarified to the respondents that their identities and contributions will never be disclosed, in addition to that the investigator would guarantee that respondents' identities will never be traceable.

1.12 Research methodology

Research refers to "a scientific and systematic search for pertinent information on a specific topic" (Kothari & Garg 2014:1). Kothari and Garg (2014:7) also define research methodology as "a way to systematically and scientifically solve the research problem through various steps that are generally adopted by a researcher in studying his research problem". This research methodology section summarises the methods which were applied in this study. It provides the research paradigm, approach, design, population, procedures and methods for sampling, procedures for data gathering and analysis and the reliability and validity of the methods used. Detailed information on the study's research methodology is given in chapter four of this research.

Research paradigm is "a way of examining social phenomena from which particular understanding of these phenomena can be gained and explanations attempted"

(Saunders, Lewis & Thornhill 2003:118). The study mainly followed a positivism research philosophy, given the large sample size. Positivism is most suitable for social sciences and humanities research. However, an interpretivism approach was also included as there was some data, which required individual opinion to be collected. Both quantitative and qualitative research approaches were used in this study. A survey method was used as the research design for this research. A survey method was most suitable for this research as the research consisted of a large sample size. The survey research technique was used to gather data on the use of mobile phones in disseminating information on agriculture. It was also used to collect data on Mashonaland West Province farmers' information needs. The target population for the study was communal, commercial farmers, all mobile service providers and all agricultural stakeholders in the province of Mashonaland West. The research targeted farmers practising different farming activities, which include crop production, livestock production and horticulture.

Stratified and simple random sampling methods were applied in this research. The target population was divided into strata and sub-strata using stratified sampling. Sets of individuals to represent every stratum were selected using simple random sampling. Individuals from each stratum were randomly selected, using simple random sampling for data collection purpose. There were five main strata and nine sub-strata in the sample. A ratio based on the population sizes of the districts was used to come up with the number of respondents to represent each district. Questionnaires were used to gather primary data. The questionnaire comprised both closed-ended and open-ended questions.

The validity and reliability for the study was guaranteed by first sending the questionnaire for authentication by the research supervisors, after which a pilot study was carried out with 20 respondents in the sample. The sample came from one of the districts of the target population. This enabled the pre-testing of the data collection instrument which was questionnaire. Limitations of the tool for data collection were noted and corrected. The data collection tool was again sent for another verification by the research supervisors.

Data analysis for quantitative data was done using the social sciences (SPSS) statistical package, while content analysis was used to analyse qualitative data.

1.13 Definition of terms

1.13.1 Agriculture

Agriculture is defined by Rimando (2004) as a process whereby human beings manage the raising of livestock and useful plants. In this study, agriculture is described as, the process of keeping animals and growing crops for economic gain and human consumption.

1.13.2 e-Agriculture

Mangstl (2008) defines e-Agriculture as that discipline which applies information and communication technologies (ICTs) in agriculture, to develop agriculture and the lives the poor rural people.

1.13.3 Information communication technologies (ICTs)

Different scholars define ICTs as:

…… technologies to facilitate the transmission, communication and the processing of information electronically (Salau & Saingbe 2008).

……. any mechanism, tool, or appliance that facilitates for the gathering and sharing of information through transmission or interaction (The General Assembly second (GA2) Agriculture Committee 2013).

…… any collection of software, hardware, people, telecommunication networks and procedures which can facilitate the process of collecting, processing, storing of data and sharing of information (Dewan & Kraemer 2000).

……. technologies that permit the processing, communication or distribution of information electronically (The CTA 2003).

…… a collection of tools used for the gathering, distribution and storing of information to assist in making informed decision (Namisiko and Aballo 2013).

Hence, for the purpose of this study, Information and Communication Technologies is defined as technologies that permit for the gathering, processing, storing and distribution of information electronically.

1.13.4 Information needs

Information is essential in our every day life, therefore it needs to be distributed to its end users packaged in the format preferred by its audience at the right time. Chisita (2010:3) stated that the need for information is "a basic requirement for information that is of value for one's private or social life" In a nutshell, for information to be considered to be worth, it must meet the needs of its intended audience.

1.13.5 Information dissemination

This is the practice of providing information to those who are likely to look for that information before they ask for it. (Sturges & Sturges 1997: 217).

1.14 Organisation of the thesis

Preliminary pages

Chapter One: Introduction and background to the study
Chapter Two: Theoretical framework
Chapter Three: Literature Review
Chapter Four: Research Methodology
Chapter Five: Data analysis, interpretation and discussion
Chapter Six: Summary, conclusions, recommendations and reflections

Chapter two is the theoretical framework of the study. It discusses the importance of theories and theoretical frameworks in research, and also discusses in details, the Diffusion of Innovations Theory which is the theory guiding this study.

Chapter three is the literature review. It assess and reviews other studies related to the topic of the current study. It analyses research findings from other researchers or scholars concerning the current research topic.

Chapter four is the study's research methodology. It explains and gives a validation of the particular procedures pursued in carrying out this research. It discusses the research approach, philosophy, the research population, research design, the sampling methods, the data collection instruments and the data analysis procedure.

Chapter five provides the data analysis, interpretation and research findings. Tables and graphs were used to present the findings.

Chapter six provides the conclusions drawn from the findings, the recommendations made and the study reflections based on the findings.

1.15 Chapter Summary

The first chapter introduced the research and covered the research background, contextual setting, problem statement, research purpose, objectives and research questions, significance, ethical considerations, scope and limitations of the study. It also summarised the study theoretical framework and methodology as these are covered in detail in later chapters.

Chapter one has summarised the study's background, indicated the problem statement of the research, outlined the focus of the study, highlighted the research questions, research scope and justification for the study. In a nutshell, this first chapter is an outline of what was covered in this study. In addition to giving a summary of the study it clarifies why it was necessary to carry out the study and explains the benefits of the study to the Mashonaland Province and Zimbabwe in general..

The next Chapter is the theoretical framework. It discusses the importance of theories and theoretical frameworks in research and also discusses in detail the Diffusion of Innovations Theory, which is the theory underpinning the study.

CHAPTER TWO

THEORETICAL FRAMEWORK

2.1 Theories and theoretical framework in research

Chapter two addresses the theoretical framework of this research. It discusses the significance of theories and theoretical frameworks in research and, in more detail, the diffusion of innovations theory (DIT) by Rogers, which was adopted for this study. The use of mobile phone as a channel which can be used for disseminating agricultural information is also discussed.

A theory in research, is defined by Best and Kahn (2004:9) as an attempt to develop a general explanation for some phenomenon focusing on determining cause-effect relationship. Rudestam and Newton (2007:6) define a theory as the language that allows researchers to make sense of similarities and differences from observation to observation while Babbie (2010:10) describes a theory as a systematic observation and explanation of aspects that relates to a particular life. Babbie (2010:11) further states that today's social theory deals with, 'what is and not with what should be'. This means that a theory in research should focus on how things are and why they are like that. McMillan and Schumacher; Agnew and Pyke as cited in Anfara and Mertz (2015:5) recommended that a good theory should: be simple, consistent, predictive, and testable; it should also support other theories, stimulate further research, and provide means for verification. A useful theory should give new insights and broaden the understanding of a phenomenon (Anfara & Mertz 2015). Theories are based on assumptions (Bates 2005:2) and they tend to deal with the why and how of a phenomenon (Johnson & Christensen 2008:20) and also give patterns of a phenomenon (Mugenda and Mugenda 2003:5). Theories are used in research as guides for addressing research problems in a logical manner. Babbie (2010:59) opines that theories are of importance in research as they help to avoid flukes, make sense of observed patterns and shape and direct research efforts. Anfara and Mertz (2015:227) expound that theories play important roles in influencing the ways researchers approach and pervade all aspects of their studies.

There are different theories for different disciplines. Ocholla and Le Roux (2011) noted that Library and information science research rely on theories from other disciplines, as it does not have theories specifically designed for its discipline. Fisher, Erdelez and McKechnie (2005) list the seventy-two theories of information behaviour and from these, there is the diffusion theory, which tries to interpret the spread of ideas and actions within social environments and focuses on how knowledge utilisation can improve human life. Wilson (1994) states that failure to base a research on a theory will be like building a pyramid without a foundation. This research is based on the diffusion of innovations theory by Rogers.

Ocholla and Roux (2011) opine that the theoretical framework of a research is the arrangement that supports the research theory. It is any theory that can be applied to understand a phenomenon (Anfara & Mertz 2015). Herek cited in Ocholla and Le Roux (2011) noted that a theoretical framework should highlight the why and how of a research, how the research connects to the existing knowledge, and should explain the type of research undertaken. Anfara and Mertz (2015) mention the four important roles of a theoretical framework in research which are: to organise and focus a study, to disclose and conceal meaning and understanding, to position the research in the academic discussion and supply a language, and to disclose its strength and weaknesses.

Theoretical framework has the ability to assist the researcher to frame and shape every part of the study; from the design of the research to interpretation of the research findings through relating towards the theory the study is based on (Anfara & Mertz 2015:231). A theoretical framework helps a researcher to see familiar phenomena relating to the research under study (Anfara & Mertz 2015:232). Anfara and Mertz (2015:233) further state that the theoretical framework has the potential to help researchers link their studies to other literature that are related to their studies, using the accepted vernacular of a given theory. A theoretical framework also helps to detect the strengths and weaknesses of a given theory, and this will give room for coming up with new ideas in a field of study (Anfara and Mertz 2015:234).

2.2 Theories used in agricultural Information behaviour

This study deals with the dissemination of agricultural information; hence, the need to relate it to theories that deal with the use of new technologies in information behaviour and adoption. There are several theories used in studying agricultural information and knowledge systems. Some of the theories comprise of: the sense-making theory, the social cognitive theory, the technology acceptance model and problem-solving model, just to mention a few.

2.2.1 Sense-making theory

This theory takes the supposition that knowledge produced today may be tomorrow's knowledge gap (Dervin 1998:41). The author explains further that this theory assumes that, as people move under dynamic conditions over time, they must make and unmake sense. People change according to how they share knowledge with others over a given time and space (Dervin 1998:40-41). The sense making theory supports the constructivist philosophy which emphasises that problems can be solved through real actions (Dervin 1998:36).

2.2.2 Social cognitive theory (SCT)

This theory was developed by Bandura, and it entails that people learn from personal experiences, observing others, and through interaction with their environments. The theory assumes that individuals are able to execute, perform a behavior, regulate and monitor individual behavior and learn from that (Bandura 1999:154). According to Rana and Dwivedi (2015), social cognitive theory (SCT) is based on three main aspects, namely: behaviour, personal and environment. The behaviour factor focuses on usage, performance and adoption issues, personal factor deals with the demographic characteristics of an individual and environment factor is concerned with the physical and social aspects that are physically external to the individual (Rana & Dwivedi 2015). The three interact to shape and influence both group and individual behaviours. As a replica of information behaviour, this theory can be used to evaluate information technology, as it can address adoption issues, usage and performance of new innovations.

2.2.3 The problem-solving model

In this model, the starting point is a grouping of people or an individual person, having a problem and not starting with the research or an innovation. The problem-solving model involves five stages, which are: identifying need, defining a problem, looking for solutions, choosing the best resolution to the problem and applying the chosen solution.

2.2.4 Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) focuses on how users can be motivated to adopt a new innovation, through how they perceive the new innovation's usefulness, simple to use and the feelings associated with its use (Muk & Chung 2015). The attitude to adopt an innovation by users is subjective to the new idea's perceived worthiness and ease in using it. Davis, as cited in Chuttur (2009), defines perceived usefulness as "the degree to which an individual believes that using a particular system would enhance his or her job performance", while perceived ease of use is "the degree to which an individual believes that using a particular system would be free of physical and mental effort". However, Muk and Chung (2015) state that the original TAM does not recognise the social influence as having influence towards adoption of technology.

This research adopts the diffusion of innovation theory.

2.3 The Diffusion of Innovations Theory

The diffusion of innovation theory (DOI), which was found by Rogers, clarifies how innovations or new initiatives are accepted. Rogers (1995:5) stated that "diffusion is the process by which an innovation is communicated through certain channels, over time, among the members of a social system". This study aims at coming up with a mobile phone innovation, as the channel of communication which can be used in the disseminating of agricultural information. The diffusion theory comprises four basic elements, namely: innovation, time, social system and communication channels.

2.3.1 Innovation

An innovation as an initiative, an application, or an objective that is observed as new (Rogers 2003:12). The author further argues that, for an innovation to be regarded as new, this is determined by the knowledge it holds, and its ability to persuade and make a decision for adoption. Rogers (2003:15) also highlights that innovations consist five basic characteristics, and these are: compatibility, relative advantage, complexity, observability and trialability.

2.3.1.1 Relative advantage

This is how an innovation is viewed by individual in comparison to the old idea it intends to supersede. If the new innovation is viewed as advantageous, the more it is likely to be adopted (Rogers: 2003:15).

2.3.1.2 Compatibility

An innovation has to agree with the available norms, standards, desires and past experience of a social system for it to be adopted (Rogers 2003: 15).

2.3.1.3. Complexity

Rogers (2003:15) defines this as the level of ease of understanding and use of an innovation. The easier to use and comprehend a system, the more it is likely to be adopted.

2.3.1.4. Trialability

This refers to the degree or level towards which a new idea may be tried and tested from the onset. The more an innovation can be tested on a restricted base, the most likely it can be adopted, compared to innovations which cannot be tested (Rogers 2003:16)

2.3.1.5. Observability

Observability is “the degree to which the results of an innovation are visible to others” (Rogers 2003:16). Visibility stimulates adoption by others. Outcomes of new idea, which are noticed easily by individuals, are more likely to be accepted (Rogers 2003:16).

2.3.2 Communication channels

Communication is “the process by which participants create and share information with one another, in order to reach a mutual understanding” (Rogers 2003:5). Diffusion is that kind of communication whereby individuals or groups of people share new ideas (Rogers 2003:204). This process is characterised by an innovation which is a new idea, an individual who knows about the new innovation, other individuals with no knowledge of the new idea and a channel to communicate the new innovation (Rogers 2003:204). Information is communicated between sources through a channel; a source is the originator of the message, while a channel is the means through which the information gets to its receiver from its sender (Rogers 2003:204). Rogers (2003:19) further states that diffusion on its own is a specific type of communication, that involves the communication elements, which in turn include an innovation, two persons or other units of acceptance and a channel for communication. The author as well notes that diffusion is a social process that involves interpersonal communication, and that interpersonal relations are powerful in changing individual attitudes. This study explored the suitability of the cellular phone as the communication channel for the transmission of agricultural information to farmers in Mashonaland West province.

2.3.3 Time

Rogers (2003:20) opines that time plays an vital role in the diffusion procedure. Time is often ignored in research that do not follow the diffusion process; however, time is an aspect of every activity in any research (Rogers 2003:20). In the diffusion process, the time aspect involves three processes, namely: the innovation-decision process, the innovativeness and innovation’s rate of adoption.

2.3.3.1 The innovation-decision process

This refers to the procedure through which a decision-maker or an individual goes by from getting the primary knowledge of an innovation through to deciding (on whether to accept or reject the innovation, implement the idea) and confirming the decision (Rogers 2003:177). This process comprises five steps: knowledge, persuasion, decision, implementation and confirmation (Rogers 2003:177). Knowledge is when an individual or decision-maker is exposed to an innovation and has an opportunity to know how it works. Persuasion is the attitude the individual or decision-maker shows towards the innovation. Decision is the choice made either to adopt or reject an innovation. Implementation occurs when an innovation is put into use, and confirmation is the reinforcement of the decision made on an innovation (Rogers 2003:177).

2.3.3.2 Innovativeness

Rogers (2003:22) defines innovativeness as the degree to which a person, or other component of acceptance, is relatively earlier in accepting an innovation than the other elements of a system, and classifies innovativeness into five categories namely: innovators, early adopters, early majority, late majority and laggards. This is shown in figure 2.1 below.

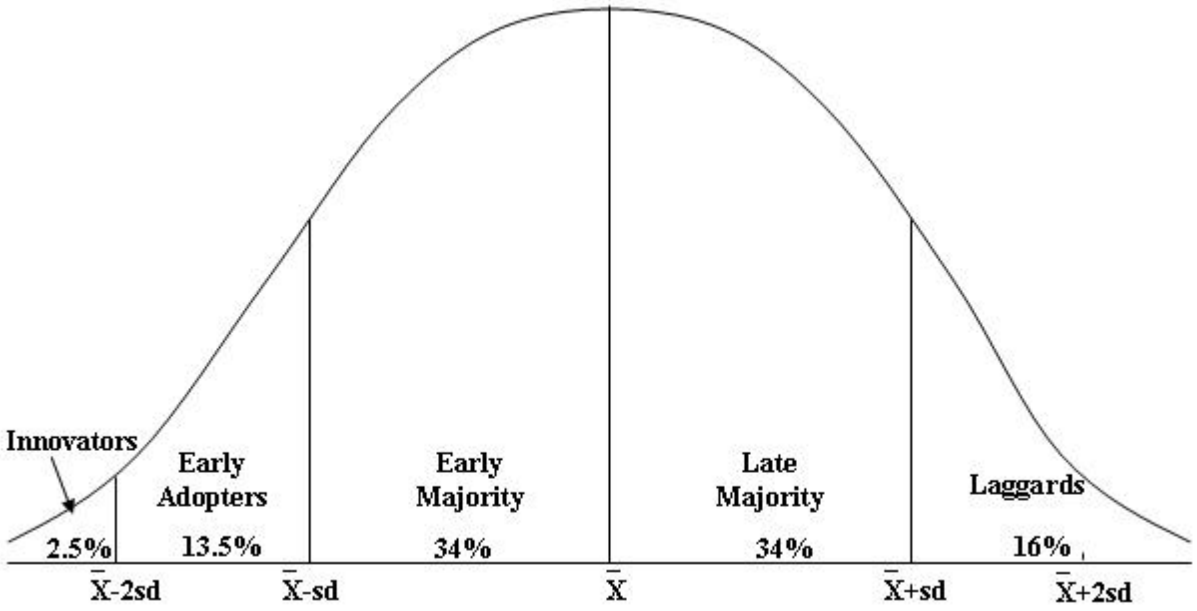


Figure 2.1: Adopter Categorisation on the Basis of Innovativeness (Rogers 2003)

Innovators actively seek information on an innovation; they are highly exposed to the mass media, a wide area network and can easily cope with new innovation (Rogers 2003:22). Innovators are risk-takers, they interact with other innovators and adopt an innovation when it is still new (Rogers 2003:283).

Early adopters have the highest level of social status, opinion leadership, , financial liquidity and education than late adopters and are more diplomatic in agreeing to an innovation than innovators, but they join a new innovation when they perceive a benefit (Rogers 2003:283).

Early majority unlike early adopters and innovators take longer time to adopt an innovation (Rogers 2003:283). Late majority approach an innovation with a high level of uncertainty in addition to they adopt an innovation after most of the society has adopted it. Late majority also have lower social status, less economic stability and little opinion leadership (Rogers 2003:284).

Laggards are the last to accept a new idea. Laggards not like other groups, have little or no opinion leadership attribute, pay their attention to traditional ways of doing things, have the lowest financial liquidity, lowest social status, oldest among adopters, and are advanced in make getting in touch with family and close friends only (Rogers 2003:295).

2.3.3.3 Rate of adoption

This is the pace by which an idea is accepted by its intended audience. Initially, only the minority individuals take on the innovation, but with time, more and more individuals will adopt and very few will remain not adopting (Rogers 2003:221). The pace of taking on an idea is calculated by the time-span needed for a fraction of the members of a social system to take up an innovation (Rogers 2003:221).

2.3.4 Social system

A social system refers “as a set of interrelated units that are engaged in joint problem solving to accomplish a common goal” (Rogers 2003:23). Members of a social system may be groups, individuals, , organisations or subsystems. Diffusion takes place in a social system; as social systems constitute boundaries within which innovations diffuse (Rogers 2003:23). Rogers (2003:24) say that diffusion of innovations is influenced by the social structure of the social system, thereby affecting the individual’s innovativeness, which is the main basis for classifying adopters According to Rogers (2003:24), the individual adoption process goes through five stages: knowledge, persuasion, decision, implementation and confirmation and the stages follow each other over a specified period.

In the knowledge stage, the individual gains knowledge of and search for information about a new innovation, and the main questions at this stage are what the innovation is, how and why it works (Rogers 2003:21). The persuasion stage is the stage an individual shapes his/her feelings towards the new idea, leading to either a positive or negative feeling about the new idea (Rogers 2003:176). At the decision stage, individual chooses either to reject or adopt an innovation (Rogers 2003:177). Implementation stage is the stage where the innovation is put into practice, and at this stage, adopters are faced with uncertainty about if the innovation will not work, which creates the need for increased technical assistance and assurance from those who would have brought the new idea (Rogers 2003:180). The final stage is the confirmation stage, whereby individuals look for supportive confirmation that they have made the right decision, and it is at this stage that individuals can decide to discontinue using the new innovation, if they find out that the innovation is not meeting their expectations (Rogers 2003:189).

Adoption of an innovation is also influenced by system norms’ compatibility with the needs of the end users. Change agents and opinion leaders should recommend innovations that fulfill the needs of the innovation’s clients (Rogers 2003:15). Rogers (2003:15) further argues that for an innovation to be perceived useful, and to be

adopted, it must be in agreement with the existing social system's beliefs, cultural values, needs and past experiences of its clients.

2.4 Criticism of the Diffusion of Innovation theory

The concept of innovation diffusion originated from studying technology related to agriculture, and because of this, the theory has received a lot of criticism and the first criticism was that the diffusion of innovation theory is more agrarian focused and would not be applicable to innovations in other sectors (Wani & Ali 2015). According to the UK Essays (2013), the weaknesses of the DOI theory are: innovation adopters do not follow a definite line as with one invention the now innovator will be the laggard and vice versa; diffusion of innovation theory does not state clearly how an innovation will be successful after going through the innovation curve; and the theory does not explain how to deal with an innovation which may change during the diffusion process, as this may affect the diffusion process. However, regardless of its criticism, DOI is perceived to be a useful theory in the social sciences, as several studies has followed the theory and many research articles based on DOI from every discipline have appeared in many top journals (Rogers 2003:102)

2.5 Application/relevance of the diffusion of innovations theory in this study

The four main aspects of the diffusion of innovation as stated by Rogers (2003) are innovation, communication channels, time and social system. These four aspects; each played an important role in this research. This research focuses on closing the digital divide created by available initiatives like Eco-Farmer and e-Mkambo. This can only be achieved through the application of the diffusion theory's four main elements in the research. In this case, a new innovation in the area will be the use of the mobile phone to disseminate agricultural information. The mobile phone will be the communication channel while the farmers and other stakeholders represent the social system.

2.5.1 Relevance of Innovation in this research

In this research, the cellular phone application is the new innovation which needs to be adopted to communicate farming information to the farming community of Mashonaland West Province of Zimbabwe. The mobile phone application has different characteristics

which need to be considered, as they influence the adoption of the innovation. Zimbabwe has a high mobile phone penetration of 103.5% Kabweza (2014), and Zimbabwe's mobile subscription rate currently stands at 94.5% of the total population (POTRAZ 2017). Odhunze and Hove (2015) opine that this widespread of mobile phones can help in improving farmer access to information in Zimbabwe.

Rogers (2003) argues that an innovation may not be new in one environment, but may be perceived new in another environment. In this case, using mobile phone to disseminate agricultural information may not be new in some areas in Zimbabwe and worldwide, but it is perceived as new in Mashonaland West Province of Zimbabwe. This is perceived new in the province, as the existing agricultural information dissemination platforms only cover selected parts of the country and selected groups of farmers. The available mobile phone agricultural information dissemination platforms include Kurima Mari, e-Mkambo, Eco Farmer, Esoko and Agro Axess.

2.5.2 Relevance of communication channels in this research

Innovations do not move in vacuums, but are communicated through some specific channels to a particular social system, over a specified period (Oliveira & Martins, 2011). Rogers (2003:204) states that for communication to take place, there must be channels between sources or participants that need to share information. Rogers (2003:204) continues to define a channel as a means through which a message is transmitted from its sources to its intended receiver. A source is defined as an individual or an organisation, which creates a message that need to be communicated (Rogers 2003:204). There are several ICTs that can be used to transmit agricultural information to farmers, Mangstl (2008) listed some and these include: mobile phones, smart cards, radio, radio-frequency identification devices (RFID), geographic information systems (GIS), imaging and acoustic technologies, email-based information sources, websites and weblogs. This research focused on the mobile phone application's suitability as a channel for communicating agricultural information**.** The mobile phone being the new innovation is also the communication channel for use in transmitting agricultural information to farmers. Rogers (2004:203) opines that diffusion in itself is some special

kind of communication, which is characterised by some specific elements of communication. These elements include an innovation, individuals, units of adoption and communication channels. In this research, the farmers are the individuals and units of adoption.

2.5.3 Relevance of time in this research

Rogers (2003:172) highlights that there are five stages in the diffusion decision-making process and the five steps are: knowledge, persuasion, decision, implementation, and confirmation. This implies that for an innovation to be adopted is has to go through all the five steps. Each step is carried out over a specific period. An innovation is adopted by different people in different time frames. The adoption of the mobile phone as a platform for disseminating agricultural information in Mashonaland west province will be a process, which will be carried out in different phases over a set period.

2.5.4 Relevance of social system in this research

Society plays an important role in decisions made by individuals towards the adoption of new innovations. The environment or society should be conducive and support the adoption of a new innovation. Rogers (2003: 23) defines a social system as “a set of interrelated units engaged in joint problem solving to accomplish a common goal”. Diffusion of innovation is influenced by the social structure of the social system it intends to be adopted in. Structure is “the patterned arrangements of the units in a system” (Rogers 2003:24). Rogers further purports that characteristic of individuals and society affects adoption of an innovation. Certain characteristics of the target population who are the end users of the innovation were studied. Socio-economic characteristics of the social system were also studied. Individual and social system characteristics play a role in technology adoption. Such individual and socio-economic characteristics which were studied include education/literacy level of target population, language preferences, infrastructure and accessibility to a mobile phone.

Education or literacy levels of individuals impact on the adoption of any new innovation. Higher education or literacy levels positively influence adoption (Ali 2012; Franklyn, Mohammed and Obidi 2012). Ango et al. (2013) agree that education impacts positively on an individual's perception of change and innovativeness. Mashonaland West Province has a literacy rate of 97.5% (ZimStat 2014). This is signal that majority of the farmers in Mashonaland West are educated and can read and write. Mugwisi et al. (2014) highlight that Zimbabwe has a shortage of agricultural information which is packaged in local languages. Packaging and customizing of information into indigenous languages is a challenge, however, Information and Communication Technologies can be used in agriculture to solve this problem (Raj 2013). Cell phones can assist in distribution agricultural information in local languages.

ICT infrastructure plays an important role in the transmission of information. In order to be able to disseminate farming information to farmers in Mashonaland West, there is need to have well connected network from mobile service network providers. There is also need for the target group to have access to mobile phones. Zimbabwe has a high mobile subscription rate. With three mobile phone service providers: Econet Wireless, Telecel, and NetOne, most parts of Zimbabwe, even remote areas have access to at least one mobile network. The price of mobile phone lines is affordable to the majority of the Zimbabwean population. Table 1 below shows the active mobile subscriptions for the country's three mobile network providers, as of the third quarter of 2017 (POTRAZ 2017).

Table 2.1 Active Mobile Subscriptions

	2nd Quarter 2017	3rd Quarter 2017	% Change
Econet	6.677.531	7.137.171	6.9%
Telecel	1.788.234	1.793.580	0.3%
NetOne	4.845.458	4.868.897	0.5%
Total	**13.311.223**	**13.799.648**	**3.7%**

(Source; POTRAZ 2017 Q3 Report)

This is an indication that most Zimbabweans have access to a mobile phone.

2.6 Chapter Summary

Chapter Two addressed the theoretical framework of the study. It presented the significance of theories and theoretical frameworks in research, and also discussed in detail, the diffusion of innovations theory, which is the theory this study is based on. The next chapter is the review of literature related to the topic being studied.

CHAPTER THREE

LITERATURE REVIEW

3.1 Introduction

Literature review refers to “a comprehensive compilation of the information obtained from published and unpublished sources of data in the specific area of interest of the researcher” (Chawla & Sondhi 2011:32). Jesson, Matheson and Lacey (2011:9) stress that with literature review, a researcher shows that is aware of what information is already available about the topic being studied and can interpret that which is known and come up with the gaps that need to be addressed**.**

The dissemination of agricultural information is today changing from the traditional information delivery methods, in which information used to be distributed by other farmers, seed companies, extension officer and newspapers. Singh (2007) states that the major limitation of the traditional methods of information dissemination was that information delivered at given times may be irrelevant, as it will be catering for specific crops which may be relevant to a few farmers, who will be growing those crops at that time, and leaving out the majority of farmers not having information suitable for the crops they will be growing. These farmers would be left with no option but to grow their crops without relevant information. Singh (2012) further specifies that other challenges of traditional methods of information dissemination include; lack of coverage, as traditional methods such as extension officers and newspapers cannot reach the majority of farmers; lack of interaction between information providers and information users to improve on performance; and accountability as information is given to the farmers without considering the farmers’ specific needs.

Today through e-agriculture, information on agriculture is being transmitted to farmers by means of ICTs (information communication technologies). Noor, Ghanghas and Chahal (2018) observes that ICTs integration in agriculture is transforming farming as ICTs are the key agents for improving access to, relevant, reliable and timely information and sharing of knowledge. The use of ICTs (Information communication technologies) in farming, which is referred to as e-agriculture, have received universal

recognition. Current studies have confirmed that the prosperous establishment and designing of information systems profoundly depend on the aspects of human beings (Mahant, Shukla, Dixit & Patel 2012), which includes: information wants, needs, preferences, demands and user perceptions. This chapter discusses related studies on the usage of cell phones in disseminating information on agriculture. The chapter covers literature related to the information needs of farmers, level of cell phone access of farmers, sources and channels of agricultural information being applied in the dissemination of agricultural information to farmers. The use of ICTs in agriculture, use of mobile phones in disseminating agricultural information, benefits of using mobile phones in agriculture, barriers to the usage of cell phones in agriculture and success stories on the use of mobile phones in agriculture are also discussed.

3.2 Information needs of farmers

Kemp (as cited in Bachhav 2012) states that "information has been described as the fifth need of man ranking after air, water, food and shelter". Thus implying information as a vital daily requirement for everyone. Information touches our everyday activities. Information should be circulated to the appropriate population at the relevant time, for it to be valuable and helpful to individuals, groups of people and organisations in decision-making.

Easdown and Starasts (2004) opine that, in order for information to be considered worth looking for, it ought to be valuable. Easdown & Starasts (2004) opine that this significance is, however, not consistent as individuals perceive the worthiness of agricultural information differently, depending on guiding principles, one's surroundings, individual and societal circumstances. Information which is regarded as important by one person or by a given combination of individuals may be considered of no use in another environment. In a study in Iran, Ommani and Chizari (2008) opine that there are two main aspects necessary for developing Information dissemination systems, communication amongst those involved have to be reciprocal, and information ought to be centred on the needs of farmers.

Studies on information needs enable new innovations developers to come up with interventions that meet end users' specific needs (Mittal, Gandhi & Tripathi 2010). Information requirements of farmers may be categorised by the "agricultural cycle" (Mittal, Gandhi, and Tripathi 2010) or the "agricultural value chain" (Ali and Kumar 2011). 'Information need', is a phrase which is used and has a number of meanings.. The meanings consist of information requirements, demands desires or wants. Information need is defined as "a basic requirement for information that is of value for one's private or social life" (Chisita 2010:3). In addition to that Chisita (2010) highlights that farmers' information needs are fashioned according to the social and fiscal performances of their group. All information created have to meet the needs of its target audience for it to be considered of importance. This means that for information to be regarded of worthiness, it should be capable of addressing the requirements or needs of its target group of people.

Information utilization and information needs are of great importance in agriculture as they take an essential function in the making of decisions by farmers. If information about a specific subject is disseminated to farmers, for example current information on weather forecasting, these farmers will have an understanding of the weather conditions, and with understanding and knowledge, the farmers can make good decisions basing on the knowledge they would have gained. They will use the knowledge to decide on when and where to plant their crops. Therefore, it can be affirmed that for one to create a viable information system, for distributing important information to a specific group of people, it is important to first get the information requirements of the target population. Knowledge of the information requirements of the intended population plays a vital role in the creation of appropriate information programmes, systems, policies, rules and regulations in organisations. The information needs of the target population can be established through the carrying out of studies, using secondary and/or primary sources of information.

Babu et al. (2011) established that other studies on information needs, wants,and preferences reveal that the reasons leading individuals to search for information vary

according to region or country. The Information Society Library (2003) affirm that *"*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 to be able to identify information needs" Meitei and Devi (2009) state that there is slow agricultural development since farmers are not receiving the information they need in time.

Meite & Devi 2009; Bachhav (2012) state that farmers' information needs vary in accordance to the level of advancement in a region or a given location. The farmers' information can be classified into six groups (Meite and Devi 2009) namely:

- **Field acquisition**: This refers to agricultural information on the types of land and how that land can be acquired.
- **Agricultural inputs:** This is information on varieties of seeds, pesticides, weather conditions, agricultural equipment, harvesting information and post-harvest technology.
- **Agricultural technology:** This refers to innovative technology information in agriculture.
- **Agricultural credit:** This is information regarding credit and loan facilities accessible to farmers.
- **Agricultural marketing:** This is information concerning markets and prices of farming products.
- **Food technology:** This is information regarding the post harvesting technology that can facilitate the maximization of profits for agricultural products.

Diekmann and Batte (2011) studied the Ohio agricultural consultants' information needs and they found that these needs can be grouped into seven classes namely:

- Livestock
- Crops
- Agribusiness

- Conservation/Environment
- Beginning farmers/Small farms
- Farm machinery
- Business management

Diekmann and Batte (2011) established that Ohio farmers' most important information preferences are associated with, conservation, farm machinery, crops, livestock, agribusiness and the environment.

In Zimbabwe the information preferences of farmers, extension workers and researchers are in line with the key agricultural fields like animal and crop science, agricultural economics and agricultural engineering (Mugwisi, Ocholla and Mostert 2014). Mittal, Gandhi, and Tripathi (2010) studied Indian farmers at a national level and divided the farmers' information needs into three foremost needs, namely:

● **Know-how information,** which gives farmers fundamental information on farming techniques.
● **Market information,** which gives information on prices of inputs and commodities, demand and transport and logistics.
● **Contextual information**, which gives information on weather and type of crops that do well in particular weather and areas.

Mittal et al (2010) further pointed out that the three classes are required at different periods over the agriculture life phases and they pass through six segments namely:

•**Crop planning:** information yields on crops and seed varieties
•**Buying seeds and other inputs:** prices of seeds and other inputs
•**Planting:** best time to plant given weather conditions
•**Growing:** best techniques for applying fertiliser
•**Harvesting, packing and storing:** best time to harvest, given weather conditions
•**Selling:** finding best price and transport options

The most significant information needed by farmers is on plant protection from diseases, weather, pest control, market prices and seed information (Mittal et al 2010). Investigating on rice farmers, Babu *et al.,* (2012) establish that rice farmers required information on disease management, pesticides, best planting time, fertiliser application, planting methods, seed treatment and storage methods. In a study on agricultural information sources and needs of Tanzanian rural farmers Elly and Silayo (2013) found that farmers need information on pest management, animal husbandry, input availability, soil fertility, diseases, crop husbandry, weather updates, new crop varieties, new breeds training, and new agricultural practices.

3.3 Information dissemination

The dissemination of information involves the transmission of up to date information amongst senders, intermediaries and receivers, in line with the different perceptions of the end user's information needs. In the information science discipline the dissemination or communication of information is one or the areas that is given minimum attention. Information communication or dissemination is the process of getting information accessible to its target audience before they ask for it (Sturges & Sturges 1997:217). Scholarly information concerning the dissemination of agricultural information confirm that there are several channels which are available and are being used to communicate agricultural information.

Effective and efficient agricultural information distribution make easy the acceptance of new technologies in agriculture, and improved farming performances, leading to an increase in yields. Thus, ICTs are bringing in changes that are leading to new opportunities through better practice and presentation of income generating technologies in many sectors which include agriculture (Unwin 2009). Ali (2012) states that ICTs have the capacity to distribute suitable information at the appropriate time that help farmers to make informed decisions, thereby transforming agriculture into a profitable business. Delivery of timely information facilitates the efficient and effective use of agricultural information by agricultural communities. With ICTs, up to date information can be timely distributed to inaccessible rural areas.

3.4 Sources and channels of disseminating agricultural Information

Agricultural information is generated from different sources and is distributed through different channels. This part talks about, in general, the different sources of agricultural information and the ICT channels used in distributing the information. It discusses the mobile phone as an Information Communication Technology channel which can be used for communicating or disseminating information on agriculture.

3.4.1 Sources and formats of agricultural information

Numerous studies to establish agricultural information sources have since been carried out. Traditionally, agricultural communities would get farming information from the television, the radio, extension officer through personal contact (Bhagat, Nain & Narda 2004) as well as other successful farmers (Singh, Narwal & Malik 2003). In Manipur Meite and Devi (2009) investigated of rural farmers' information needs, they established that the radio, the television and newspapers are the channels of transmitting agricultural information which were preferred by the majority of farmers. Nevertheless, other current studies: Diekmann and Batte (2011), Churi, Mlozi, Tumbo and Casmir (2012), and Ango, Illo, Abdullahi, Maikasuwa and Amina (2013), illustrate that farmers are in favour of personal contact with extension workers, television, radio, the internet, the mobile phon and extension newsletters as channels of disseminating information on agriculture. Yaseen, Xu, Yu and Hassan (2016) state that the farmers' key sources of agricultural information are: agricultural extension staff, agro-dealer companies, the media, other farmers and self experience. Mugwisi, Ocholla and Mostert (2012) report that agricultural information comes from libraries, agricultural organisations, departmental collections, personal collections, the internet, colleagues, workshops and seminars. In Zimbabwe Mugwisi, Ocholla and Mostert (2014) also note that "researchers and extension workers play a significant role in the dissemination of agricultural information to the farmers". They keep in touch with farmers through a number of channels which consist of the radio, newspapers, television, telephone and mobile phones, posters, pamphlets,and agricultural public meetings like field days and agricultural shows. Mtega (2012), Lwoga, Stilwell and Ngulube (2011), studied the information sources for rural farming

communities, found that farmers mostly acquire agricultural information from cooperatives, the radio, other successful farmers, newspapers and extension services.

Msoff and Ngulube (2016), in a research on the dissemination of agricultural information in third world countries, indicate that poultry farmers source information on the management of poultry mostly from families, friends, researchers, extension workers, neighbours, and the radio. The other sources, which were used sparingly, include books, posters, newspapers and leaflets; whereas, the least information sources used include cell phones, the television and the internet. Koyenikan (2011) classifies agricultural sources of information as formal and informal sources of information The formal sources being the radio, the press, seminars and workshops while the informal sources include other farmers, relatives, friends and personal experience. Ajuwon and Odeku (2012) opine that information sources come in two different formats, namely print and non-print formats. The print format comprises: books, periodicals, photographs, technical reports, maps, government documents and abstracts, while non-print formats include electronic books and journals, audio visual material, microfilms, images, and records from the internet (Ajuwon & Odeku 2012). The authors provide that the sources of these information formats are human, archives, the internet and libraries.

3.4.2 Information communication technology (ICT) as sources and channels of disseminating agricultural information.

Asenso-Okyere & Mekonnen (2012) define information and communication technologies (ICTs) as tools which makes easy information handling and communication. The technologies consist of: software and hardware, collection media, processing, storage, transmission and information presentation in whichever format**.** Dewan and Kraemer (2000) define ICTs as an assortment of software, hardware, telecommunication networks, procedures and people that can assist in data collection, processing, dissemination and storage of information. CTA (2003) refer to Information and Communication Technologies as technologies that permit the processing, communication and distribution of information by electronic means. Singh (2012) said that the three basic ICTs which are information management technology, communication technology and computer

technology. Namisiko and Aballo (2013) opine that Information and Communication Technology is a set of tools used for the gathering, distribution and keeping of information to aid in the making of decision. With reference to the given descriptions of ICTs from a number of researchers stated above, Information and Communication Technologies is in this study described as technologies that permit for the gathering, processing, storing and distribution of information electronically.

3.4.2.1 ICTs in agriculture

The term e-Agriculture is a new term in agriculture that explain a process whereby information, resources and ideas are exchanged via ICTs for sustainability in farming activities and rural growth (Mangstl 2008). e-Agriculture presents that rich possibility of improving the customary methods of delivering of services and the traditional channels of communication in approaches that expand the agriculture sector's capacity to meet the farmers' information needs (Namisiko & Aballo 2013).

Namisiko and Aballo (2013) reveal that e-agriculture is centred on developing the rural farming communities by improving agricultural information and communication procedures. Namisiko and Aballo (2013) further indicate that e-agriculture is at the moment identified as that better approach of empowering rural farmers in order for them to make informed decisions. e-Agriculture have proved to be the focal area, particularly in the third world countries, since it is universally seen to be an answer to poverty reduction. Mangstl (2008) and Barnabas (2013) agree that e-agriculture is shifting the customary methods of agricultural and farming behaviours for the enhancement of rural livelihood and agriculture.

3.4.2.2 Background to e-Agriculture

e-Agriculture is an international society of practice initiated by the 2003 and 2005 World Summit on the Information Society, which intends to enhance food security and agricultural development by using Information and Communication Technologies in the sector (FAO 2005). This global community bring together different people across the globe to exchange ideas, resources and information using ICTs for rural development

and sustainable agriculture (Mangstl 2008). The e-Agriculture global community at present has a membership of more than 12,000 from 170 countries. Those individual who are members of this global community are information specialists, farmers, researchers, students, business people, development practitioner and policy makers with an interest in the improvement of processes and policies concerning the use of Information and Communication Technologies which are in support of rural development and agriculture in order to develop rural livelihoods (FAO 2005). The e-agriculture global community's duty is to to play the role of a catalyst for rural development and agricultural stakeholders to share information and knowledge, learn from each other and develop the decision-making process concerning the function of ICTs in enhancing sustainable food security and agriculture (FAO 2005).

3.4.2.3 Role of ICTs in agriculture

Information and Communication Technologies are important in agriculture today, they come with several benefits to farmers. The benefits comprise of: enhanced access to timely and accurate information; facilitation of information exchange; improvement on efficiency; quality and quantity of agricultural products; more information production and distribution at a minimal charge; facilitation of easier and faster access to markets; and increased competitiveness and growth in agricultural production (Chikaire, Ani & Nnadi 2015; Namisiko & Aballo 2013; Chukwunonso, Mohammed & Obidi 2012; Ommani & Chizari 2008). ICTs have the ability of transforming agriculture into lucrative businesses, since they are capable of delivering pertinent and appropriate information that helps knowledgeable decisions making by the farmers (Ali 2012; Ommani & Chizari 2008). ICTs comprises of three major technologies, namely: communication technology, computer technology and information management technology (Singh 2012). These applications play significant roles in knowledge and information processing, transmission and management (Singh 2012). Unwin (2009) report that, due to changes being brought about by the use of ICTs, innovative opportunities are coming up to enhance the performance and usage of livelihood technologies different sectors in which agriculture is no exception. Arokoyo (2005) states that ICTs application in agriculture has the potential to:

- get to a huge audience via the Internet, the television and the radio.
- efficiently be used for demonstrations and training, through the use of CD-ROM, video, television and VCD.
- effectively and efficiently used for packaging and searching for the required information.
- connect stakeholders.
- efficiently used for mobilising the community.

Isife, Mnodim and Albert (2013) summarised the responsibilities of ICTs in agriculture as: enabling the reach of a large audience, effective facilitation of community mobilisation, easy transmission of information, enables networking, easy access to information and minimisation of paperwork in record keeping. In summary, ICTs are significant in agriculture as they; allow easy entry to, and dissemination of, information on agriculture: allows for networking; facilitates remote access to information; and helps farmers to make knowledgeable decisions.

3.4.2.4 ICT applications in agriculture

Several ICT applications can be used to improve agriculture. The applications vary according to its intended purpose and the accessibility of necessary infrastructure. These applications have the ability to record information, produce duplicates of the recorded information, transfer large quantities of knowledge and information over long distances at a very low cost and facilitate interaction in information communication and knowledge sharing (Singh 2012). Richardson (1997) argue that whichever ICT that is used to develop the lives of the poor rural communities which plays an indirect or direct role towards enhancing agricultural production, post-harvest and marketing activities, contributes to the reduction of poverty. The ICTs applications which are in use in e-agriculture comprise of the following: knowledge management systems (KMS), wireless communication, radio-frequency identification (RFID), phones, geographic information

systems (GIS), digital personal assistants (PDAs), CD-ROM, smart cards, radio, (Singh 2012) and precision agriculture (PA) (Taylor & Whelan 2013).

- **Geographical Information Systems (GIS)**

Geographic information system (GIS) or geospatial information system (Singh 2007), is an ICT application which integrates hardware and software to gather, keep, analyse, present and handle data that are connected to a geographic location (Munyua, Adera & Jensen 2008; Singh 2012). GIS application enables the screening, understanding, examination, explanation and visualisation of information in numerous ways so as to divulge relations, trends and patterns which appear as reports, globe, maps and charts (Geographic Information Systems 2018.; Munyua, Adera & Jensen 2008). GIS has the capability to plot where things are, map densities, map quantities, find what is inside, find what is nearby and transform map. This ability enables GIS to reduce costs, improve efficiency, enable good decision-making, and enhance record keeping and communication (Geographic Information Systems 2018.). The GIS portable mapping element enables the compilation of field information like geospatial attributes and time tags and can supply an efficient opportunity for distributing study information and reviewing natural resources inconsistency such as landscape and soil inconsistency, remote sensing and weather forecasting (Munyua, Adera & Jensen 2008).

- **Knowledge Management System (KM)**

This is an ICT application used for the management and organisation of knowledge to sustain the development, capturing, keeping and dissemination of information in organisations (Singh 2012). different platforms can be used for knowledge management systems information sharing. The ICT-based platforms include: electronic mail, the telephone, the mobile phone, web based video conferencing, use of intranets, discussion forums and voice over IP (Snyder and Lee-Partridge 2009).

- **Wireless communication**

This encompasses various types of wireless communications, such as satellite communication, broadcast radio, mobile communication systems, Wi-Fi, bluetooth technology and personal digital assistants (PDAs). With wireless technology, information

is transmitted in the air, through the use of electromagnetic waves, without requiring cables, wires or any electronic conductors (Singh 2012; Agarwal 2015).

- **Radio-frequency identification** (**RFID**)

RFID refers to an ICT application that is capable identifying an item uniquely and automatically, through the use of electromagnetic radio waves. RFID can keep volumes of data for a long period and tags are capable of being read beyond the sight of a reader several metres away (Singh 2012). RFID is a proficient way of recognising animals and gathering animal information promptly (Kelepouris, Pramatari & Doukidis 2007). Through the use if RFID, animal administration procedures, like feeding, sorting and drafting are capable of being prepared automatically with little or no human participation (Trevarthen & Michael 2007).

- **Electronic commerce (e-commerce)**

Eletronic-commerce is the purchasing and selling of goods and services over electronic systems using online transactions (Singh 2012). In this study, farmers can use the cell phone application to get agricultural market information for their products. In Zimbabwe, many people are now making use of the cell phones to make payments for commodities and services.

- **Precision Agriculture (PA*)***

Taylor & Whelan (2013) define Precision Agriculture 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 minimising unintended impacts on wildlife and the environment".

Munyua, Adera & Jensen (2008) describe PA as the "next great revolution in agriculture", for the reason that it is capable of managing land by means of the square metre, assessing and foretelling outbreaks of diseases and natural calamities, enabling farmers

to optimise usage of inputs, like fertiliser. Precision Agriculture have been used n agriculture to boost production. In Zimbabwe PA is being used for soil testing, analysis, and land-mapping, this has led in an increase of the production of accurate information to direct in the making of informed decision for those who are engaged in providing f agro services. The International Crop Research Institute for the Semi-Arid Tropics (ICRISAT) state that in Zimbabwe the yields for farmers who have adopted PA have increased by 30-50%.

3.5 Level of mobile phones access

ICTs, which include cell phones have the ability to make better the circulation of agricultural information and improve the livelihoods of people. Global cellular phone exposure grew from 12% in 1999 to 76% in 2009 (Tegegn & Dafisa 2017). In a study on the utilisation of cell phones for agricultural purposes in Nigeria, Asa and Uwem (2017) found that 98.7% of the research participants had access to cell phones with 90.5% being mobile phone owners.

Zimbabwe has a high mobile subscription rate. With three mobile phone service providers POTRAZ (2017) reported that Zimbabwe's cellular phone distribution rate increased from 97% to 100.5% in the second and third quarter of 2017.

3.6 The use of mobile phones in agriculture

Since the e-agriculture community was established, several organisations have commenced e-agriculture actions, either on large or on a small scale. Illustration of such schemes are: Manobi, e-Choupals, Gyandoot, the Evergreen Farming Group (EGF) and Participatory 3D mapping just to cite a few. The majority of these initiatives comprise of the fundamental purpose of giving essential, reliable, and appropriate information to farmers. Bertolini (2004) observes that the mobile phone short message service-application is the major vital rising ICT application in use for transmitting information in Africa. Sekabira and Qaim (2017) state that since 2000, the cellullar phone technology has been broadly accepted in most developing countries, and studies has shown that the use of cell phones has enhanced farmers' market access and income.

Numerous factors contribute to the reasons cell phones are believed to be of importance in development; a number of such factors were mentioned by various researchers who say that, mobile phones are portable and offer protection to holders (Donner 2006), cell phones need not to depend on physical visible infrastructure like phone wires and roads but require basic literacy ability (Rashid & Elder 2009), cell phones allow information transmission and can be afforded by the poor rural populations (Bertolini 2004; Rashid & Elder 2009). Mittal and Tripathi (2009) agree with the other scholars as they opine that mobile phones have three advantages over other ICTs, because they have easy access to customised content, are mobile and time-saving. Aker and Mbiti (2010) argue that cell phones are the ICTs that are mostly adopted by farmers, as they are easy t to keep, provide cost-effective advantages and enhance the societal rank of its users. In their study to find out if mobile phones can improve agricultural outcomes in Niger, Aker and Ksoll (2016) note that farmers who have access to cell phones and know how to use them to get information have increased the quantity of crops they produce and this has resulted to increase in the production of their cash crops from one cash crop to, at least, two. Aker (2010) in a study in Niger on mobile phones and agricultural markets found that cell phone exposure has resulted in the reduction of millet consumer price distribution by 10-15 percent.

There are several successful mobile phone based agricultural information dissemination projects globally. The successful projects include: e-Choupal, Reuters Market Light (RML, Manobi, Web Portal, ONASA, CocoaLink, NAFIS and KACE, just to mention a few.

3.6.1. e-Choupal

In Hindi choupal refers to ‘village gathering place’ regarding that e-Choupal is a business set of connections to facilitate the circulation of information on agriculture to farmers in India (Richardson 1997). This facility was created by ITC Limited (formerly India Tobacco Company), to help farmers to gain access to information on agriculture without difficulty. ITC uploads farming information from farming stakeholders and farming organisations on

the e-Choupal's web page. The information will be packaged into local languages through the use of a computer. The information is subsequently distributed to farmers. The e-Choupal platform is available online and it enables the spreading of knowledge and information by transferring and transmitting farming information to farmers. In addition it enables the selling of agricultural inputs through the networking of consumers and sellers of farming products (Richardson 1997).

Farming communities in the Indian remote rural communities can access e-Choupal as individual easily at village Internet kiosks The kiosks are operated by kiosk workers who are also farmers. The e-Choupal invention is a successful invention, this is witnessed by the following outcomes: e-Choupal currently have 1000 kiosks and the services of e-Choupal have reached more than half a million farmers in 6000 villages in a period of two years after its commencement (Richardson 1997), and today 40 000 villages are benefiting from e-Choupal services, with kiosks located within every five kilometre radius (TBI Team 2018). In addition to that, through e-Choupal ITC managed to get $15million worth of soybeans with in a year after the launch of e-Choupal. The soya beans is sourced from farmers directly without sourcing it through mediators. Furthermore, booth operators get a payment for each transaction they process while farmers gain from improved prices and lesser costs on transactions; not like traditionally, where they had to stay for a long time to find markets for their agricultural yields in addition to having to pay for storage space, loading and dispatching of their crops in the local markets (Richardson 1997; FAO 2007).

To its recognition, ITC is growing e-Choupal services in areas of loans and insurance. ITC is working on establishing a database of risk management services, credit report profile, insurance and non-cash loans for farm inputs to allow farmers to acquire loans and cover their yields through e-Choupal services (Richardson 1997).

3.6.2 Reuters Market Light (RML)

RML provides farming information to Indian farmers on a daily basis through personalized short messages to individual farmer's phone. This information is packaged in the nine indigenous languages and across all telecommunication operators and all cell

phone handset types. It has information sets for 450 crop assortments, more than 1300 marketplaces and 3500 weather positions. RML has been used by over 1.3 million recorded farmers across 50,000 communities within 17 Indian states and about a million additional farmers through sharing (Samhita 2012).

3.6.3 Manobi – Senegal

This successful innovation called Xam Marse has been in operation in Senegal from 2001. The platform offers free of charge access to short message services and internet-based market information. This system was developed by Manobi a Senegalese organisation. Manobi gathers and uploads agricultural products prices into a database, through the use of cell phones (Richardson 1997; Rashid & Elder 2009). Using their phones farmers have access to the database and can check for prices of different agricultural products and choose the best offers where they can sell their produce (Rashid & Elder 2009). Because of Xam Marse fishermen have managed to reduce the quantities of fish which used to get spoiled while searching markets. Buyers and farmers have also realised that they can get more profits if they sell their produce to local markets than to export markets (Rashid & Elder 2009).

3.6.4 Web Portal in China

This is an agricultural web portal created by the Ministry of Agriculture for China. The portal consists of links to agricultural websites from China's provinces and regions. The web gateways supports the exchange and utilisation of information resources (Zhang, Wang & Duan 2016). Also in China, the agricultural sector workers and farmers share agricultural information though a hotline number 12316. Farmers, through a voice call, send their agricultural information queries to experts to this hotline number through their mobile phones. By the end of 2013, this platform had responded to 3.62 millions of farmers' inquiries (Zhang, Wang & Duan 2016).

3.6.5 ONASA in Benin

Food security inspectors in Benin are using the mobile phone's sms and the Internet to observe the prices of Benin's 25 most vital staple foods on rural markets. This service is referred to as ONASA. After working hours, ONASA supplies the costs of the staple foods to an internet café, the data is subsequently processed and sent to subscribers through the use of SMS. Subscribers are allowed to to use the sms platform to ask for for information.

3.6.6 NAFIS and KACE in Kenya

In Kenya the National Farmers Information Service (NAFIS) through the National Agricultural and Livestock Extension Programme (NALEP), package agricultural information in Kiswahili and English and distribute it to Kenyan farmers via cell phones and telephones (http://www.nafis.go.ke/). This service gives electronic trading platforms and market information traders and farmers on prices of agricultural produce. Another platform known as KACE (Kenya Agricultural Commodity Exchange), also gives agricultural produce market information via cellullar phone's sms platform and IVR (interactive voice response). IVR enables the usage of the voice mail platform to convey information on agriculture to farmers. KACE's major activities includes connecting farmers and buyers, through the provision of agricultural products market prices daily (Karugu 2011).

Also, in Kenya there is another mobile phone agricultural information dissemination application known as MFarm. MFarm is a market information system, which was established in 2011 to offer daily market prices for 42 crops to Kenyan farmers (Wyche and Steinfield 2016). Through subscribing to, and joining MFarm, farmers use their cell phones to receive and send daily market information (Wyche and Steinfield 2016).

3.6.7 CocoaLink - Ghana

According to USAID (2012), the CocoaLink is a cell phone based platform, which was introduced in Ghana in 2011 to offer social, agricultural and marketing information to cocoa farmers in Western Ghana's 15 communities. This has helped to advance the

incomes and lives of cocoa farmers in Ghana. Cocoa farmers subscribe to CocoaLink to get and exchange realistic information through short message services text and voice messages, with business specialists and other farmers. CocoaLink is accessible to every Ghanaian who owns or have access to a mobile phone, with messages communicated in English or the indigenous language. The connection now has over 4000 registered subscribers, and 95% of these are cocoa farmers.

3.6.8 Mobile phone agricultural initiatives in Zimbabwe

In Zimbabwe, there are also some mobile phone and other ICT-based agricultural information dissemination initiatives.. The available platforms include e-Hurudza, Eco-Farmer, Esoko, Kurima Mari and e-Mkambo.

3.6.8.1 e-Hurudza- Zimbabwe

E-Hurudza is an electronic farm manager platform, which provides agricultural information to farmers. It was developed by a Zimbabwean company to support the Zimbabwean government's land reform programme (Chisita 2010). However, this platform was developed in the laboratory and no groundwork was done (Musungwini 2016). The Department of Agricultural Extension Services (AREX) distributes the e-Hurudza software to farmers and trains them on how to use it. E-Hurudza requires a computer, printer and relevant infrastructure.

3.6.8.2 Eco- Farmer

According to Econet Wireless (2018), EcoFarmer is an e-agriculture service available to Zimbabwean farmers. Established and launched b*y* Econet Wireless in 2013, the service is a weather-indexed natural disaster insurance service that assists Zimbabwean smallholder farmers to acquire insurance cover at eight cents for each day. The eight cents is taken away from the farmers' prepaid cell phone account daily throughout the farming season. This service is available to Econet subscribers and ecocash registered

users only. When a family is completely registered and pays subscriptions on a daily basis, he or she will get:

- Every day's weather information from a weather station connected to his/her field.
- Market and farming tips
- Daily rainfall information
- Weekly best agricultural practices
- Weekly crop information
- Monthly free market pricing requests
- Loan ranking
- Free adverts and marketing relations
- Financial linkages

The Eco-Farmer platform permit farmers to make a monetary claim, if their crops fail due to both excessive or inadequate rain. If there is a drought, farmers get US$100 for each 10kg of seed which was grown. The scheme is an innovative weather inspection network, which allows Econet to know accurately how much rain fell on the farmer's field. This service was popular with smallholder farmers in Mashonaland West Province, improvement areas were identified and are being resolved, so that the programme can be expanded to other provinces.

3.6.8.3 Esoko

Launched by the Zimbabwe Farmers' Union (ZFU) in 2012, Esoko is a mobile platform, which uses the SMS platform to send agricultural information to ZFU member farmers (ZFU 2013). Esoko is currently providing agricultural information on 33 commodities to 17 fresh produce markets across Zimbabwe. Esoko provides its services to over 170,000 smallholder farmers (Odhunze and Hove 2015). Esoko is a for profit platform, which originated from Ghana and is being used in other countries, including Kenya, Uganda, Malawi, Nigeria, Sudan and Mali (NewsDay 2012).

3.6.8.4 Kurima Mari

Kurima Mari is a Shona phrase which means farming for money (Dzenga 2016). This is an agricultural information dissemination platform introduced in Zimbabwe in 2015 to provide information on agricultural production and marketing of agricultural products to assist farmers to expand their profits through agriculture (Dzenga 2016). The Kurima mari platform gives specific information on crops, livestock, tips on markets and links to experts. The platform is a harmonized project of the Ministry of Agriculture and Zimbabwe Livelihoods and Food Security Programme (LFSP), a local non-governmental organisation. It is funded by DFID (the United Kingdom's Department for International Development), and is being put into operation in Mutasa, Makoni, Mutare, Gokwe South, Kwekwe, Shurugwi, Guruve and Mt Darwin districts. It targets smallholder farmers and the platform can only be used on smart phones (Nyakudya 2017). The challenge with the Kurima Mari application is that it can only be accessed on smart phones, which some farmers do not have.

3.6.8.5 e-Mkambo

Mkambo is a Ndebele word for Market, hence e-Mkambo means e-Market (Kabweza 2014). e-Mkambo is a mobile agricultural information dissemination services which was launched in 2012 by Knowledge Transfer Africa (KTA) in partnership with Afrosoft Holdings (Muza 2013). Kabweza (2013) summarises e-Mkambo services as follows:

- getting information regarding the entire products that is sold at the markets through the City Councils, monetising this data and sending this data to financial institutions and farmers, who will use it to identify which crops are on demand or are fetching a lot of money on the markets, so as to provide short term loans to farmers and traders.
- Organising sellers at marketplaces, like Mbare, into clusters to facilitate the acquiring of loans from the banks and use the their clusters as security.
- Providing premium SMS services to farmers with instructions on enhancing their farming practices, marketing intellect, what to produce so as to produce the products which are on demand from buyers.

- Established a call center to compliment the SMS to communicate information back and forth with farmers.

However, the e-Mkambo service is only accessible to farmers who go to markets to sell their produce (Musungwini 2016). This highlights that all other farmers, who do not go to sell their produce to markets, do not have access to this service.

3.7 Challenges to mobile phone and other ICTs usage in agriculture

Challenges refer to any obstruction that deter the execution and the smooth running of a project. For instance, these obstacles may lead to the discontinuation of a project. Whilst ICTs have the capability of improving people's lives in all areas of human growth, there are some barriers that may cause sluggish execution, especially in third world countries. Unless ICTS are implemented effectively, present socio-economic discrepancies such as people's access to vital needs may get worse (Jamwal and Padha 2009). However, in spite of the obstacles, Jamwal and Padha (2009) opine that if ICTs are taken up efficiently, they can enable the empowerment of communities with improved access to knowledge, services and networks. Ali (2012) said that the key obstacles to the successful execution of ICT-based information dissemination services in agriculture consist of: connectivity, funding, infrastructure and equipment, education level, language, content and acceptance by parent organisations and target population, and also shortage of suitable technology. Chauhan (2018) commended that barriers to correct execution of e-agriculture in India consist of:

- Inadequate organisational capability to convey farmers' exact services.
- Inadequate agricultural infrastructure and support facilities
- Lack of knowledge concerning appropriate agricultural methods, amongst farmers.
- Rights problems of the public and government-generated data
- Agricultural content establishment and its upgrade
- Unavailability of general agricultural platforms for farmers in India
  Inadequate utilisation of ICT for agricultural purpose
- Lack of "Agricultural Think-Tanks"

In Zimbabwe, no access to ICTs like personal computer and inadequate access to the internet are the key obstructions towards the production and diffusion of agricultural information, from libraries and research organizations (Mugwisi et al 2014). To be successful in introducing ICT-based information distribution services, it is essential to initially predict the confrontations and the obstacles before execution, and to make sure how such obstacles can be dealt with.

3.7.1 Education level

Education level is the point an individual has reached in education, varying from primary, secondary and tertiary. The education level of respondents is important in data compilation and in adopting to new innovations. The education levels of stakeholders do have either a optimistic or pessimistic function on the acceptance of any new technology. A high level of education positively persuades acceptance and a low level of education negatively influence acceptance (Ali 2012; Franklyn et al. 2012). Ango et al. (2013) establish that high level of education increases one's personal feelings towards innovativeness and change. Okwu, Kaku and Aba (2007) furthermore argue that the degree of education influences a person's understanding, adoption and access of new farming practices. The literacy level of farmers play a important role in their utilisation of cell phones to access farming information, and in navigating through their phones, thus, affecting their mobile phone usage and consequently, the adoption (Okello-Obura, Minishi-Majanja, Cloete and Ikoja-Odongo 2009). Nevertheless, Zimbabwe has a very high literacy level; hence, the education level challenge should not be an obstacle to the use of cell phones by Zimbabwean farmers.

3.7.2 Adoption, funding, cost and technical expertise

Adoption refers to the approval by the main organisation and the end-users of an innovation whereas funding means the financing of all what is needed to sustain a given project. In addition, cost refers to the charge required in establishing an Information and Communication Technology-based services, and technical expertise are the necessary abilities to run and start using the service. In India, Raj (2012) establishment that the

majority of ICT-based agricultural information dissemination platforms were put into operation as testing projects and when the period they were supposed to run as pilot projects expired the projects were discontinued or were put into practice on a small scale. Saravanan (2011) also discovered that efforts to continue pilot projects are in no way taken seriously in most developing countries, as in most cases farmers are reluctant to finance the services as they believe that the state must provide for agricultural extension services. The majority of these projects are financed by donors, and by the time the donor eventually leaves, the organization which will be supposed to implement the project because of lack of funds to continue with the project will simply discontinue the project or operate it at on a small scale basis. The additional problem which may lead to a project discontinuation is inability to persuade end- users to accept the innovation. For an innovation to be accepted by its intended audience it must be prove that it is of greater advantage when it is compared to existing options. Oino, Towett, Kirui and Luvega (2015) assessed the sustainability of projects which were financed by donors in Kenya, and they found that sustainability is a challenge, not only in Kenya, but in most developing countries. Several factors affect sustainability and the factors are simple and complex, internal and external (Oino et al. 2015).

The other blockade is the ICTS' high costs. Franklyn et al. (2012) indicate that the ICTs' soaring costs block the majority of farmers and organisations from executing and using information systems which are ICT-based. Franklyn et al. (2012) propose that governments ought to participate in funding agricultural services which are ICT-based. Easdown and Starasts (2004) note that ICT invention need management, that function at national level where strategic monetary decision are implemented. ICTs are expensive standard for getting information, as they present numerous technological tools which are required before putting in place, and there is need for training intended audience on the use of the new technology (Churi et al. 2012). An additional aspect which is associated with cost is affordability and this also influence acceptance, implementation and use of a new technology. Ango et al. (2013) state that, those farmers who get lesser income do not easily accept and make use of of new farming technologies. Their major reason for adopting being affordability as these farmers are unable to pay the expensive charges

associated with ICT tools, modern machinery and service costs, and they also lack digital literacy expertise. Lack of an understanding of ICT and poor access to Information and Communication Technologies influence the acceptance of ICTs within the agricultural sector (Franklyn et al. 2012).

3.7.3 Infrastructure

Insufficient rural Information and Communication Technology infrastructure hold back the usage of ICTs in the majority of rural communities. For example, the result of a research which was conducted in India by Raj (2012) indicate that, within the three villages where this research was conducted, not a single person had access to the internet had a computer. There are a lot of technological connections which are required to connect the rural population to the internet; such technologies comprise of: functioning telecommunications infrastructure, costly computer software and hardware and Internet Service Provider (ISP) infrastructure (Easdown & Starasts 2004). Terrible infrastructure is another challenge that institutions are facing in the implementation information services which are ICT. Kibet (2011), conducted a research in Kenya, and found that:

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

Cadilhon (2013) made visits to ILRI Water and Food project and CGIAR projects in two districts of Ghana and found that poor infrastructure deter growth in Ghana’s agricultural sector. As a result of poor infrastructure, the connectivity becomes poor, leading to the opening of emails on the internet and responding to these emails taking long. Majority of farmers in these regions own cellular phones, and are able to call traders of agricultural produce to confirm the market prices so that they make informed decisions on when and where to sell their produce.

3.7.4 Connectivity

Experimental research support that Information and Communication Technologies have a productive influence on the improvement of every country (Kuhlmann 2005). On the

other hand, connectivity is one of the causes of inadequate ICT usage (Franklyn et al. 2012), particularly with the rural farming communities. Most of the families in rural communities in the third world nations are do not have electricity; for those who have electricity, power cuts are regular. Due to no electricity or regular power cuts there is no or poor connectivity in most ares. In addition, Purnomo and Lee (2010) argue that broadband price is expensive for people who live in the remote rural communities. This adds to restricted use of Information and Communication Technologies, as broadband connection can be afforded by only a minority. Nevertheless, the International Telecommunication Union (ITU) reports between 2012 and 2017 broadband contributions grew by 20 per cent, with the less developed countries having the utmost growth rate of mobile broadband subscriptions (ITU 2017).

The cell phone network connectivity can also affect the usage of cell phones in information distribution. In Ghana, Cadilhon (2013) found that the at times text messages and phone calls may possibly not go through due to network congestion. Cadilhon (2013) declare 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”.

3.7.5 Language

The vital requirements for growing knowledge and information e-agriculture schemes is investing in making technical agricultural information available in local languages by re-packaging it (Mangstl 2008). While researchers and extension officers are busy transforming research contributions into indigenous languages, Zimbabwe is still faced with scarcity of research materials which is re-packaged into local languages (Mugwisi et al. 2014). Research input customisation and localisation is a difficult task, however, can be improved by using Information and Communication Technologies in agriculture (Raj 2012). Agricultural information need to be re-packaged into indigenous languages, and in appropriate formats. In addition to challenges similar to having no access or restricted access to agricultural information, Zimbabwean farmers also face problems of getting information which is packaged in indigenous languages as the available information is in

English. There is a likelihood that the information which is available in English is not understood by its target audience. Using ICTs to distribute agricultural information can aid in the re-packaging of agricultural information into multi-languages and also improve on the accessibility of information in remote areas.

3.7.6 Age

Research show that age is essential in influencing mobile phone acceptance and usage. In their study, Okel
lo et al (2012) establish that young people take up new technology, without difficulty, more than old people; and that they have a positive attitude to new technology, more than old people. Usage of cell phone in agriculture is contrary linked to age (Okello et al. 2012).

3.8 Chapter Summary

Chapter three reviewed other available researches conducted by other scholars that are similar to the study at hand. Next is chapter four, it elaborates on the study methodology followed for this research.

CHAPTER 4

RESEARCH METHODOLOGY

4.1 Introduction

The previous chapter was the review of literature which is linked to the usage of cell phones in the distribution of agricultural information. This chapter presents the research methodology as well as techniques used in this study. It presents the research paradigm, research design, research approach, research population, and the sampling techniques which were used in the study. It also details the data gathering tools and the data analysis methods used in the study. Ramamurthy (2015:2) defines research, as meticulous and the logical investigation into a specific area, to improve the knowledge of the researcher, to develop a theory, or to revise some facts resulting in the formulation of innovative ways of solving a problem. Research is “a scientific and systematic investigation on a specific topic, to search for pertinent information, in order to establish new facts in a branch of knowledge (Kothari and Garg 2014:1). From both definitions above, it shows that research is consistent and must follow a systematic manner. Walliman (2005:11) states that research comprised three characteristics: systematic, validation and self-correction. Systematic means that research has to be logical and follow some procedures, and cannot be taken haphazardly (Walliman 2005:11). Validation implies that research is empirical and is not divorced from reality, while self-correction implies that research results should be open for criticism and public scrutiny (Walliman 2005:11).

4.2 Research paradigm

A research paradigm is “a way of examining social phenomena from which particular understanding of these phenomena can be gained and explanations attempted” (Saunders, Lewis & Thornhill 2012: 140). The definition implies that a paradigm refers to that standard researchers can follow when they are carrying out research through studying the beliefs and thoughts of human beings. Ngulube (2015) and Saunders, Lewis & Thornhill (2012: 134-137) concur that positivism, pragmatism and interpretivism are some of the known basic research philosophies.

4.2.1 Positivism

Positivism refers to that research paradigm, which is usually used to investigate theories or hypotheses in the physical, natural and social sciences, especially when the research is dealing with large samples and is most suitable for quantitative research (Taylor and Medina 2013). According to Blumberg, Cooper and Schindler (2011:16); and Bryman and Bell (2014:12), positivism opines that universal truth exists in the universe and relies on the supposition that, society is examined by gathering objective facts, society comprises of basic elements to which it can be reduced, the investigator is independent, taking the position of an objective analyst and the society exists externally and is viewed objectively. Another assumption of the positivism paradigm is that, research seeks to come out with true and relevant statements which can be used to explain, describe and understand the situation under study (Creswell and Clark 2011:40). Positivism approach to research is most applicable when one is conducting a research which deals with quantitative data (Creswell and Clark 2011:40).

4.2.2 Interpretivism

Interpretivism advocates that reality is not certain, however, it is formed or created when the external world interacts with people; the investigator is a member of that which is being investigated, research is determined by interests, and common experience can be realised by observing the entirety (Blumberg, Cooper and Schindler 2011:17; Bryman and Bell 2011:12)). The fact that interpretivism research looks at the totality makes it most suitable when one is dealing with research involving a smaller number of participants and aiming at collecting qualitative data.

4.2.3 Pragmatic paradigm

Pragmatism is a research philosophy suitable for societal investigations, disregarding whether one is carrying out a mixed methods, qualitative or quantitative research, but it is most suitable for mixed methods type of research (Morgan 2014). Pragmatism opines that truthfulness can only be regarded as available if it is testable through practice (Gill and Johnson 2010:206).

4.2.4 Research methodologies

Kothari and Garg (2014:4); Madan, Paliwal and Bhardwaj (2011:7) state that research can be approached in two methods that is quantitative approach and qualitative approach. However, Creswell and Clark (2011:2) and Ngulube (2015) assert that there is a third method, the mixed method research (MMR).

4.2.4.1 Quantitative research

Research is said to be quantitative when events are explained basing on statistical data which could have been collected, the statistical data will be in numbers and figures, that can be analysed using mathematical methods (Kothari and Garg 2014:66, Blumberg, Cooper and Schindler 2011:148). In quantitative research numerical data is collected and analysed and the findings also will be in numerical format. Data collection for quantitative research is collected through the use of quantifiable methods of data collection and the format will also be quantitative (Kothari and Garg 2014:66). Quantitative research methodology is most suitable for questions that are capable of being measured or counted (Blumberg, Cooper and Schindler 2011:17). In quantitative research the research questions usually have the intention of answering questions about how many, when and which? That is, information that can be computed (Kothari and Garg 2014:66). Ramamurthy (2015:5) states that quantitative research aims at studying phenomena which need to be articulated in numbers. Quantitative research is normally associated with positivism research philosophy (Ngulube 2015).

4.2.4.2 Qualitative research

Qualitative research is normally suitable for interpretivism research philosophy (Bryman and Bell 2011:386; Ngulube 2015). It is concerned about scrutinising and revealing the profound sense of human behaviour, beliefs, emotions and experiences in order to get a complex, and not general understanding of people's experience and this information cannot be generalised to other similar larger groups (Bryman & Bell 2011:287). Data collection and analysis for qualitative research allows for greater flexibility than in quantitative research; and the data collected in qualitative research is textual data,

which is normally concerned with motives of human behaviour. Qualitative research is often comprised of fewer respondents (Kothari and Garg 2014:3; Cooper and Schindler 2014:147). Ramamurthy (2015:5) states that qualitative research aims at a deeper understanding of phenomena

4.2.4.3 Mixed method research (MMR)

MMR is that type of research that include both quantitative and qualitative research methodologies; one in which, at least, one quantitative and one qualitative data gathering method are used to gather the research data (Creswell and Clark 2011:2).

Positivism research philosophy and quantitative research methodology were followed in this study as the study dealt with a large sample. Positivism is most suitable for social sciences and humanities research. Qualitative studies are mainly based on interpretivism approach while quantitative and mixed methods studies are respectively based on positivism and pragmatism approaches (Ngulube 2015; Creswell and Clark 2011:41). However, qualitative data was also collected, using the same data collection instrument, on questions which requested additional information through the 'other (specify)'. Qualitative data, which was collected through the 'other (specify)' option was able to be converted into quantitative data using content analysis. Qualitative data from the literature review was also considered, and since this data could not be converted into numbers, content analysis was, therefore, used to analyse this data.

4.3 Research Design

Research design refers to "the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure" (Kothari and Garg 2014:29). Blumberg, Cooper and Schindler (2011:152) refer to a research design as the plan and structure that describes the activities necessary for obtaining responses to research questions. This suggests that a research strategy or design presents the general arrangement of how an investigator will carry out the answering of research questions. A research design is, thus, not only the methods of data collection, but also involves the plan of when, why and how there is need of collecting some particular data (Blumberg, Cooper and Schindler 2011:152).

Survey, experiment and case study are the three basic research designs associated with the quantitative research approach (Saunders, Lewis &Thornhill 2012:160; Ngulube 2015)

The study employed the survey plan for the purposes of collecting data. A survey is a study plan which gathers standardised information for every respondent in the sample and it is designed with the intention of answering the who, what, where, how many and how much questions (Saunders, Lewis and Thornhill 2012: 176). A survey was most appropriate for this research. The merits of the survey research, as mentioned by Saunders, Lewis and Thornhill (2012: 177), which made it most suitable for this research are that surveys are economical in data collection, they make data collection from large sample investigations easier mostly through the use of questionnaires. Surveys are also suitable for descriptive research (Kothari and Garg 2014:55). The sample size for this research was large. The gathering of data for studies with large sample sizes is more economical when surveys are used. Data can be easily collected from different respondents in different settings through surveys (Saunders, Lewis and Thornhill 2012:177). In a survey, data is acquired straight from respondents, and the collection of data can be done under any environment. Survey research is the most suitable method for gathering original data from large populations that cannot be directly observed (Babbie 2010:254). A survey also permits for the usage of different data collection techniques and these can be used individually or can be combined. In a survey data collection can be simply and promptly achieved (Saunders, Lewis and Thornhill (2012:177).

4.3.1 Data collection techniques

There are several techniques of data collection that can be applied to survey research. The techniques include: questionnaires, interviews and observations (Babbie 2010:267; Ngulube 2015).

Saunders, Lewis and Thornhill (2012:678) define a questionnaire as an instrument of data collection where by respondents are requested to give answers to a set of some similar questions following a prearranged sequence.

For the purpose of this study, the data collection tool was a questionnaire. To mantain anonymity in this study, it was not obligatory for respondents to divulge their names or identities on the questionnaire, but only on the consent letter that they signed. Questionnaires can include structured or unstructured questions (Singh 2007:69), and may have open-ended questions or closed-ended question or both. Two structured questionnaires were used in this study. One questionnaire was for farmers and the other questionnaire was for network providers and other stakeholders in the agricultural sector.Both questionnaires were generally comprised of closed-ended questions and very few open ended questions. Closed-ended questions are questions where by respondents are restricted to respond to the questionnaire by strictly choosing their answers from the choices which will be available, while open-ended questions are questions where respondents are allowed to give personal view (Adams, Khan & Raeside 2014:123).

Questionnaires are either administered by an interviewer or are self-administered. In this study, for the farmers stratum the researcher administered the questionnaires that is, the researcher would ask the farmers the questions on the questionnaire while recording their responses. Like in a census situation, the researcher acted like an enumerator to ensure that the farmers' responses were from those listed on the questionnaires. For the network providers and other stakeholders stratum the questionnaires were self administered.

The questionnaire method of data collection was used in this study due to is merits which were listed by Kothari and Garg (2014:96) as: a cheap method of data collection, gives room for dealing with respondent individually, permits for the answering of questions by respondents independently at the respondent's convenience, and is a reliable method of data collection for large samples

4.4 Research population

A research population refers to a group of individuals, or the entire items or the target audience from which data is collected by an investigator by studying one or more its samples (Saunders, Lewis and Thornhill 2012: 680; Babbie 2010:199). A Research population is thus, a set of persons or items from which samples are taken for data collection purposes.

Hayes (2011) stated that a research populace comprises of two categories namely: the accessible population and the target or research population. The research or target population is a totality of the subjects who can help in the answering of the questions of the research at hand and those are the subjects the researcher have an interest in. The accessible population is the total number of subjects which is available for the study at hand. Which is in most cases a systematic detachment of the research or target population. The accessible population is the population researchers mostly work with as in most cases it is not possible to carry out a study on the actual population. This is only made possible through sampling. All farmers and all network providers and other agricultural stakeholders in Mashonaland West Province was the target population for this study. The research targeted farmers practising different farming activities, which included crop production, livestock production and horticulture.

4.5 Sample and sampling procedures and methods

Sampling is “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 and Garg 2014:147). Ramamurthy (2015:84) agrees with Kothari and Garg (2014:147) that sampling refers to the choosing of a small number of items from the target population to symbolize that target population so that a study could be carried out. Ramamurthy (2015:84) added that sampling is necessary when carrying out a study which has a large research population. Kothari and Garg (2014:147) assert that in quantitative research it is necessary to use sampling and samples because samples and sampling have the following merits:

- They are inexpensive as they save both money and time save time by investigating a part of the target population than the whole research population;
- It is more sensible to gather data from a sample than from the whole population.
- They are quicker in the gathering of data as data is gathered from a part of the target population;
- They generate much correct results because lesser figures permit for classic field investigations;
- The use of a sample is the best way if the research population is unlimited.

4.5.1 Sampling methods

Probability and and non-probability sampling are the two basic methods of sampling (Kothari and Garg 2014:55-56; Doane & Seward 2010:36; Babbie 2010:191). Non-probability sampling is that sampling method whereby the possibility of selecting an individual is not known (Saunders, Lewis & Thornhill 2012:677; Babbie 2010:196); while in probability sampling, all units of a sample has the same chances of being chosen and the probability of choosing a member can be calculated. Probability sampling was used in this study, hence, that every member of the population had similar chances of being chosen.

The major probability sampling methods according to Babbie (2010:211); Kothari and Garg (2014:173)) are:

- simple random sampling,
- systematic sampling,
- cluster/area sampling
- stratified sampling,
- multi-stage sampling,
- replicated sampling
- sequential sampling

Simple random and stratified sampling were the sampling methods used in this study. Stratified sampling is that sampling method where the population under study is separated into subsets referred to as strata, whereby in each stratum there will be great homogeneity (Babbie 2010; 215) or the population under study will be separated into mutually exclusive and mutually exhaustive subdivisions (Singh 2007:104). Individuals or units are subsequently chosen from each stratum by the means of simple random sampling to come out with a sample. The advantages of stratified sampling are that it enables the production of separate results for each division and enables the provision of results which can be compared between strata (Singh 2007:104). Stratified sampling results are dependable as they provide information which is detailed, with reduced sampling errors (Singh 2007:104). This study used stratified sampling to categorize the whole research population into five strata namely:

- Farmers in Communal Areas
- Farmers in Resettlement Areas
- Small Scale Commercial Farmers (SSCF)
- Large Scale Commercial Farmers (LSCF)
- Network providers and other stakeholders

Proportionate stratified sampling based on the population sizes of each stratum was, thereafter, used to come up with the number of respondents to represent each stratum. Proportionate stratified sampling is a probability sampling method in which the number of elements chosen to represent a stratum is proportionate to the number of elements in each stratum (Oxford Reference 2018). This means that the bigger the population size in a stratum, the more the elements to represent that stratum. Lastly, simple random sampling was used for choosing groups of individuals to represent each stratum.

Simple random sampling refers to the probability sampling process that provides each individual or item in the target population the same chances of being chosen (Daniel 2012). Simple random sampling have the following advantages:

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

4.5.2 Sample Size

A sample size, according to Ramamurthy (2015:86) “refers to the number of items in a sample” and a sample is defined as the subset of the population under study. A sample is taken from the available population being studied. It is a fraction of the entire set of units that an investigator will study to get information regarding the entire group. Ramamurthy (2015:86) notes that a sample size ought not to be too big or too small. And to achieve a neither too big nor too small sample, Ramamurthy (2015:87) suggests that before selecting a sample size the following should be considered:

- Flexibility: meaning the sample size should give room for changes if need arises.
- Population variance: this is the variation in the characteristics of the population to be studied. The population could be either highly diverse or less diverse. The higher the diversity, the larger the sample; so that all the characteristics of the population will be represented.

For this study, there were five strata in the sample. Samples for each stratum of the farmers were selected from four districts of the province. To select the districts to take samples from, population sizes of the districts were considered, and the four districts with the highest populations were selected. For the network providers and other stakeholders, stratum samples were taken from Chinhoyi district, which is the Provincial Capital. Hence, only five districts out of the 13 were chosen to represent farmers in the entire province, this was done to limit travelling for data collection purposes due to the

limited funds available to cater for travelling costs. Table 4.1 below shows the population sizes for all the districts in Mashonaland West province:

Table 4.1 District population sizes Mashonaland West Province

District	Population Size
Chegutu Rural	153 655
Chegutu Urban	50 590
Chinhoyi	77 929
Hurungwe	329 197
Kadoma	92 469
Kariba Rural	41 369
Kariba Urban	26 451
Karoi	28 606
Makonde	153 540
Mhondoro-Ngezi	104 342
Norton	67 591
Sanyati	112 897
Zvimba	263 020
Total	**1 501 656**

Source: ZimStat 2012 (Population Census 2012)

The four districts with the highest population sizes are Hurungwe, Zvimba, Chegutu Rural and Makonde. Samples for the farmers for this research were taken from these four districts. To select districts to take samples for the farmers' strata, the four districts with the highest populations were selected; urban districts were not selected due to less agricultural activities and small population. The four selected districts are not close to each other, confirming that there was an even representation of the province in the sample.

To come up with a sample size proportionate sampling, according to the population, sizes of each stratum was used. According to ZimStat (2017) the total number of own

account workers in agriculture in Zimbabwe is 2 918 762 and 11.1% of these are based in Mashonaland West province. This indicates that there are 323 983 farmers in Mashonaland West. 323 983 was the research target population. Fraenkel and Wallen (2000) state that the minimum elements for a research sample vary according to the type of research being carried out. Fraenkel and Wallen (2000) further assert that for a correlation descriptive research, the sample should have a minimum of a 100 elements; for a descriptive causal comparative research, there should be a minimum of 30 elements; and for research to determine the existence of relationships, a minimum of 50 elements should be maintained. Table 4.2 shows the population size of each stratum.

Table 4.2. Stratum population sizes for farmers

Stratum	**Population Size**
Resettlement Areas	690 429
Communal Areas	439 687
Small Scale Commercial Areas	60 118
Large Scale Commercial Areas	47 436
Total	**1 237 670**

(ZimStat 2017).

To come up with the sample size for this research, from the target population, Krejcie and Morgan (1970) table for determining sample size of a known population was used. Krejcie and Morgan (1970) note that as the population increases, the sample sizes also increases, but at a diminishing rate and then remains constant after slightly reaching more than 380 elements. The target population for this research was 323 983 hence a sample size of 384 elements was selected based on Krejcie and Morgan (1970)‘s table. The table below shows Krejcie and Morgan (1970)’s table for determining sample sizes for a known population.

Table 4.3 Table for determining sample size from a given population

N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	341
20	19	120	92	300	169	900	269	3500	246
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	351
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	181	1200	291	6000	361
45	40	180	118	400	196	1300	297	7000	364
50	44	190	123	420	201	1400	302	8000	367
55	48	200	127	440	205	1500	306	9000	368
60	52	210	132	460	210	1600	310	10000	373
65	56	220	136	480	214	1700	313	15000	375
70	59	230	140	500	217	1800	317	20000	377
75	63	240	144	550	225	1900	320	30000	379
80	66	250	148	600	234	2000	322	40000	380
85	70	260	152	650	242	2200	327	50000	381
90	73	270	155	700	248	2400	331	75000	382
95	76	270	159	750	256	2600	335	100000	384

(Source: Krejcie and Morgan, 1970)

Using the population sizes in each stratum and the total number of farmers in the province the ratios for the total number of farmers in each stratum were calculated mathematically:

Resettlement Areas – 690 429/1 237 670 x 323 983=180 732.553

Communal Areas – 439 687/1 237 670 x 323 983 = 115 096.199

SSCA – 60 118/1 237 670 x 323 983 = 15 736.997

LSCA – 47 436/1 237 670 x 323 983 = 12 417.249

After calculating the sum of farmers in every stratum, the sum of elements to represent each stratum in the sample was also proportionally and mathematically calculated as below:

Resettlement Areas – 180 732.553/323 983 x 384 = 214.213

Communal Areas – 115 096.199/323 983 x 384 = 136.417

SSCA – 15 736.997/323 983 x 384 = 18.652

LSCA – 47 436/1 237 670 x 323 983 = 12 417.249/323 983 x 384 =14.717

Table 4.4 shows the number of respondents in the sample for each stratum.

Table 4.4. Number of elements in the sample per stratum

Stratum	**Number of Elements**
Resettlement Areas	214
Communal Areas	136
SSCA	19
LSCA	15
Total Sample Size	**384**

4.6 Data collection procedures and methods

In a research, either primary or secondary data can be used. Primary data refers to data which is gathered specifically for the study at hand, while secondary data refers to data that is already organized, is available in published sources and was gathered for other purposes and not specifically for the study at hand (Saunders, Lewis and Thornhill 2012:304). Primary data is data which is gathered by a researcher, in order to investigate the current problem. Both primary and secondary data were used used in this study. Primary data came from the data which was collected through the survey and secondary data came from the literature review.

4.6.1 Data collection procedure

Data collection was done in 20 days from 10th – 29th January 2019. The researcher collected all the data. A minimum of two days, and a maximum of 4 days was spend in a district. Primary data was collected from farmers using an interviewer administered questionnaire. Also, primary data was collected from network providers and other stakeholders, using a separate self-administered questionnaire. For farmers, the researcher would ask each respondent individually the questions in the questionnaire while recording their responses.

4.7 Data analysis

The collected data was analysed, in order to interpret and make meaningful information out of the data. Analysis of data assists the researcher to know the research position and the connection among the research variables, and to find answer to the research problem and questions so as to draw conclusions and propose recommendations.

4.7.1 Data analysis procedure

SPSS (the statistical package for the social sciences) software was used to analyse data for this research. This was used to indicate the proper statistical measures like percentages and frequencies. Tables and graphs were used for data presentation. Content analysis was used to analyse data from the few open-ended responses generated from the 'other (specify)' options in the questionnaires and the secondary data from the literature review..

4.8 Validity and reliability

Research excellence is calculated through its validity and reliability. Research is said to be valid and reliable if the findings can be repeated and the conclusions are true (Connaway & Powell 2010:60).

Validity is the level to which a measuring instrument correctly measures what it is designed to measure, and gives the correct answer; while reliability is the level of uniformity and stability to which a measurement process gives similar responses if repeated (Kumar 2014:214; Bryman and Bell 2011;36). In a nutshell, validity relies on

the correctness and appropriateness of the data collection and data analysis tools and it helps a researcher to come up with relevant conclusions from the data collected.

Reliability is dependable on the possibility of getting the similar results, if an identical measurement procedure is done again in a similar study. Kumar (2014:214) states that in quantitative research there are three kinds of validity, that is: face and content validity, concurrent and predictive validity, and construct validity.

Face and content validity is the judgment that a measuring tool is measuring what it is supposed to measure considering the reasonable connection between the research study objectives and the research questions (Kumar 2014:214). This demands that each study objective must be aligned to at least one research question (Kumar 2014:214). Concurrent and predictive validity are measured by the level at which a measuring tool can predict the results and how well the the measuring tool can compare with the results of a second assessment, if the assessment is repeated (Kumar 2014:215). Kumar (2014:215) orate that “construct validity is an indication of the quality of a research instrument to measure what it is supposed to measure”.

Lincoln and Guba as cited in Bryman and Bell (2011:44); and Kumar (2014:219) opine that the goodness or quality in qualitative research is judged by its trustworthiness and authenticity. Trustworthiness consists of credibility, transferability, dependability and confirmability (Bryman & Bell 2011:44; Kumar 2014:219).

Credibility is ensuring that research results are believable, transferability is ensuring that the research findings can relate to other situations. Dependability is assessing whether the research results can apply at other times, and confirmability is the degree at which the researcher has allowed his/her values to intrude to a high level (Bryman and Bell 2011:45).

The validity and reliability of this research was established by the following measures: The questionnaires were first sent for verification by the project supervisors. After verification, a pilot survey was conducted with a sample of 20 respondents taken from Chinhoyi district, which is Mashonaland West Province’s capital. This was for the

farmers' questionnaire. Chinhoyi district was not part of the farmers' accessible population. For the Network providers and other stakeholders, samples were taken from Makonde District which was also not part of the accessible population for the Network providers and other stakeholders category. This enabled for the data collection instruments (questionnaires) pretesting. Shortcomings of the questionnaires were noted and then attended to. The questionnaires were then send to the project supervisors for final verification.

4.9 Summary

The research methodology chapter talked about the approaches and design of the study. It as well addressed the sampling techniques, data collection procedures, the research instruments, data analysis procedures, the validity and reliability instruments used in this study. The next chapter is a presentation of the research findings.

CHAPTER FIVE

DATA PRESENTATION, INTERPRETATION AND DISCUSSION

5.1 Introduction

This study's purpose was to explore the use of mobile phones in disseminating agricultural information to farmers in Zimbabwe's Mashonaland West Province, with the intention of improving on the gap created by the available initiatives. The preceding chapter covered the study's methodology. The present chapter gives the findings of the research, which are informed by the collected data. The chapter begins with the description of respondents followed by the presentation, interpretation and discussion processes. Graphs, tables and subjects are used to illustrate, interpret and discuss collected data. Discussion of findings is supported by literature, as discussed in the previous chapters, as well as from theoretical frameworks. The summary concludes the chapter.

Data was collected from the four districts which had the highest populations. These districts were Chegutu, Hurungwe, Makonde and Zvimba. A sample of 384 was taken to represent all the farmers in Mashonaland West. This had a 100% response rate. Two diverse questionnaires were administered, one for farmers and the other for other agricultural stakeholders and network providers. The questionnaire for other agricultural stakeholders and network providers had questions, which were compulsory for all respondents then a section which was supposed to be respondent to by network providers only. The findings are presented and discussed in two parts; with section 5.2. covering data collected from the farmers' questionnaires, while section 5.3 covers data collected from network providers and other stakeholders. In both sections, data is presented and discussed according to the sequence of the questions.

5.2. Data presentation, interpretation and discussion of responses from farmers' group

This section presents, interprets and discuses the findings of the research from the data gathered from the farmers.

5.2.1. Respondents' demographic information

The first part presents the demographic information of the people who took part in the survey. Demographic information of respondents was not mentioned in the objectives of the study; however, it was important to gather such information as this helped the investigator to have an understanding of the background characteristics of the target population. Respondents were required to specify their location, sex, age group and education level. In this research, the district of each respondent was recorded to ensure that respondents were from the target population group. Gender was also important as it helps to establish which group of people is mostly into farming. Age range was also recorded to establish the average age that mostly populates the farming community of the province. Education level was significant in that it helps to define information needs, channels, sources and formats. Also, some degree of literacy is necessary for one to be capable of using the mobile phone technology.

5.2.2 Respondents distribution by district

Table 5.1 illustrates the groups of respondents by district. This shows the total number of farmers who participated in this research and the percentage of each district compared to other districts in the sample.

Table 5.1: Survey participants by district

District	Frequency	Percent
Chegutu	66	17.2
Hurungwe	141	36.7
Makonde	65	16.9
Zvimba	112	29.2
Total	**384**	**100**

The respondents were taken from the four districts of Mashonaland West Province. The district with the highest population had the highest number of participants, and the one with the lowest population had the least number of participants. Hurungwe, with 141 (36.7%) respondents had the highest number followed by Zvimba district with 112 (29.2%), Chegutu district had 66 (17.2%) respondents, and Makonde had the least number of respondents which was 65 (16.9%) of the total respondents.

5.2.3 Survey respondents by gender

Table 5.2 presents the study participants by gender. Three hundred and two males participated in the survey and this was 78.6% of the total respondents while 82 (21.4%) females participated in the survey.

Table 5.2 Survey participants by gender

Gender	Frequency	Percent
Male	302	78.6
Female	82	21.4
Total	**384**	**100.0**

The findings revealed that generally, men dominate farming activities in Mashonaland West Province of Zimbabwe. These findings agree with those of Salau and Saingbe (2008) they highlighted that, in Nasarawa State, men are in the forefront when it comes

to do with issues related to research in agriculture. Ango et al (2013) reports that in Nigeria agriculture is in most cases done by men in Nigeria. Takawira (2018) adds that in Zimbabwe during the land reform programme, just 10% of the land was given to women, and this was due to cultural practices where land is accessible to woman through a patrilineal line. This may explain the reason why this study revealed a less female representation in this study. However, this finding contradicts with Manjengwa and Mazhawidza (2009) who established that in Zimbabwe approximately women constitute 86% of those involved in agriculture with land being the main source of women's livelihood. However, data collection for this research was done at AGRITEX district offices, where the researcher used convenience sampling by waiting for farmers as they came out of their offices for other agricultural services and asked them to respond to the questionnaire. The fact that female respondents were few could have been because most women stayed at home, at the particular time, to do their family daily duties whilst men travelled to the offices to get agricultural inputs and do other farming consultation with extension officers.

FAO (2011) mentions a range of investigations done in Africa that showed that gender inequalities have negative impact on agricultural production, mainly due to discrepancies in access to land and agricultural inputs between men and women. Nigeria, for example, 14 percent of males have access to formal agricultural inputs credit loans while just 5 percent females can acquire that same official credit loans. In Kenya, only 4 percent females can access agricultural loans, while 14 percent males have access to the same loans. Saito, Mekonnen and Spurling (as cited in FAO 2011). In Uganda, women receive only one percent of available credit while men receive the remainder (Dolan, 2004). In Uganda also, female-headed families said that they were eager to develop their farming engagements, however, they indicated lack of access to loans as the barrier to livelihood diversification (Ellis, Manuel & Blackden, 2006). Women's maize yields in Malawi were 19% lower than those of their male counter parts, while in Osun State Nigeria, women's rice harvests were 66% lesser than men's and all this was attributed to land access and inputs distribution, with men having more access to land and inputs than women (FAO 2011).

Studies in Kenya have found that men producing maize, cowpeas and beans get higher yields per hectare than women producing the same Saito, Mekonnen and Spurling (as cited in FAO 2011). In Western Kenya, Alene et al. (as cited in FAO 2011) found that those households which were being led by women had 23% lesser farming yields than the households which were being led by men. Ongaro (as cited in FAO 2011) also found that in Western Kenya the maize yields of women smallholder farmers were 16% lower than those of their male counter-parts. All these differences in Kenya were attributed to female farmers having lesser admission to land, farming inputs, and having lower education levels.

5.2.4 Farmers' age groups

The farmers were asked to specify their age groups and the responses are shown in table 5.3. From the 384 farmers who participated in the survey, 8 (2.1%) were in the 18-30 years range while 37 (9.6%) were in the 31-40 years age range, 50 (13%) in the 41-50 age range and 289 (75.3%) were in the 51 and above age range. The results are shown in Table 5.3 below.

Table 5.3 Age range in years

Age	Frequency	Percent
18-30	8	2.1
31-40	37	9.6
41-50	50	13
51 and above	289	75.3
Total	**384**	**100**

The findings indicate that the majority 289 (75.3%) of farmers were above 51 years which is the middle-aged group. Several studies established that age has a contribution in the accessibility of agricultural information. in support of this, Salau & Saingbe (2008); Ango et al (2013) report that the young and middle-aged people can easily adopt and utilise

new technologies, in-contrast with the aged people. Okello et al (2012) affirmed that usage of cell phone in farming is contrary associated with age.

5.2.5 Education level by farm type

The question sought to ascertain the respondents' highest level of education and table 5.4 shows the results. The findings show that 188 (49%) attained secondary school level, 118 (31%) tertiary level, 40 (10%) university level, 26 (7%) primary level, and 12 (3%) vocational training level. The findings show that every farmer in the survey had attained some level of education with the majority having reached at least secondary school level.

Table 5.4 Highest level of education and farm type

Highest level of education	Farm Type						Total
	Communal area	Resettlement	Small-scale commercial area	Large scale commercial area	A1	A2	
Primary	16	0	0	0	10	0	**26**
Secondary	117	36	0	0	28	7	**188**
Tertiary	0	22	19	15	39	23	**118**
University	0	0	0	0	33	7	**40**
VCT	3	0	0	0	9	0	**12**
Total	**136**	**58**	**19**	**15**	**119**	**37**	**384**

The level of education was of importance in the study as it helped in justifying respondents' information seeking behaviour, information sources and channels. Age and educational level are of importance to technological literacy, with studies affirming that the middle-aged, the youth and the educated have positive attitude to change and can adopt and utilise new technologies faster than the aged and the illiterate (Salau & Saingbe, 2008; Ango *et al* 2013).

According to Rogers (2003:24) one of the five phases of the individual adoption procedure is knowledge. During the knowledge period, a person gains knowledge of and searches for information about an innovation; the main questions at this stage are what new idea is, why and how it works (Rogers 2003:21). Individuals' education or literacy levels positively impact on the adoption of new innovations (Ali 2012; Franklyn et al. 2012 & Ango et al. 2013). This high degree of education explains that illiteracy can never be a barrier to the usage of cellular phones by farmers in Mashonaland West Province, as the farmers are literate.

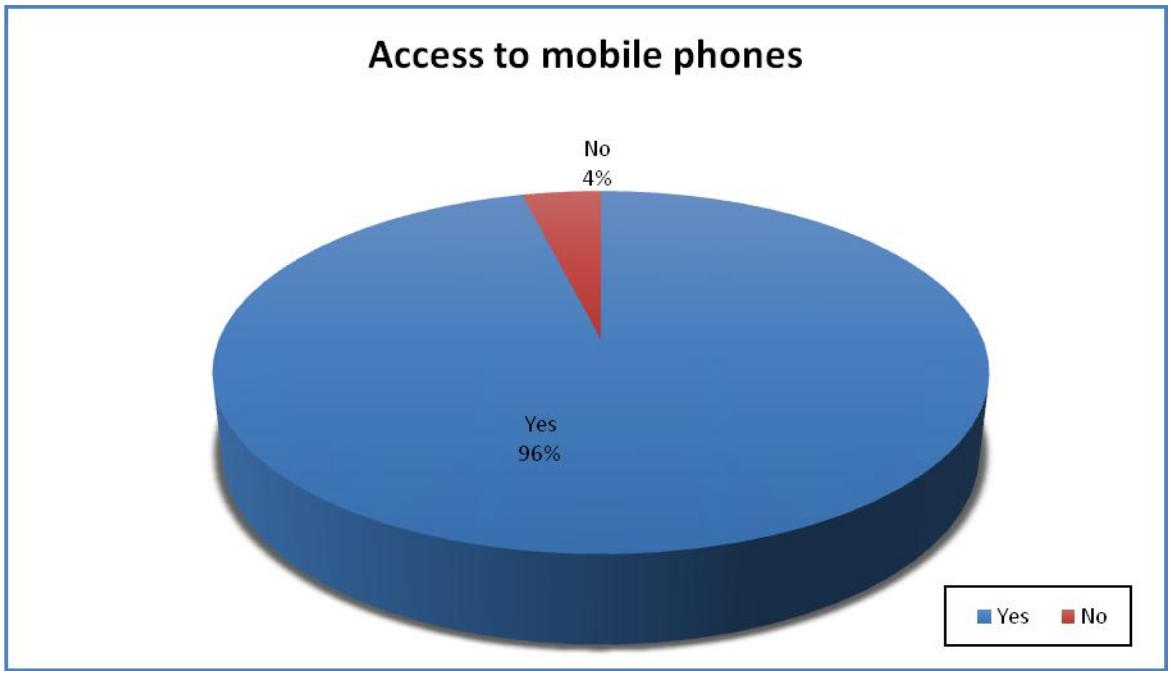
5.2.6 Mobile phone access and use for agricultural information

This part illustrate the findings of the study concerning the mobile phone access by farmers and the usage of the mobile phones in accessing agricultural information.

5.2.6.1 Mobile phone access

It was inquired if respondents have any access to cell phone. Figure 5.1 illustrates that 96% (369) of the population indicated that they have access to a cell phone while 4% (15) mentioned that they had no access to a cell phone.

Figure 5.1 Mobile phone accesses



The 96% access rate was a clear demonstration that the province has a high mobile access rate. This has a positive impact on the possibility that most of the are capable of using cell phones to get agricultural information. In a study in Nigeria in a research on the utilisation of cell phones in agriculture, 98.7% of those who took part in the study were reported to have access to mobile phones (Asa & Uwen 2017).

5.2.6.2 Mobile phone ownership

This question aimed at ascertaining that respondents own mobile phones. Table 5.5 and Table 5.6 show the results. This is shown by frequencies and by gender respectively. Eighty-one percent (311) of the farmers owned mobile phones while 19% (73) did not possess cell phones.

Table 5.5 Mobile phone ownership

Own mobile phone	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	311	81.00		
No	73	19.00		
Total	384	100		

Table 5.5 demonstrates that out of the 311 (81%) respondents with mobile phones, 262 (68.2%) were males and 49 (12.8%) were females. The study is on the use of mobile phone and the results indicate that although 81% (311) respondents owned such devices, yet 96% (369) had access to mobile phones.

The results therefore show that although some respondents did not own phones, they were able to access these gadgets from other sources. The study did not, however, prompt this question further.

Table 5.6 Mobile phone ownership by gender

Own mobile phone	Gender of respondent		Total
	Male	Female	
Yes	262 (68.2%)	49 (12.8%)	311 (81%)
No	40 (10.4%)	33 (8.6%)	73 (19%)
Total	**302 (78.6%)**	**82 (21.4%)**	**384 (100%)**

The response concurs with a study in Nigeria regarding the utilisation of cell phones in agriculture in which 98.7% (148) of the respondents had access to mobile phones with 90.5% (134) were mobile phone owners (Asa & Uwen 2017). In Ethiopia on a study on mobile phones and farmers' decisions on marketing of their produce, there was a high

usage of cell phones in Ethiopia's rural communities, with all the study areas having a cell phone coverage, and half of the families owning one cell phone at least (Tadesse and Bahiigwa 2015)..

5.2.6.3 Phone type

Respondents who specified that they own mobile phones were asked the type of phone they possessed; that is, smart or ordinary phone. Table 5.7 shows that of the 311 (81%) respondents who own mobile phones, 209 (54%) males and 21 (6%) females have smart phones, while 53 (14%) males and 28 (7%) females have ordinary phones. POTRAZ (2017) reported that the mobile phone penetration rate for Zimbabwe increased from 97% in the second quarter of 2017 to 100.5% in the third quarter.

Table 5.7 Phone Type

Gender	**Type of phone**				
	No Phone	Smart phone	Ordinary phone		
Male	40 (10.4%)	209 (54.4%)	53 (12.8%)	302	78.6%
Female	33 (8.6%)	21 (5.5%)	28 (7.3%)	82	21.4%
Total	**73 (19%)**	**230 (60%)**	**81 (21%)**	**384**	**(100%)**

The study revealed that Mashonaland West Province, besides having many farmers who own and have access to mobile phones, has a high rate of those who own smart phones. This is an indication that mobile phones applications, which require the use of smart phones, have a high rate of adoption, given that 230 (60%) of the respondents had smart phones.

5.2.6.4 Internet Access

Respondents with mobile phones were asked whether they had access to the internet on their phones and Table 5.8 shows the results.

Table 5.8 Internet Access

	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	211	67.8	67.8	67.8
No	100	32.2	32.2	100.0
Total	**311**	**100.0**	**100.0**	

Responses showed that 211 (67.8%) participants had access to the internet while 100 (32.2%) said they did not have access to the internet. However, lack of access to the internet on smart phones was not seen as obstacles to the dissemination of information through mobile phones because farmers could still access information via SMS on any mobile phone type.

5.2.6.5 Mobile Network subscription

This question intended to establish the network(s) to which respondents subscribe. Table 5.9 gives the names of the networks the farmers who own mobile phones subscribed to.

Table 5.9 Mobile Network subscription

Network Provider	Frequency	Percent
Econet	273	87.8
Netone	209	67.2
Telecel	84	27
Total	**566**	**182.0**

***multiple responses generated**

The question allowed for multiple responses. The results revealed that 273 (87.8%) farmers subscribe to Econet, 209 (67.2%) to NetOne and 84 (27%) to Telecel and the total adds up to 566 subscribers. This shows that some respondents subscribed to more than one mobile network. The results agree with POTRAZ's (2018) second quarter report that Zimbabwe has a high mobile penetration rate. POTRAZ (2018) reports that a total of 12,152,471 people that is 87.7% of the total population of Zimbabwe were active mobile network subscribers, with Econet having a market share of 65.8%, NetOne 23.9% and Telecel 10.3%. The rate of mobile network subscribers had increased by 3.1% when compared to the first quarter of 2018 (POTRAZ 2018).

5.2.6.6 Network service provision perception

The perception of farmers on the service provision by network providers was also measured. Table 5.10 illustrates the farmers' perception on the network providers' service.

Table 5.10 Network service provision perception among farmers

Network Service	Frequency	Percent
Excellent	0	0
Very Good	9	2.9
Good	249	80.1
Bad	46	14.8
Very Bad	7	2.2
Total	**311**	**100**

Responses indicated that 249 (80.1%) mentioned that the network reception was good, while 9(2.9%) indicated that it was very good; 53 (17%) indicated that network provision was bad to very bad. The findings from the farmers concurred with the findings from the network providers (as indicated in 5.3.12) that at least 75% of the province had network coverage, regardless of poor connectivity in some areas. As indicated in previous chapters, empirical studies confirmed that poor connectivity and poor infrastructure are

the major obstacles to the use of ICTs in agriculture (Kuhlmann 2005; Kibet 2011; Franklyn et al. 2012 & Cadilhon 2013). However, the findings of this study confirmed that the province's network coverage was good, as only a smaller percentage (17) indicated that it was bad to very bad.

5.2.6.7 Other ICT tools and their uses

Participants were requested to indicate other ICT tools, besides the mobile phone, which they have access to and what they use them for. Table 5.11 shows the results.

Table 5.11 Other ICT tools and their uses

ICT Tool	Frequency	Percent
Computer/Laptop	104	27.1
Radio	323	84.1
Television	196	51
Camera	4	1
None	61	15.9

***Table indicates multiple responses**

The other ICT tools which were mentioned were the radio, which had the highest number of respondents 323 (84.1%), followed by the television with 196 (51%) respondents. This concurred with Abdi, Jacob and Chesambu (2017), who also found that vegetable farmers in Kenya were mostly getting information through the radio and the television. Other tools which were mentioned in the current study were desktop computers/laptops 104 (27.1%) and digital cameras 4 (1%). Sixty-one respondents responded that they had no access to other ICT tools. Respondents highlighted that they use computers and laptops to keep personal information, for work assignments, accessing the internet and playing games. They used cameras to take and store pictures, radio and televisions were used for entertainment and getting access to the news. The findings agreed with Bell and Payne as cited in FAO (2017) that the radio,

television, the cell phones, computers and the internet are the major ICT options for transmitting agricultural information.

ICTs in agriculture have a significant function in agriculture as they allow for the reaching of a large audience, community mobilisation, easy transmission of information, networking, easy access to information and minimisation of paperwork in record keeping (Isife, Nnodim & Albert 2013). The other benefits of using ICTs in agriculture are: farmers can make informed decisions, get improved quantity and quality of agricultural products, spend minimum costs on information generation, dissemination and access, and easier and faster access to markets (Namisiko & Aballo 2013; Ommani & Chizari 2008; Chukwunonso et al. 2012).

5.2.6.8 Uses of mobile phones

This question aimed at establishing what the farmers were using their mobile phones for. Table 5.12 illustrates the findings.

Table 5.12 Uses of mobile phones by farmers

Use	Frequency	Percent
Making and receiving calls	366	95.3
Making and receiving SMS	366	95.3
Playing games	141	36.7
Internet access	183	47.7
Other	76	19.8

*Table indicate multiple responses

Three hundred and sixty-six (95.3%) of the farmers responded that they use phones for making and receiving calls and messages, 141 (36.7%) said they also use their phones to play games, 183 (47.7%) and 76 (19.8%) use mobile phones to access the internet and other uses respectively. The other uses which were mentioned by farmers included

the use of social media platforms like Facebook, WhatsApp, Twitter and Instagram. Three hundred and eleven (81%) respondents indicated that they own mobile phones; however, section 5.3.1 shows that 96% (369) respondents have access to mobile phones, which suggests that individuals who do not own mobile phones use other farmers' mobile phones to make calls, receive call, send SMS and receive SMS.

These findings agreed with other studies carried out in another place that farmers use their cell phones for other uses. Masuka et al (2016) established that Zimbabwe's small-scale farmers were utilize their cell phones to access the internet, WhatsApp, Facebook and Twitter. The fact that farmers were already using mobile phones to search the internet and to share information can be an indication that the use of mobile phones for agricultural information sharing can be an easy task for farmers.

5.2.6.9 Access to agricultural information on mobile phone

Farmers were asked whether they receive agricultural information on their mobile phones. Table 5.13 shows their responses.

Table 5.13 Access to agricultural information on mobile phone

Access		**Frequency**	**Percent**
	Yes	134	43.1
	No	177	56.9
	Total	**311**	**100.0**

Of the 311 farmers who said they had mobile phones, 134 (43.1%) responded that they were receiving agricultural information on their mobile phones and 177 (56.9%) said they were not receiving information on agriculture through their cell phones. For those who indicated that were receiving agricultural information on their mobile phones, the researcher noted that the majority were receiving this information through farming WhatsApp groups. Table 5.9 showed that there were 273 (87.8%) Econet subscribers, however there were only 134 respondents who said they were receiving agricultural

information through their mobile phones, which shows that regardless of subscribing to Econet, farmers were not subscribing to the Eco-Farmer platform, Econet's agricultural information dissemination platform. Econet frequently sends all Econet subscribers SMS asking them to subscribe to the Eco-Farmer platform, but the results of this study show that few farmers are subscribing to Eco-Farmer.

Scholarly information has revealed that the ICT's cell phone application is the ICT application which was mostly adopted by farmers to share agricultural information, as they are handy in handling, they provide economic advantages and enhance the social status of users (Aker and Mbiti 2010). In India, RML uses the mobile phone SMS platform to transmit agricultural information packaged in local languages through the use of all mobile handsets to over one million registered farmers on a daily basis (Samhita 2012).

In Senegal, Xam Marse uses the mobile phone SMS platform to disseminate information on agricultural produce prices to both producers and buyers of agricultural products (Rashid & Elder 2009). In Kenya, NALEP, KACE and MFarm use both the mobile phone SMS and voice applications to deliver market information for agricultural products to farmers and buyers (NAFIS n.d; Karugu 2011 & Wyche and Steinfield 2016). In Zimbabwe, there are platforms like Eco-Farmer, Kurima Mari, Esoko and eMkambo which use cell phones to distribute agricultural information to different farming groups.

5.2.6.10 Interest in accessing agricultural information on mobile phone

Respondents who responded that were not receiving agricultural information on their mobile phones were asked to indicate whether they have interest in receiving agricultural information on their mobile phones or were not interested. Table 5.14 shows the results.

Table 5.14 Interest in accessing agricultural information on mobile phone

Interested	Frequency	Percent
Yes	175	98.9
No	2	1.1
Total	**177**	**100.0**

Out of the 177 respondents who indicated that were not receiving agricultural information though cell phones, 175 (99%) showed that they have an interest in receiving agricultural information on their phones. This is an indication that farmers are very excited about receiving agricultural information through cell phones. However, they are not receiving this information because they are not aware of the available platforms or are not able to pay the subscriptions. Table 5.16 demonstrated that the majority of farmers 186 (48.4%) were unaware of the available mobile phone information dissemination platforms and in table 5.17, farmers cited high cost of mobile phone data 277 (72%) as the main barrier to mobile phone usage in agriculture. These findings agree with Wyche and Steinfield (2015), who found affordability as an obstacle to the usage of cell phones by farmers, for according to them, the farmers maintained very little or no credit in their phones. In a similar study Islam and Grönlund (2011),, found that 65% of the respondents were willing to receive agricultural information through their cell phones, 22% were not willing and 135 were undecided.

5.2.6.11 Current information being received through mobile phones

Those who took part in the study were required to specify the information they were currently receiving on their mobile phones. Results are indicated in Table 5.15.

Table 5.15 Current information being received through mobile phones

Type of Information	Frequency	Percent
Crop production	63	16.4
Livestock production	67	17.4
Poultry production	95	24.8
Horticulture	20	5.2
Bee farming	1	0.3
Aquaculture	1	0.3
Crop Insurance	25	6.5
Credit and loans	40	10.4
Weather forecasting	80	20.8
Agriculture products markets and prices	82	21.4
Agriculture machinery	24	6.3
Planting methods	12	3.1
Pesticides	38	9.9
Other	38	9.9

***Table indicates multiple responses**

Responses indicate that farmers were receiving varied information. Table 5.15 shows poultry production as the information mostly received by the majority (95; 24.8%) of farmers, respectively followed by agriculture products markets and prices (82:21.4%) and weather forecasting (80:20.8%). The findings agree with Sekabira and Qaim (2017) who affirmed that the mobile phone technology has widely improved farmers' market access and income. The least information being received by farmers on their mobile phones include bee farming (1:0.3%) and aquaculture (1:0.3%) and this could be because they are not major activities in the districts. Respondents indicated that they

were also receiving other information that was not specified in the questionnaire, and this included information on training and/workshops.

Results from this study agree with other similar studies which confirm that farmers were receiving agricultural information on mobile phones (Chhachhar, Gureshi, Khushk & Maher, 2014; Chhachhar & Hassan, 2013; Tadesse & Bahiigwa, 2015) and the information they received included weather information, fertiliser, disease, pest, weed and livestock management, markets and market prices.

Although results show that farmers were receiving agricultural information on their mobile phones, the percentages were very low; all below 50%, compared to the percentage of farmers eager to get information through their mobile phones 99% (Table 5.14). This portrayed that most farmers in the province are eager to receive agricultural information on their phones but are not getting that service mainly because they are not aware of the available platforms, and they cannot afford the high costs of mobile data.

5.2.6.12 Knowledge on information dissemination platforms

Respondents were asked if they were aware of any of the available information dissemination platforms. Table 5.16 shows the results.

Table 5.16 Knowledge on information dissemination platforms

Platform	Frequency	Percent
Eco-Farmer	160	41.7
Esoko	0	0
e-Mkambo	0	0
Kurima Mari	75	19.5
None	186	48.4

***Table indicates multiple responses**

The results showed that most of the participants 186 (48.4%) were not aware of the available platforms, with 160 (41.7%) respondents aware of the Eco-farmer platform, 75 (19.5%) aware of Kurima Mari platforms and none aware of Esoko and e-Mkambo platforms. The results, therefore, indicate that although some farmers were aware of the available platforms like Eco-Farmer but were not using this platform to get agricultural information as the majority of service providers indicated that they were not using the platforms to distribute agricultural information to the farmers (Table 5.34). Stakeholders are not using the information dissemination platforms like Eco-Farmers, while findings showed that 41% of the farmers were aware of the Eco-Farmer platform. Farmers indicated that one of the reasons impeding the usage of cell phone to access agricultural information was high costs of mobile data (see Table 5.17). This possibly explains why farmers, who are aware of the Eco-Farmer platform, are not using the platform to access agricultural information; for to get information from Eco-Farmer there is need for subscribing to the platform. The Eco-Farmer platform has been reported to be the most popular with smallholder farmers in Mashonaland West Province (African farming and Food Processing 2013). This could be the reason why it is the platform most farmers are aware of. However, the fact that this platform is not being used by the farmers who are aware of its existence could be due to its high subscriptions rates of eight cents per day, and also because it is available to Econet subscribers and ecocash registered users only (Econet Wireless 2018).

5.2.6.13 Factors affecting mobile phone use

This question sought to establish the factors affecting mobile phone use by farmers. This question allowed for multiple responses. Table 5.17 shows the findings.

Table 5.17 Factors affecting mobile phones use by farmers

Response	Frequency	Percent (%)
Lack of access to mobile phones	93	24.2
High Costs of mobile phone data	277	72.1
Language	45	11.7
Other	227	59.1
Total	**642**	**167.1**

From the results of this study it was recognized that the main factors contributing to limited usage of mobile phones in agriculture are high costs of mobile phone data 277 (72.1%), lack of access to mobile phones (24.2%), language used on mobile phones 45 (11.7%) and other 227 (59.1%). The other factors which were specified under 'Other' were: high costs of mobile phones and the high cost of subscription that are charged by the available agricultural information dissemination platforms. In a related research, Babu et al (2011) found that the key limitations to accessing information were poor availability of reliable information. In addition respondents mentioned that they were not aware that information was available and that the available information was not timely. Wyche and Steinfield (2015) cited affordability and poor infrastructure as limitations that limit farmers from using mobile phones in their agricultural activities. Poor infrastructure, in the sense that farmers have limited or no access to electricity to charge their cell phones, which results into farmers' phones being turned off most of the time; or being left at charging kiosks, meaning that such farmers do not receive information in time (Wyche and Steinfield 2015). Fawole and Olajide (2011) in a study in Nigeria, also found that farmers implicated cost as the key aspect that limit them from using cell phones, the internet and the television as sources of information. Respondents also mentioned lack of access to mobile phones as another constraint to cell phones use by farmers; and this contradicted with the findings of this study, (figure 5.1), in which 96% of the respondents indicated that they have access to mobile phones.

5.2.7 Information sources, formats and channels used by farmers

This section shows the results of the study concerning the information sources, formats and channels used and preferred by farmers to receive agricultural information. It shows the other sources, besides mobile phone, that farmers use to access agricultural information; the formats and channels they currently use, and the ones they would prefer to use. Achebe and Lucky (2013) stated that the dissemination of correct, factual and understandable information connects the scientist with the farmer via the different sources and channels of information.

5.2.7.1 Other sources of agriculture information

This question required respondents to tell the other channels and sources of agricultural information besides the mobile phone they were currently using. This question allowed for multiple responses.

Table 5.18 Other sources of agriculture information

Source	Frequency	Percent
Extension workers	384	100.0
Field days	384	100.0
Other farmers	253	65.9
Friends	142	37.0
Neighbours	329	85.7
Radio	253	65.9
TV	96	25.0
Newspapers	80	20.8
Newsletters	38	9.9
Internet	85	22.1

***Table indicates multiple responses**

The study revealed that besides the mobile phone, respondents were getting agricultural information from other sources which included: extension officers 384 (100%), field days (100%), neighbours 329 (85.7%), other farmers 253 (65.9%), radio 253 (65.9%), friends 142 (37%), television 96 (25%), the internet 85 (22.1%),

newspapers 80 (20.8%) and newsletters 38 (9.9%). Extension officers, field days, other farmers and neighbors are formal and informal sources that rely less on printed sources. Other sources, like radio and television, are the other ICT channels which farmers indicated that they have access to in Table 5.11. Regarding radio and television, respondents highlighted that they listen to and view programmes, on radio and television respectively, that included: Murimi wanhasi (Today's farmer), Farming news, and Talking farming. These programmes usually bring in various agricultural specialists, including AGRITEX, Department of Research and Specialists Services (DR&SS) to talk on specific topics, or answers questions, from their listening audience (Mugwisi 2013).

Ogidi (2014) found that rural farming communities in Nigeria mostly use interpersonal, that is, friends, relatives and neighbours as channels to communicate agricultural information. The study showed limited use of mass media, with the radio as the channel most were using to access agricultural information. Babu. et al., (2011) established that for agricultural information farmers relied on private input dealers (68.6%), government agriculture extension officers (51.2%), television (43.6%), relatives (39.9%), other successful farmers (36.2%), primary agricultural cooperative banks (PACBs) (35.7%), the press (30.6%), farming magazines 9.2%, the radio (5.4%), and farming associations groups (4.7%). The findings of this study agreed with both Ogidi (2014) and Babu. Et al., (2011) who found that the channels and sources used by farmers to access information included extension officers, other farmers, radio, friends 142 (37%), the internet, newspapers and newsletters. In Kenya Rees et al. (2000) found that Kenyan smallholder farmers' main sources of information were relatives, neighbours and friends , farmer cooperatives, market points, Ministry of Agriculture, office of the president and the Roman catholic Church.

5.2.7.2 Access formats

Respondents were required to specify in what format of they were receiving agricultural information.

Table 5.19 Access formats

Format	Frequency	Percent
Print	248	64.6
Voice	356	92.7
Video	166	43.2
Audio-visual	121	31.5
SMS	256	66.7
MMS	48	12.5
Other	0	0

***Table indicates multiple responses**

Table 5.19 illustrates that respondents were receiving agricultural information in print 248 (64.6%), voice 356 (92.7%), video 166 (43.2%), audio visual 121 (31.5%), SMS 256 (66.7%) and MMS 48 (12.5%) formats.

Comparatively, Tables 5.18 and 5.19 indicate that respondents' available access corresponds with the other sources where farmers get agricultural information. Most of the farmers were getting information in the form of print and voice and these are the formats which can be provided through field days, other farmers, neighbours, friends, extension workers and the radio. The radio was found as the cheap and most popular channel for communicating information in several studies in most developing countries (Nyareza and Dick 2013; Norin. n.d.), as face-to-face communication with extension officers is limited because of poor farmer-to-agricultural extension officer ratio (Daniel 2012). Unlike extension officers, the radio can reach more people at a given time (Mtega 2018).

In addition, 256 (66.7%) (Table 5.19) respondents indicated that were receiving information in SMS formats; However, 230 (60%) (Table 5.7) respondents pointed out that they have smart phones. This implies that the type of phone is not an obstacle in receiving SMS, which can be received on any phone type. Respondents also mentioned that were receiving information through video and audio-visual (Table 5.19). Since video

is part of audio-visual it can be concluded that respondents just mentioned these two as they were options available on the questionnaire and the researcher did not probe further on this.

5.2.7.3 Farmers' formats preferences

This question required the farmers to specify their format of preference in receiving agricultural information. The question allowed for multiple responses.

Table 5.20 Farmers' formats preferences

Format	Frequency	Percent
Print	263	68.5
Voice	360	93.8
Video	225	58.6
Audio-visual	186	48.4
SMS	321	83.6
MMS	63	16.4

***Table indicates multiple responses**

Table 5.20 shows that 263 (68.5%) respondents prefer print format, 360 (93.8%) voice, 225 (58.6%) video, 186 (48.4%) audio-visual, 321 (83.6%) SMS and 63 (16.3%) multi-media service (MMS) formats. Three hundred and eleven (81%) respondents indicated that they own mobile phones; however, 369 (96%) respondents had access to mobile phones. Similar studies agree with the findings; for instance, Babu. et al., (2011) revealed that farmers prefer receiving agricultural information through personal contact, cell phone's voice and SMS applications, a cell phone helpline, formal and informal education, television, print and radio. Sani, Omenesa, Sambo, Abdullahi and Yuguda (2015) found that farmers' preferred format of information were: video documentaries, radio broadcasts, extension publications and personal contact. In Nigeria, Ogidi (2014) found that rural farmers prefer receiving agricultural information through extension officers and the television if they can be made available.

5.2.8 Farmers' information needs

Msoffe and Ngulube (2015) affirm that if information is required to solve a problem, such information is purposive, immediate, and time framed. Farmers will always require information to solve their daily farming problems. Bachhav (2012) states that timely and relevant information helps farming communities in taking right decision, which helps in sustaining agricultural development. Section 5.2.7 presented the results of the study regarding the information sources, formats and channels used and chosen by farmers to receive agricultural information. In relation to these sources, channels and formats used and preferred by farmers. Section 5.2.8 presents the farmers' information needs, such as how often farmers search for agricultural information, their language preferences and the farmers' views about the usage of cell phones in disseminating agricultural information.

5.2.8.1 Agriculture information search frequencies

Respondents were asked to indicate how often they search for agricultural information from the sources and channels indicated in 5.2.7.

Table 5.21 Agriculture information search frequencies

Response	Frequency	Percent
Daily	277	72.1
Weekly	42	10.9
Every Two weeks	25	6.5
Monthly	14	3.6
Never	26	6.8
Total	**384**	**100.0**

Farmers' information search behaviours were measured by the frequency of information search, such as daily, weekly, fortnightly, monthly and never. Table 5.21 shows that 72.1% (277) of the farmers search for agricultural information every day 42 (10.9%)

search weekly, 25 (6.5%) search every two weeks 14 (3.6%) monthly while 6.8% (26) of the farmers never search for agricultural information.

Babu et al. (2012), investigated information search behaviour of rice farmers, the measured this by daily, weekly, fortnightly, monthly, seasonally and yearly, and none, and they found that rice farmers mostly seek information seasonally, depending on needs and on a daily basis.

5.2.8.2 Agricultural information updates preferences

Respondents were requested to specify the information they would prefer to be continuously updated on. This question allowed for multiple responses. Table 5.22 summarises the responses.

Table 5.22 Agricultural information update preferences

Type of information	Frequency	Percent
Crop production	384	100.0
Livestock production	384	100.0
Poultry production	383	99.7
Horticulture	151	39.3
Bee farming	41	10.7
Aquaculture	12	3.1
Crop Insurance	175	45.6
Credit and loans	247	64.3
Weather forecasting	344	89.6
Agriculture products markets and prices	363	94.5
Agricultural machinery	51	13.3
Planting methods	325	84.6
Pesticides	363	94.5
Other	101	26.3

***Table indicates multiple responses**

All respondents 384(100%) indicated that they preferred to be updated on crop and livestock production while 383 (99.7%) preferred to get updates on poultry production, 363 (94.5%) preferred to get updates on markets, prices and pesticides. 344 (89.6%) of the respondents also indicated that they prefer to be updated on weather forecast , planting methods 325 (84.6%) and credit and loans 247(64.3%). The least preferred update was aquaculture, with only 12 (3.1%) respondents; this implies that aquaculture was not a major farming activity in the districts of the research. The results showed that the most required information include livestock, crop, poultry production, agricultural products and markets, and weather forecasting, among others. This agreed with table 5.15 where farmers indicated that were mostly receiving the information on crop, livestock and poultry production, weather forecasting, agriculture products markets and prices and here (Table 5.22) they indicated that they want to continue getting updates on the same type of information.

Bachhav (2012) opine that if farmers receive agricultural information in time this have a positive impact on agricultural production as this enable farmers to make informed decision if they have timely information on weather patterns, best agricultural practices and best markets for their products. These findings agreed with other studies that showed that farmers need different information. Saravan (2011), in India, established that most farmers need information on disease and pest management, Tologbonse, Fashola & Obadiah (2008) affirmed that most women farmers in Niger require information on crop production, weather, credit availability, soil and farm management.

Babu et al., (2012) and Elly and Silayo (2013) agree with Saravan (2011) and Tologbonse, Fashola & Obadiah (2008); adding that farmers also require information on pesticides, best planting time, animal husbandry, soil fertility, planting methods, fertiliser application, storage methods, seed treatment. input availability, weather updates, training on new breeds, new crop varieties and new farming techniques. Bachhav (2012) investigated the rural farmers' information needs and found that they require every day information for different agricultural activities. In Nigeria, Okwu and Umoru (2019) explored the information needs of women farmers and their research revealed that

women farmers require information on pesticides and fertiliser application, improved crop varieties, storage systems and better marketing system. Babu. et al., (2011) studied the information needs and search behaviours of a group of farmers in India, and they found that information on pest and disease management, fertiliser application, pesticides, inputs and seed varieties were the most needs among the farmers. Information relating to after harvesting, storage, grading, transport, distribution and consumer behavior was given the least priority.

5.2.8.3 Other Information sought for besides agricultural information

Respondents were requested to specify other information they also search for besides agricultural information and there were two common responses, which were: health information 124 (32.3%) and current news 265 (69%).

Table 5.23 Other Information searched for besides agricultural information

Information Type	Frequency	Percent
Health information	124	32.3
News	265	69

This question was directed to all the 384 respondents, as it sought to establish other information that respondents would like to get, either through mobile phones or other channels, besides agricultural information. Table 5.23 shows the results. The farmers indicated that besides agricultural information, they also require and search for health information and current news. Health and current news can be regarded as basic needs in everyday life. The Office of the United Nation High Commissioner for Human Rights and the World Health Organisation (WHO) (2008) claim that the right to health is an inclusive right, which will lead to people living a healthy life. The main characteristics of the right to health include enough sanitation, safe drinking water, adequate nutrition, safe food, satisfactory housing, healthy working and environmental conditions and

gender equality (United Nation High Commissioner for Human Rights and the World Health Organisation (WHO) 2008).

5.2.8.4 Languages preferences

This question aimed at establishing the language preferences for farmers. This question allowed for multiple answers.

Table 5.24 Languages preferences

Language	Frequency	Percent
English	330	85.9
Shona	277	72.1
Ndebele	29	7.6

Multiple responses

Table 5.24 shows that 330 (85.9%) farmers prefer English, 277 (72.1%) Shona, 29 (7.6%) preferred information in Ndebele. The results revealed that farmers require information in local languages. Geographically, Ndebele is not a predominant language in the area under study; so this explains why it had a low preference. The choice of English could be related to the literacy level, as shown in Table 5.4 on the educational level of respondents. Besides, English is the national language of communication in Zimbabwe.

Mugwisi et al. (2014) highlight that Zimbabwe has lack of agricultural information which is in indigenous languages. Customisation and localisation of content is a challenge, however, this can be improved through using ICTs (Raj 2013). The mobile phone application can assist in the distribution agricultural information in local languages.

5.2.8.5 Solution to mobile phone information dissemination gap

Farmers were required to suggest solutions to closing the mobile phone information dissemination gap created by the available platforms. Table 5.25 shows the results.

Table 5.25 Solution to mobile phone information dissemination gap

Solution	Frequency	Percentage
Available platforms must cover the whole country	253	65.9
Government must introduce free platforms for farmers	326	85

To respond to this question, data was collected on respondents' opinion on how the information dissemination gap which was created by platforms like Eco-Farmer, Esoko, e-Mkambo and Kurima Mari can be closed. Two hundred and fifty-three (65.9%) and 326 (85%) respondents agreed that the solutions to closing the information dissemination gap created by the available platforms were that, the available platforms should cover the whole country rather than specific areas or provinces. Respondents also indicated that there is need for the government to introduce free information dissemination platforms that all farmers can be join. The fact that respondents want the government to introduce free platforms indicates that most farmers cannot afford the high subscription rates being charged by the available platforms. Eco-Farmer charges eight cents per day as subscription (Econet Wireless 2018). However, this study did not reach out to service providers like Eco-Farmer and Kurima Mari to establish how much they were currently charge as subscriptions.

5.2.8.6 Mobile phone usefulness in disseminating agricultural information

Respondents were asked if they think that mobile phones can be useful in the dissemination of agricultural information and Table 5.26 show the responses.

Table 5.26 Mobile phone usefulness in disseminating agricultural information

Useful	Frequency	Percent
Yes	384	100
No	0	0
Total	**384**	**100.0**

From the results, all the 384 (100%) respondents agreed that cell phones are useful in agricultural information distribution.

Farmers were asked how cell phones can be used to meet their information requirements, and this was an open-ended question which required qualitative data. The common responses were; “through SMS”, “through voice calls” and “through online videos”. Farmers were also requested to indicate the benefits of receiving agricultural information via their cell phones. The Majority of the farmers mentioned that “mobile phones are cheaper”, “mobile phones are faster in transmitting information” and “mobile phones are cheaper and faster in transferring information”. Mobile phones are regarded as cheaper and faster in disseminating information; however, farmers indicated that the major deterrent to mobile phone use was the high cost of mobile data (Table 5.17). This however shows some contradiction on the part of the respondents.

Respondents were also asked how mobile phones can be used to meet their information needs and the responses were:

- Information could be sent to farmers through SMS
- Information could be sent to farmers through voice calls
- Information could be sent to farmers through online videos.

5.3 Data presentation, interpretation and discussion for Network providers and other stakeholders

This section presents the findings of the research from the data collected from the network providers and other stakeholder. For this category, data was collected from Chinhoyi urban district, since it is the provincial capital where most of the other

agricultural stakeholders, as well as all the three network providers: Econet, NetOne and Telecel, are found. The questionnaire for other agricultural stakeholders and network providers had questions which were compulsory for all respondents, and had a section for network providers only. Like in section 5.2.1 data for this section is presented and discussed by the sequence of the questions.

5.3.1 Stakeholder respondents by district and name of organisation

A questionnaire was distributed to fifteen stakeholders and network providers. Some were left for respondents to fill, which the researcher collected the day after, while the researcher waited to collect those that were immediately completed by stakeholders and network providers. Table 5.25 presents the stakeholder participants by district and organisational name.

Table 5.27 Stakeholder respondents by district and organisation name

District Name	**Organisation Name**
Chinhoyi	Chinhoyi Farmer Centre
Chinhoyi	Econet
Chinhoyi	Farm and City
Chinhoyi	Feedmix
Chinhoyi	Fivet Animal Health
Chinhoyi	GMB
Chinhoyi	Moples
Chinhoyi	National Foods
Chinhoyi	Netone
Chinhoyi	SeedCo
Chinhoyi	Telecel Zimbabwe
Chinhoyi	Veterinary Distributors
Chinhoyi	Willian Bain and Co Holding
Total	**13**

Out of the 15 distributed questionnaires, 14 questionnaires were completed. However, a questionnaire was rejected since it was noted that the respondent was from Makonde district, which is outside the targeted district, Chinhoyi, for this category. By implication, this category was left with thirteen organisations, comprising three network providers and ten other stakeholders.

5.3.2 Stakeholder services

Stakeholders were requested to indicate the type of service they provide to farmers. This question allowed for multiple responses.

Table 5.28 Stakeholder services

Service	Frequency	Percent
Agricultural machinery	5	35.7
Seed	4	28.6
Fertilisers	4	28.6
Chemicals	6	42.9
Network provider	3	21.4
Other- stock feed & grains, chicks, veterinary products, feed additives	5	35.7

*Table show multiple responses

Table 5.26 presents the type of services which different stakeholders offer to farmers in the province. The results showed that there were five companies that provide agricultural machinery, four seed and fertiliser companies, six chemical companies, three network providers and five companies which provide other services. The other services mentioned included: supplying of stock feed, grain, chicks, veterinary products and feed additives. The results revealed that the province was well covered with regard to agricultural inputs and mobile network coverage.

5.3.3 Provision of information to farmers

Stakeholders were asked if they provide any information to farmers. Table 5.27 shows stakeholders' responses.

Table 5.29 Provision of information to farmers

	Do you provide any information to farmers? N=13		
Organisation name	**Yes**	**No**	**Total**
Chinhoyi Farmer Centre	0	1	1
Econet	1	0	1
Farm and City	1	0	1
Feedmix	1	0	1
Fivet Animal Health	1	0	1
GMB	1	0	1
Moples	1	0	1
National Foods	1	0	1
Netone	0	1	1
SeedCo	1	0	1
Telecel Zimbabwe	1	0	1
Veterinary Distributors	1	0	1
Willian Bain and Co Holding	1	0	1
Total	**11**	**2**	**13**

Out of the 13 stakeholders, 11 responded that they are providing information to farmers and two responded that they were not providing information to farmers. The findings indicated that majority of stakeholders were providing agricultural information to farmers.

5.3.4 Type of Information provided to farmers

Service providers who responded that they were providing information to farmers were asked to specify the type of information they were providing.

Table 5.30 Type of information provided to farmers

Type of Information	Frequency
Training	2
Markets for agricultural products	1
Stock feed	4
Seed	3
Agricultural machinery	2
Fertilisers	3
Agro-chemicals	5
Technical advice	1
Farming tips	1
Farming news	1
Product information	1
Total	**24**

***Table indicates multiple responses**

Table 5.28 shows all the type of information stakeholders were providing. This was an open-ended question. The information types provided by stakeholders somehow correspond with the types of information that farmers said they were getting, and for which they were willing to get updates on (Tables 5.15 and 5.22). Farmers had shown that they were getting information on crop, livestock and poultry production, which the stakeholders are providing through farming tips, news, fertiliser, seed, stock feed and product information. Farmers also mentioned that they were receiving, and would want to be kept updated on, product markets and agricultural machinery. The stakeholders confirmed that they were providing information on the same related topics and areas..

5.3.5 Information transmission channels

Respondents were required to specify the channels they use to transmit information to farmers. Table 5.29 shows the channels which stakeholders used to communicate information to farmers.

Table 5.31 Information transmission channels

Channel	Frequency	Percent
Radios	2	15.4
Newspapers	1	7.7
Television	0	0
Farming magazines	2	15.4
Mobile phone	4	30.7
Newsletters	4	30.7
The internet	1	7.7
Farmer Field days /gatherings	5	38.5
Agriculture shows	8	61.5
Other	7	53.8

***Table indicates multiple responses**

This question allowed for multiple responses. Agricultural shows with 8 (61.5%) proved to be the channel most stakeholders were using to transmit agricultural information. Agricultural shows and field days (table 5.18) were also stated by most(100%) of farmers as sources of getting agricultural information. Farmer field days had 5 (38.5%), mobile phones and newsletters had 4 (30.7%), radio and farming magazines had 2(15.4%) and the least channels used were newspapers and the internet with 1(7.7%) each. Farmers also mentioned the radio, newspapers and newsletters as the information sources. However, farmers also mentioned television, which, in contrast no service provider indicated. The study was about the use of mobile phones in disseminating agricultural information; results indicated that there is low usage of cell phones in the transmission of agricultural information in the province, as only 30.7 % of

the stakeholders showed that they were using mobile phones to distribute agricultural information to farmers.

5.3.6 Formats used to disseminate information by service providers

This question aimed at establishing the formats used by stakeholders to disseminate information to farmers. This question allowed for multiple responses.

Table 5.32 Formats used to disseminate information by service providers

Format	Frequency	Percent
Print	9	69.2
Voice	6	46.1
Video	0	0.0
Audio-visual	2	15.4
SMS	5	38.5
MMS	0	0.0
Total	**22**	**169.2**

Table 5.30 shows the formats used by stakeholders to disseminate information to farmers. Nine (69.2%) stakeholders indicated that they were using the print formats, 6 (46.1%) voice formats, 5 (38.5%) SMS platform, 2 (15.4%) audio-visual and none were using video and MMS.

The formats stakeholders were using to disseminate information were also mentioned by the farmers as the available and preferred formats. For example, farmers mentioned that they were getting, and preferred getting, information through print, voice, video and SMS formats (Tables 5.19 and 5.20); and stakeholders also indicated that they were providing information in the same formats. Farmers also indicated that they were getting, and were willing to get information through MMS, but no stakeholder noted that they were providing information through MMS. Farmers mentioned both videos and audio-visuals. while stakeholders mentioned only audio-visuals. May be this was

because farmers had to choose from the available options in the questionnaire, while the other stakeholders could differentiate the linked options.

5.3.7 Language used to disseminate information by service providers

Stakeholders who indicated that they were providing information to farmers were asked the language(s) they use to disseminate information to farmers.

Table 5.33 Language used to disseminate information

Language	Frequency	Percent
English	11	100
Shona	7	63.6
Other	6	54.5

***Table indicates multiple responses**

Table 5.31 shows the languages used by stakeholders to disseminate information to farmers. Eleven (100%) specified that they were using the English language and 7 (63.6%) were using Shona. Stakeholders were asked to specify the exact languages they used under the 'other' category, and the only language which was mentioned was Ndebele. This question allowed for multiple answers and the results signified that some stakeholders were using two languages or all the three languages. The three languages (English, Shona and Ndebele) mentioned by the stakeholders were the same languages mentioned by the farmers, when asked a similar question. Farmers indicated that they preferred to get information in English (85.9%), Shona (72.1%) and Ndebele (7.6%). The results showed that English is the language preferred by the majority of farmers and the language most used by the other stakeholders.

The findings concurred with other studies on language use. Mangstl (2008) suggests that there is need to repackage and make agricultural information available in local languages; Raj (2012) indicates that there is need for content localisation and

customisation; and Mugwisi et al. (2014) point out that, in Zimbabwe, there is still lack of materials in indigenous languages, as most of the available information is in English.

5.3.8 View on the utilisation of mobile phones in transmitting agricultural information.

Stakeholders were required to state how they perceived the use of modern technology on transmitting agricultural information. Table 5.32 shows the findings.

Table 5.34 View on the utilisation of mobile phones in transmitting agricultural information.

View	Frequency	Percent
Effective	4	30.8
Efficient	3	23
Effective and efficient	6	46.2

This was an open-ended question. Six (46.2%) reported that it was both effective and efficient, four (30.8%) said it was effective while 3 (23%) were of the opinion that it was efficient.

Stakeholders agreed with farmers that mobile phones can be useful, effective and efficient in the provision of information, as 98.9% (Table 5.14) of farmers who own mobile phones also acknowledged that they were interested in receiving agricultural information through their mobile phones.

5.3.9 Knowledge on available agricultural information dissemination platforms

Stakeholders were also asked if they are familiar with any of the available agricultural information dissemination platforms.

Table 5.35 Knowledge on available agricultural information dissemination platforms

Platform	Frequency	Percent
Eco-Farmer	7	53.8
Esoko	0	0
e-Mukambo	0	0
Kurima mari	5	38.5
Total	**12**	**92.3**

***Table indicates multiple responses**

Table 5.33 illustrates the results. Seven (53.8%) were aware of the Eco-Farmer platform, five (38.5%) were aware of the Kurima Mari platform and none was aware of Esoko and e-Mkambo. Like farmers, stakeholders were only aware of Eco-Farmer and Kurima Mari as the available information dissemination platforms and were not aware of Esoko and e-Mkambo.

The results from farmers and stakeholders show that Eco-Farmer and Kurima Mari are the information dissemination platforms farmers and stakeholders are aware of, with Eco-Farmer being the platform the majority are aware of.

5.3.10 Platforms used to disseminate information to farmers

Stakeholders were asked which platforms they were using to transmit agricultural information to farmers from the mentioned platforms. Table 5.34 illustrates the results.

Table 5.36 Platforms used to disseminate information to farmers

Platform	Frequency	Percent
Eco-Farmer	1	9.1
Esoko	0	0
e-Mkambo	0	0
Kurima Mari	0	0
None	10	90.9

Only one organisation mentioned were using Eco-Farmer to transmit agricultural information to farmers. In section 5.3.9, seven and five stakeholders mentioned that they were aware of the Eco-Farmer and Kurima Mari platforms respectively; however, regardless of being aware of the platforms, both farmers and organisations were not using the available platforms to receive and disseminate agricultural information. Chisita (2010); Odhunze and Hove (2015); Musungwini (2016) and Nyakudya (2017) noted that the available ICT-based agricultural information dissemination platforms, such as Esoko, e-Mkambo, Kurima Mari, and Eco-Farmer cater for specified groups of farmer, which may explain why stakeholders and farmers are not using the platforms. Esoko and Kurima Mari cater for smallholder farmers, EcoFarmer caters for farmers who are capable of paying subscriptions and e-Mkambo is available to farmers who go to markets to sell their produce (Chisita 2010; Musungwini 2016; Nyakudya 2017; Odhunze & Hove 2015).

5.3.11 Challenges in disseminating agricultural information to farmers

Stakeholders were required to reveal the problems they were facing in transmitting information to farmers and how those challenges could be resolved. Table 5.35 shows the results.

Table 5.37 Challenges in disseminating agricultural information to farmers

Challenge	Frequency	Solution	Frequency
None	3	0	0
Limited/poor network coverage	7	Increase network coverage	7
Reaching a large crowd	5	Use of mobile phones	5
Embracement of modern technology by farmers	1	Need for training farmers	1
High subscription rates	1		1
Illiteracy on part of farmers	1		1

***Table indicates multiple responses**

The results show that most challenges faced by stakeholders in communicating agricultural information to farmers are: limited and poor network coverage and reaching out to a large crowd.

The majority of farmers indicated that network coverage was very good to good, others indicated that network coverage was bad to very bad, while network providers indicated that their coverage ranges between 75% and 80% and for those covered, some area are faced with poor connectivity. , Stakeholders, though based in the provincial capital, where there is good coverage, were still faced with poor network coverage whenever they needed to communicate with farmers in remote areas. Stakeholders mentioned that the solution to this is increasing network coverage and using mobile phones to reach large crowds. One stakeholder mentioned that one other challenge is illiteracy on the part of farmers; however, this did not tally with the farmers' rated illiteracy level from the finding on education level (Table 5.4), which showed that every farmer in the survey has attained some level of education, with the majority having reached at least secondary level. Also, the majority of stakeholders indicated that they were using mostly

English language to transmit information to farmers. This confirmed the farmers claim in Table 5.24 that they would prefer English as the language of communicating agricultural information to them. All these presupposes that the farmers were literate.

5.3.12 Network coverage and accessibility

The three network providers were asked if their networks cover the whole province of Mashonaland West and the responses were: Econet almost, NetOne yes and Telecel majority of the province. They were also asked the current levels of mobile phone access for each network provider. The responses were: Econet around 80%, NetOne almost 80% and Telecel about 75%. The responses from Network providers showed that the network coverage, although, not 100%, but at least 75% of the province had network coverage. However, regardless of the high coverage rate 53 (17%) of the farmers (Table 5.10) indicated that the network reception was bad to very bad. Network providers also mentioned in Table 5.32 that the use of mobile phones in disseminating agricultural information can be very effective and efficient; however, other stakeholders indicated in Table 5.35 that they are faced with the challenge of poor network coverage, this could be that they cannot get in touch with the farming communities in remote rural areas that is the 25% network providers are not covering and those who said the network was bad to very bad. Network providers also admitted that they have a challenge of poor connectivity and no parts to upgrade boosters.

5.3.13 Charges for data, voice and SMS

Network providers were asked the current charges for data (as at February 2019 when the data was collected); voice and SMS, and all the three network providers responded that they were charging five cents per SMS, one dollar for 250 megabytes data bundle. For voice calls, Econet and NetOne were charging 14 cents per minute while Telecel was charging 13 cents.

5.3.14 Special provisions to groups

Network providers were asked if they have any special provisions for groups, including farmers. NetOne responded that they were not providing any, Econet responded they

were doing so through the Eco-Farmer platform, and Telecel also said that they have a platform called Farmers' club. Econet and Telecel had special provisions for farmers; however, the findings discovered that most of farmers were unaware of the available agricultural information dissemination platforms. Also, those who were aware from both farmers and stakeholders majority, were not using these platforms as the platforms were tailor made for specific groups of farmers or were not covering their province, and/or the subscriptions being charged by these platforms were not affordable to the farmers.

5.3.15 Challenges in service provision

Network providers were asked about the challenges they were facing in service provision and the following were mentioned as the major problems:

- Fewer farmers are willing to subscribe to available platforms
- Poor connectivity
- No spare parts for upgrading boosters

In 5.3.11 network providers mentioned that there is a higher coverage of at least 75%; however, their responses in 5.3.15 shows that, though there is a higher coverage, there are challenges of poor connectivity and there is need for upgrading boosters. This clarified the fact that no farmer indicated that the network reception was excellent and some claimed that it was very bad.

5.4 Chapter Summary

This chapter was on the presentation, interpretation and discussions of the research findings.

Respondents' demographic information showed that respondents came from the target population and target districts. The findings revealed that the respondents were literate, as all farmers who participated in the research had reached some level of education. There were more males than females who participated in the research, and the most of the respondents were above 51 years.

The findings also revealed that the majority of the respondents had access to mobile phones, with above half owning cell phones and having internet access via their cell phones. Respondents said make use of their cell phones to make and receive calls and massages (including on agricultural information), play games and access the internet.

As also shown from the findings, both farmers and stakeholders were aware of only Eco-Farmer and Kurima Mari as the available information dissemination platforms, even though they were not using these platforms to disseminate or receive agricultural information. The findings also established that besides the mobile phone, farmers and stakeholders were using other channels and sources to disseminate and receive agricultural information. The sources and channel mentioned included agricultural shows, field days, extension officers, friends, other farmers, neighbours, the radio, television, newsletters, newspapers and the internet. The information from both mobile phones and other sources and channels were being received in print, voice, video, SMS and MMS.

The findings also revealed that farmers required various farming information and that stakeholders were also providing different information to farmers. The information required by farmers and that which was being provided by stakeholders included: crop production, livestock production, poultry production, weather forecasting, product markets and prices, agricultural machinery, farming news and training.

It was also revealed that there are a number of obstacles that farmers face that limit their usage of cell phones to receive agricultural information; and among others, the major factor was the high costs of mobile data subscription charged by network service providers.

The next chapter is the summary of findings, conclusions, recommendations and reflections.

CHAPTER SIX

SUMMARY, CONCLUSIONS, RECOMMENDATIONS AND REFLECTIONS

6.1 Introduction

This chapter provides the summary, conclusion, recommendations and reflections of the study. The summary is provided in connection with the objectives of the study, conclusions are made according to the findings of the research, and recommendations are provided on how mobile phones can be used to transmit agricultural information to farmers in Mashonaland West Province. The study intended to investigate the usage of cell phones in transmitting agricultural information to the Mashonaland West Province of Zimbabwe's farming community so as to improve the coverage gap, created by the available initiatives.

6.2 Objectives of the study

In investigating the use of mobile phones in disseminating agricultural information to farmers in Mashonaland West of Zimbabwe, the following were the study's objectives :

- To establish the kind of information the farmers are currently accessing through mobile phone application.
- To identify the information needs of the farmers in Mashonaland West Province
- To identify how mobile phones can be used to meet the information needs of the farmers in Mashonaland West Province of Zimbabwe.
- To assess the level of mobile phone access, and the brands of mobile phone available among the Mashonaland West farmers.
- To analyse the sources and channels of disseminating available agricultural information to the farmers in Mashonaland West Province.
- To establish the formats in which the information is available.
- To establish the format(s) the farmers would prefer to get the information in.
- To establish the barriers limiting access to agricultural information through mobile phone application in Mashonaland West Province

6.3 Summary of findings

This section is the summary of the research findings, presented by research objectives.

6.3.1 Summary on demographic information of respondents

A total of 384 farmers, and 13 network providers and other stakeholders participated in this research. Respondents for the farmers' stratum were taken from the four districts, with the highest populations, of Mashonaland West Province. The districts were Chegutu, Hurungwe, Makonde and Zvimba. The survey had a 100% response rate from the farmers as data collection was done by the researcher, who asked the respondents the questions in the questionnaire whilst writing down their answers. The network providers and other stakeholders' stratum had 87% response rate as 13 organisations responded to the questionnaires.

In terms of gender, men dominated the farming activities in the province, as over 302 (78.6%) of the farmers who participated in the study were men and only 21.4%) were women. Regarding age, most of the farmers (73%) were 51years old or above 51. This implies that the farming activities in Mashonaland province mainly comprise of the middle-aged group which can easily adopt new technology.

In terms of education, every farmer who participated in the survey had reached some level of education, with the majority 188 (49%) having attained secondary education, 118(39%) attained diploma level, and 40 (10%) had undergraduate degrees.

6.3.2 Summary on the kind of information farmers access through the mobile phone application

Accessibility to agricultural information through cell phones was low. Most (57%) of the respondents were not accessing agricultural information via their mobile phones. Out of the 43% who indicated that were receiving information through their mobile phones, it was noted that they were mainly getting it through WhatsApp groups, and not from the agricultural information dissemination sources.

Eleven network providers and other stakeholders said that they were providing farmers with agricultural information; however, only four were providing this information using the mobile phones platform, and of the four, only one was using one of the agricultural information dissemination platforms (Eco-Farmer). No farmer indicated receiving agricultural information from agricultural information dissemination platforms like Eco-Farmer. However, one network provider indicated using the Eco-Farmer platform to disseminate farming information to farmers. This can be an indication that almost all the farmers who took part in the study were not subscribing to Eco-Farmer, which would have required paying costly subscriptions.

The kind of information received by farmers using their cell phones varied (see Table 5.15). Poultry production, agriculture products and markets, weather forecasting, livestock production and crop production were the most received type of information; pesticides, crop insurance, agriculture machinery, horticulture, planting methods, training and workshops information were less received; and bee farming and aquaculture were the least type of information received.

6.3.3 Summary on the information needs of the farmers in Mashonaland West Province.

While information was required for a variety of agricultural practises, this research established that the most required information by farmers included crop 384 (100%), livestock 384 (100%), poultry production 383 (99.7%), agricultural products markets and price 363 (94.5%), pesticides 363 (94.5%), weather forecasting 344 (89.6%), planting methods 325 (84.6%) and credit and loans 247 (64.3%) (see Table 5.22). Other information needed by the farmers included crop insurance, horticulture and agricultural machinery. The least information required were aquaculture and bee farming. Besides agricultural information, farmers also required health information and current news. Farmers mostly preferred English language, followed by Shona; with Ndebele being the least preferred because there are fewer Ndebele speaking people in the areas covered in the study.

6.3.4 Summary on how mobile phones can be used to meet the information needs of the farmers in Mashonaland West Province of Zimbabwe.

The entire 384 farmers who took part in the study concurred that cell phones can be helpful in disseminating agricultural information, by using SMS, voice calls and videos. The findings showed that most of farmers were unaware of the existing mobile phone information dissemination platforms like Eco-Farmer, e-Mkambo, Esoko and Kurima Mari, because these platforms were not covering the whole country and the subscriptions being charged were too high for most of the farmers. Farmers pointed out that for cell phones to satisfy their information needs, the available platforms should cover the whole country and the government must introduce free platforms for farmers.

6.3.5 Summary on the level of mobile phone access and the brands of mobile phone available among the Mashonaland West farmers.

The findings showed that the majority of the respondents (369; 96%) (see Figure 5.1) had access to mobile phones, with 311 (81%) (see Table 5.5) being mobile phones owners. The study also established that out of the 369 (96%) respondents who owned mobile phones, 230 (60%) actually owned smart phones (see Table 5.7) and 211 said that they have access to the internet through their smart phones (see Table 5.8).

The majority of respondents subscribe to more than one network provider as the findings showed that 566 (182%) subscribe to different networks (see Table 5.9). Respondents indicated that the network service reception ranges from very good to very bad, with the majority (249; 80.1%) indicating that the reception was good (see table 5.10). Network providers indicated that, at least 75% of the province had network coverage regardless of poor connectivity in some areas (see section 5.3.12).

Mobile phones were being used mostly to make and receive calls (95.3%), make and receive massages (95.3%), followed by accessing the internet (47.7%) and least, for

playing games (36.7%) (see Table 5.12). Furthermore, respondents reported that besides the mobile phone they also have access to other ICT tools like computers/laptops, television, the radio and cameras; and they used these to complete work assignments and store personal information (see section 5.2.6.7).

6.3.6 Summary on the sources and channels of disseminating agricultural information available to the farmers in Mashonaland West Province

The results revealed that respondents were receiving agricultural information through mobile phones; however, besides mobile phones, they were also receiving agricultural information through other channels and sources. Extension workers, agricultural shows, field days, neighbours, friends, other farmers, the radio, the television, the internet, newsletters and newspapers were among the different sources and channels respondents were using to receive agricultural information. Farmers who took part in the study also said, were willing to continue getting updates of the same agricultural information via mobile phones.

The study also revealed that both respondents and other stakeholders were not much aware of the information dissemination platforms, as Eco-Farmer and Kurima Mari were the only known platforms. However, regardless of being aware of the Eco-Farmer and Kurima Mari platforms, stakeholders were not using these channels to disseminate agricultural information to farmers. Only one service provider (Econet) indicated using the Eco-Farmer platform to disseminate agricultural information. Respondents indicated that they also preferred receiving agricultural information in MMS format; however, no stakeholder indicated using the MMS format to disseminate information to farmers.

6.3.7 Summary on the formats in which the information is available

The results revealed that print, voice, video and SMS were the available formats used by both respondents and stakeholders to receive and provide information. Respondents also indicated that the MMS platform was another format which was available to them.

6.3.8 Summary the format(s) the farmers preferred to get information in

The results revealed that voice (360;93.8%), SMS (321;83.6%) print (263;68.5%) and video (225;58.6%) were the most preferred formats of respondents, with the least format being MMS (63;16.4%) (see Table 5.20). Respondents reported that they preferred receiving agricultural information through the MMS format; however, no stakeholder indicated that using the MMS format to disseminate agricultural information.

6.3.9 Summary on the barriers limiting access to agricultural information through the mobile phone application in Mashonaland West Province

High costs of mobile phones, data and high subscriptions rates were the major factors mentioned limiting access to agricultural information through mobile phones (see Table 5.17). Language was also mentioned by a few respondents as another barrier. Though majority of those who took part in the study had access to cell phones, lack of access to mobile phones was also mentioned by a few respondents as one other limiting factor.

6.4 Conclusions on the use of mobile phones in disseminating agricultural information to farmers in Mashonaland West Province of Zimbabwe

Drawing from the findings of the study, this part gives the following conclusions:

6.4.1 Conclusion on the kind of information farmers access through the mobile phone application

The study concluded that the types of information being accessed by farmers through mobile phones vary. This include information on poultry production, agriculture products and markets, weather forecasting, livestock production, crop production, pesticides, crop insurance, agriculture machinery, horticulture, planting methods, trainings and workshops, bee farming and aquaculture. The number of farmers who access agricultural information using mobile phones is low, considering that 57% of the respondents were not receiving agricultural information using their mobile phones. The study also concluded that the few farmers who access agricultural information through

their mobile phones are not receiving it from the available agricultural information dissemination platforms, but from WhatsApp groups.

6.4.2 Conclusion on the information needs of the farmers in Mashonaland West Province

The study concluded that farmers in Mashonaland West Province require information on crop, livestock, poultry production, agricultural products markets and price, pesticides, weather forecasting, planting methods, credit and loans, crop insurance, horticulture and agricultural machinery, aquaculture and bee farming. Besides agricultural information, farmers also require health information and current news.

6.4.3 Conclusion on how mobile phones can be used to meet the information needs of the farmers in Mashonaland West Province of Zimbabwe

Mobile phones can be used to meet farmers' information requirements, as all the 384 respondents agreed that mobile phones can be helpful in the distribution of agricultural information through using voices calls, SMS and video mobile phone applications. The study also concluded that the majority of farmers in the province have access to mobile phones, with most of them actually owning mobile phones.

6.4.4 Conclusion on the level of mobile phone access and the brands of mobile phone available among Mashonaland West farmers

Majority of farmers in the province have access to mobile phone, and most of them actually own mobile phones. This is evidenced by the fact that 96% of the respondents had access to mobile phone, while 81% own mobile phones, and some farmers subscribe to more than one network provider. The study as well concludes that most of the farmers in Mashonaland West Province own smart phones and can access the internet. However, the study surmised that, regardless of farmers having access to mobile phones, there is still a gap in receiving agricultural information from agricultural information dissemination platforms like Eco-Farmer and Kurima Mari, which are the

only platforms a few of the respondents and stakeholders specified that they were aware of.

6.4.5 Conclusion on the sources and channels of disseminating agricultural information available to the farmers in Mashonaland West Province

Results showed that respondents were receiving agricultural information through both mobile phones and other channels; and sources like extension workers, agricultural shows, field days, neighbours, friends, other farmers, the radio, the television, the internet, newsletters and newspapers. However, there were more farmers who were using other sources and channels to get agricultural information than those who were using mobile phones. Results also exposed that most respondents and stakeholders were unaware of the agricultural information dissemination sources, such as Eco-Farmer, Kurima Mari and Esoko, which use mobile phones to circulate information on agriculture.

The study, thus, concluded that different sources and channels of agricultural information dissemination platforms are available to farmers in Mashonaland West province, even though the mobile phone channels are underutilised.

6.4.6 Conclusion on the formats in which the information is available

The study concludes that agricultural information is available to farmers in a variety of formats, which include: print, voice, video, SMS and MMS. Therefore, farmers are not limited in choosing formats of their preferences

6.4.7 Conclusion on the format(s) the farmers preferred to get the information in

The study concluded that the same available formats are the preferred ones by farmers in Mashonaland West Province.

6.4.8 Conclusion on the barriers limiting access to agricultural information through mobile phone application in Mashonaland West Province

High costs of mobile phones and mobile data, high subscriptions rates charged by the available agricultural information dissemination platforms, and language used by information providers were the major factors mentioned that limit access to agricultural information through mobile phones. Hence, the study concluded that there is need to establish agricultural dissemination platforms where farmers can access information for free or at affordable rates.

6.4.9 General conclusion

In conclusion, the study established that the coverage gap created by the available agricultural information dissemination platforms, like Eco-Farmer, Kurima Mari, eSoko and eMkambo, can be improved by using mobile phones to disseminate agricultural information in the province. The use of mobile phones can be achieved, given that majority of the respondents either have access to mobile phones or actually own personal mobile phones. This study also found that the province had, at least, 75% network coverage, and on connectivity, most of the respondents confirmed that it was good. Some respondents mentioned that they were already receiving agricultural information though their mobile phones, and were willing to continue getting agricultural information updates the same channel. Those who were not currently receiving agricultural information through their mobile phones indicated that were willing to do so. Both respondents and stakeholders agreed that the use of mobile phones in the dissemination of agricultural information can be very useful, efficient and effective.

6.5 Recommendations on the use of mobile phones in disseminating agricultural information to farmers in Mashonaland West Province of Zimbabwe

The following section sets out recommendations based on each research objective.

6.5.1 Recommendations on the kind of information farmers access through mobile phone application

The recommendations on the kind of information farmers access through the mobile phone application are as follows:

The findings revealed that very few respondents were accessing information through the mobile phones SMS application. The information they were accessing through mobile phone SMS platform was not coming from the available agricultural information dissemination platforms, because both respondents and stakeholders were not aware of the other agricultural information dissemination platforms; and the few who were aware were not using the platforms due to high data subscription costs. Therefore, it is recommended that the available agricultural information dissemination platforms should extend their coverage and hold awareness campaigns so that their targets become aware of their existence.

6.5.2 Recommendations on the information needs of the farmers in Mashonaland West Province

The study established that respondents required different types of information which included crop, livestock, poultry production, agricultural products markets and price, pesticides, weather forecasting, planting methods, credit and loans, aquaculture and bee farming. It is suggested that agricultural information suppliesr and agricultural information dissemination platforms should work together to create information needs profiles for their target audience, to make it easy to get and send available information to their end users.

6.5.3 Recommendations on how mobile phones can be used to meet the information needs of the farmers in Mashonaland West Province of Zimbabwe

The study established that the use of mobile phones can be more useful, effective and efficient in bridging the information gap created by the available agricultural information distribution platforms for the Mashonaland West Province farmers; therefore it is recommended that:

- The government introduces a platform, which uses cell phones to distribute information on agriculture to farmers.
- The platform should be funded by the state, and farmers will be accessing information for free, or at subsidised rates that all farmers can afford.
- The service should operate through Information Centres.
- The Information Centres should be based in the local extension offices.
- English, Shona and Ndebele should be used as the languages of communicating the information to the farmers.
- In policy terms, government, agricultural institutions, agricultural information providers and agricultural stakeholders should work together to create an agricultural information database that can act as a focal point for sharing information and knowledge.
- The 'One Stop Shop' should be web-based and should link with farmers through mobile their phones

6.5.4 Recommendations on the level of mobile phone access and the brands of mobile phone available among the Mashonaland West farmers

The results established that most of those who took part in the study had access to mobile phones, with most respondents owning smart phones, and subscribing to more than one network. It also established that network reception was mostly good. It is, therefore, recommended that a platform which uses mobile phones to transmit

agricultural information to the farming community in Mashonaland West Province be established as most of the farmers have access to mobile phones.

6.5.5 Recommendations on the sources and channels of disseminating agricultural information available to the farmers in Mashonaland West Province

The findings established that respondents and stakeholders were using different sources, channels and formats to receive and disseminate agricultural information to farmers. It is then recommended that the mobile phone agricultural information dissemination platforms should also have user-profiles for the sources and formats preferred by end users of their services, while advocating for the mobile phone as the most convenient channel for communicating agricultural information.

6.5.6 Recommendations on the formats in which the information is available and format(s) the farmers preferred to get the information in

The results revealed that print, voice, video and SMS were the available and preferred formats, and some respondents also indicated that the MMS was another available platform. It is recommended that these mobile phones-based formats should be continually used.

6.5.7 Recommendations on the barriers limiting access to agricultural information through the mobile phone application in Mashonaland West Province

The study found that the major barriers to using mobile phones in disseminating agricultural were high costs of mobile data, high subscriptions being charged by the available agricultural information dissemination platforms and high costs of mobile phones. Poor connectivity was also mentioned as a challenge; however, network providers indicated that the province had at least 75% network coverage. It can be concluded that the respondents who said that there was poor connectivity are the ones staying in areas which do not have network coverage.

It is therefore, recommended that to cater for those farmers, who cannot afford to buy mobile data or subscribe to available platforms, the government should provide financial support for the establishment of information centres at local agricultural extension offices. These centres will be providing free Wi-Fi for farmers and farmers can visit these centres with their mobile phones to access agricultural information. Farmers can also correspond with the information centres through their mobile phones from the comfort of their homes. It will be the government's responsibility, through the information centres, to subscribe to the agricultural information dissemination platforms for the farmers. In addition to that, the government have to provide funds to develop the infrastructure in rural areas, in order to avoid poor connectivity or lack of electricity in the information centres. The information centre should be the linking platform for farmers, extension officers, agricultural information dissemination platforms, network providers and all agricultural stakeholders in the province.

It is also recommended that network providers should work towards improving their network coverage so that there will be 100% network coverage.

6.6 Suggestions for further research

This study focused on the use of mobile phones in disseminating agricultural information to Mashonaland West Province of Zimbabwe's farmers as a means of improving the information gap created by the available agricultural information dissemination platforms. Although this was a thorough study, which covered the four districts of Mashonaland West Province, the researcher feels that there is still need to carry out further studies to cover all the districts of Mashonaland West Province or even at the national level. Such studies will need to use different theoretical frameworks and different methodological approaches.

In a nutshell, the study explored the use of mobile phones in disseminating agricultural information to the farming community of Mashonaland West Province of Zimbabwe as a

means of covering the information gap created by the available agricultural information dissemination platforms. Basing on the results, it is safe to conclude that it is viable to use mobile phones to disseminate agricultural information to farmers in Mashonaland West Province of Zimbabwe.

6.7 Reflection on the study

This section focuses on study reflections. It covers reflections on the purpose of the study, methodology, data analysis, limitations of the study and contribution of the study to knowledge.

6.7.1 Reflections on the purpose of the study

In terms of the purpose of this study, which was to explore the use of mobile phones in disseminating agricultural information to farmers in Mashonaland West Province of Zimbabwe, with a view to improve on the coverage gap created by the available initiatives, the study managed to accomplish its purpose. The reflections below support how the study purpose was achieved.

6.7.2 Reflections on methodology

The survey method was used as the research methodology of this study. This was appropriate for the study, given that the sample was very large and the research was quantitative in nature. Survey method is the methodology which is most applicable for large samples. Data collection for large samples is mostly made easier to accomplish through a survey. The use of simple random sampling was most suitable for this study as it ensures that respondents from the target population had equal chances of being chosen to participate in the survey; hence, there was no bias in selecting respondents. Data collection was really challenging as respondents had busy schedules were asked to participate in the survey when they were visiting the district offices for other purposes. As a result of this, there were reluctant gestures to complete the questionnaire, due to time and business restrictions. Therefore, the researcher, rather than trying to convince them would move to the next possible and applicable respondent, until the required number of respondents was achieved. Generally, data was collected from those

respondents who agreed to take part in the survey. The researcher personally collected the data, which helped to minimise contextual and content errors.

6.7.3 Reflections on data analysis and interpretation

The use of the SPSS software for analysing quantitative data was appropriate and relatively helpful. Content analysis and literature review were used to analyse qualitative data. The conceptual framework acted as a guide for data collection and data analysis.

6.7.4 Limitations of the study

The study was limited to only five districts, that is four districts with the with the highest populations for the farmers stratum and the provincial capital district for the Network providers and other stakeholders. However, the province is made up of thirteen districts, meaning that the other eight districts were not represented. This might have created a gap in what could have been uncovered in the other districts.

6.7.5 Contribution of the study

In terms of its purpose, which was to investigate the use of mobile phones in disseminating agricultural information to farmers in Mashonaland West Province of Zimbabwe with a view to improve on the coverage gap created by the available initiatives, the study managed to accomplish its purpose. The study has contributed towards reducing information coverage gap by giving recommendations to that effect.

References

Abdi, H., Jacob, W., & Chesambu, N.A. (2017). Type of information and communication technology tools used in dissemination of agricultural market information to vegetable farmers in Vihiga County , Kenya. *International Journal of Management Research & Review. 7(10) 997-1005.* Available: https://pdfs.semanticscholar.org/a909/df36ab68fa1b2eaf44c46a7488e4e13e2410.pdf?_ga=2.158381946.1393484030.1572343391-1753718272.1556547354 (Accessed 29 October 2019).

Adams, J, Khan, HTA and Raeside, R. 2014. Research methods for business and social science students. Los Angeles : SAGE

Adegite,V. 2006.TalkingITGlobal.Org.Available:http://www.tigweb.org/youth-media/panorama/article.html?ContentID=7924&print=true (Accessed 3 November 2017

Agarwal, T. 2015. Different types of wireless communication with applications. Available:

https://www.elprocus.com/types-of-wireless-communication-applications/ (Accessed 06 July 2018).

Ajuwon,G.A and Odeku, E.L. 2012. Module one information sources Ibadan: African Journals Online. Available:

http://karibouconnections.net/medlibafrica/training_module/pdf/module1.pdf (Accessed 20 August 2018).

Aker, J.C and Ksoll, C. 2016. Can mobile phones improve agricultural outcomes? Evidence from a randomized experiment in Niger. Food Policy 60: 44-51. Available:

https://www.sciencedirect.com/science/article/pii/S0306919215000330 (Accessed 24 July 2018).

Aker, J.C. 2010. Information from Markets Near and Far: Mobile Phones and Agricultural Markets in Niger. *American Economic Journal: Applied Economics* Available: http://www.aeaweb.org/articles.php?doi=10.1257/app.2.3.46 (Accessed 11 July 201)8.

Aker, J. C. and Mbiti, I. 2010. Mobile phones and economic development in

Africa. *Journal of Economic Perspectives*. 24(3) 207-232. Available: http://sites.tufts.edu/jennyaker/files/2010/09/aker_mobileafrica.pdf (Accessed 04 September 2018).

Ali, J. 2012. Factors affecting the adoption of Information and Communication Technologies (ICTs) for farming decisions*. Journal of Agricultural and Food Information 13(1):*78-96. Also available: http://www.tandfonline.com/doi/pdf/10.1080/10496505.2012.636980 (Accessed 9 May 2018).

Ali, J., and S. Kumar. 2011. Information and Communication Technologies (ICTs) and farmers decision-making across the agricultural supply chain. *International Journal of Information Management* 31:149–159.

Anfara, V.V. & Mertz, N. T. (Eds.) 2015. Theoretical frameworks in qualitative research. Los Angeles : SAGE.

Ango, AK, Illo. AI, Abdullahi, AN, Maikasuwa.MA & Amina, A. 2013. Role of Farm-Radio Agricultural Programmes in Disseminating Agricultural Technology to Rural Famers for Agricultural Development in Zaria, Kaduna State, Nigeria. *Asian Journal of Agricultural Extension, Economics & Sociology* 2(1). http://www.sciencedomain.org/abstract.php?iid=178&id=25&aid=1263#.U701z0Dcpgs (Accessed 20 July 2018).

Arokoyo, T. 2005. ICTs application in agricultural extension service delivery. Available: http://patnsukjournal.net/Vol4No2/p1.pdf (Accessed 19 July 2018).

Asa, U. A. and Uwem, C. A 2017. Utilisation of mobile phones for agricultural

purposes by farmers in Itu area, Nigeria. *European Scientific Journal*.13 (19). Available: https://eujournal.org/index.php/esj/article/viewFile/9643/9228 (Accessed 22 August 2018).

Asenso-Okyere, K. and Mekonnen, D. A. 2012. The importance of ICTs in the provision of information for improving agricultural productivity and rural incomes in Africa. Available:

https://www.zef.de/uploads/tx_zefportal/Publications/ece1_ICT%20Productivity%20(1).pdf (Accessed 06 September 2018).

Babbie, E. 2010. The practice of social research.12th .ed. Belmont: Wadsworth.

Babu, SC, Glendenning, CJ, Okyere, KA & Govindarajan, SK. 2012. Farmers' information needs and search behaviors: Case study in Tamil Nadu, India. http://ageconsearch.umn.edu/bitstream/126226/2/Farmers%20information%20needs%20and%20search%20behaviour%20case%20study%20in%20Tamil%20Nadu%20India.pdf (Accessed 22 June 2018).

Bachhav, NB. 2012. Information needs of the rural farmers: a study from Maharashtra, India: a survey. *Library Philosophy and Practice (e-journal).* S66. http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=2043&context=libphilprac

(Accessed 16 June 2018).

Bandura, A. 1999. A social cognitive theory of personality. In Pervin, L. & John, O. (Eds.), Handbook of personality (2nd ed., 154-196). Guilford Publications: New York.

Barnabas, A A. 2013. An e-farming framework for sustainable agricultural development in Nigeria. *Journal of Internet and Information System*.3(1). Also available on http://academicjournals.org/article/article1379948233_Adeyemo.pdf (Accessed 27 June 2018).

Bates, M. J. (2005). An introduction to metatheories, theories, and models. In K. E. Fisher, S. Erdelez, & L. McKechnie (Eds.), Theories of information behavior. Medford, NJ: American Society for Information Science and Technology. Available: https://pages.gseis.ucla.edu/faculty/bates/articles/metatheories.pdf (Accessed 27 April 2018).

Bertolini, R. 2004. Making information and communication technologies work for food security in Africa. http://www.ifpri.org/sites/default/files/publications/ib27.pdf (Accessed 20 June 2018).

Best, J. & Kahn, J.V. 2004. Research in education. Prentice- Hall: New Delh

Bhagat, G.R., Nain, M.S. & Narda, R. 2004. Information sources for agricultural technology. *Indian Journal of Extension Education*, xxxx(1-2). Available:

https://www.researchgate.net/profile/MS_Nain2/publication/255723019_Information_sources_for_agricultural_technology/links/0046352088128534ab000000/Information-sources-for-agricultural-technology.pdf (Accessed 10 January 2018).

Blumberg, B., Cooper, D. R & Schindler. 2014. Business research methods. 12th.ed. New York: McGraw-Hill International.

Bryman, A & Bell, E. 2014. Research methodology: Business and management context. South Africa: Oxford University Press.

Cadilhon, J. 2013. When dismal infrastructure affects the entire agrifood system. Available: http://www.e-agriculture.org/blog/when-dismal-infrastructure-affects-entire-agrifood-system (Accessed 22 June 2018).

Chauhan R. M. 2018. Advantages and challenging in e agriculture. *Oriental. Journal of. Computer Science. and Technology*. 8(3). Available: http://www.computerscijournal.org/?p=2966 (Accessed 27 June 2018).

Chawla, D. and Sondhi, N. 2011. Research methodology concepts and cases. New Delhl:Vikas Publishing House Pvt. Ltd.

Chhachhar, A. R., Qureshi, B., Khushk, G. M. & Maher, Z. A. 2014. Use of mobile Phone among farmers for agriculture information. *European Journal of Scientific Research*, 119(2), 265–271. Available: https://www.researchgate.net/publication/269994255_Use_of_Mobile_Phone_among_Farmers_for_Agriculture_Information (Accessed 20 May 2019).

Chhachhar, R. A. and Hassan, M. S. 2013. The use of mobile phone among farmers for agriculture development. *International Journal of Scientific Research*, 2(6), 95–98. Available: https://www.researchgate.net/publication/244484894_The_Use_of_Mobile_Phone_Among_Farmers_for_Agriculture_Development (Accessed on 29 May 2019)

Chikaire, J. U., Ani, A.O. & Nnadi, F.N. 2015. Analysis of Information and Communication Technology roles in poverty reduction among small and medium scale farmers in Imo State, Nigeria. *Library Philosophy and Practice*. Available: http://digitalcommons.unl.edu/libphilprac/1284. (Accessed 06 July 2018).

Chikulo, S. 2013. Scope and potential of ICTs in agricultural extension. Available: http://www.ruzivo.co.zw/blog/139-scope-and-potential-of-icts-in-agricultural-extension.html (Accessed 03 November 2017).

Chisita, CT. 2010. An investigation into the use of ICT in the provision of agricultural information to small scale farmers in Harare. http://conference.ifla.org/past-wlic/2010/85-chisita-en.pdf (Accessed 22 June 2018).

Chukwunonso,F., Mohammed, A & Obidi, N. 2012. The adoption of information and communication technology (ict) in agriculture in Adamawa State, Nigeria. *African Journal of Agricultural Research and Development* 5(3).

Churi, AJ, Mlozi, M.R.S, Tumbo, S.D & Casmir, R. 2012. Understanding farmers' information communication strategies for managing climate risks in rural semi-arid areas, Tanzania. *International Journal of Information and Communication Technology Research*. 2(11). Available: http://esjournals.org/journaloftechnology/archive/vol2no11/vol2no11_6.pdf (Accessed 20 June 2018).

Chuttur, M.Y. 2009. Overview of the Technology Acceptance Model: origins, developments and future directions. *Sprouts: Working Paperson Information Systems, 9(37)*. Available: http://sprouts.aisnet.org/9-3 (Accessed 22 October 2019).

Connaway, L.S & Powell, R.R. 2010. *Basic research methods for librarians*. *5th*.ed. Santa Barbara: Libraries Unlimited.

Creswell, J. W & Clark, V. L. 2011. *Designing and conducting mixed methods research*. 2nd.ed. Los Angeles: SAGE

CTA. 2003. Presentation to CTA Observatory on "ICTs– transforming agricultural extension?" September 23-25. Available: http://web.archive.org/web/20050719165943/http://www.cta.int/observatory2003/keynote_papers/Challenges_in-demand-driven_extension.pdf (Accessed 13 June 2018).

Daniel, J. 2012. Sampling essentials: practical guidelines for making sampling choices. Available: www.sagepub.com/upm-data/40803_5.pdf (Accessed 30 June 2018).

Dervin, B. 1998. Sense-making theory and practice: an overview of user interests in knowledge seeking and use. *Journal of Knowledge Management.* 2(2). Available:

http://www.emeraldinsight.com/doi/pdfplus/10.1108/13673279810249369 (Accessed 26 January 2018).

Dewan, S and Kraemer, LK. 2000. Information technology and productivity: preliminary evidence from country-level data. *Management Science*, 46(4):548-562.

Diekmann, F & Batte, MT. 2011. Information needs of agricultural consultants in Ohio. E- Journal of Extension. 49(11). Available: http://www.joe.org/joe/2011august/rb5.php (Accessed 29 June 2018).

Diekmann, F, Loibl, C & Batte, MT. 2009. The economics of agricultural information: factors affecting commercial farmers' information strategies in Ohio. *Review of Agricultural Economics.* 31(4): 853-872.

Doane, D.P & Seward, L.E. 2010. *Essential statistics in business and economics.* Boston: McGraw Hill Irwin.

Dolan,C.S. 2004. "I sell my labour now": gender and livelihood diversification in Uganda. Canadian Journal of Development Studies, 25(4): 643–661. Available: DOI: 10.1080/02255189.2004.9669007 (Accessed 29 July 2019).

Donner, J. 2006. The Social and economic implications of mobile telephony in Rwanda: an ownership/access. *Typology Knowledge, Technology, & Policy*. Summer 19(2):17-28. Available: http://download.springer.com/static/pdf/982/art%253A10.1007%252Fs12130-006-1021-7.pdf?originUrl=http%3A%2F%2Flink.springer.com%2Farticle%2F10.1007%2Fs12130-006-1021-7&token2=exp=1433768777~acl=%2Fstatic%2Fpdf%2F982%2Fart%25253A10.1007%25252Fs12130-006-1021-7.pdf%3ForiginUrl%3Dhttp%253A%252F%252Flink.springer.com%252Farticle%252F10.1007%252Fs12130-006-1021-7*~hmac=999ead676b62f09c1b05c995c3f4edc00dbf8147970b72d26d57e33a5bda29b4 (Accessed 22 September 2017).

Dzenga. L. 2016. Kurima Mari: Future of communal farming

Available: http://www.herald.co.zw/kurima-mari-future-of-communal-farming/ (Accessed 27 June 2018).

E-agriculture, 2017. Available: http://www.e-agriculture.org/e-agriculture (Accessed 09 August 2017).

Easdown, W & Starasts, A. 2004. Constructing useful information for farmers– the role of IT. http://regional.org.au/au/asa/2004/symposia/4/3/238_easdownwj.htm (Accessed 27 April 2018).

Econet Wireless. 2018. Econet launches eco-farmer for Zimbabwe's smallholder farmers. African Farming and Food Processing, 7 October. Available: http://www.africanfarming.net/crops/agriculture/econet-launches-eco-farmer-for-zimbabwe-s-smallholder-farmers (Accessed 27 March 2018).

Ellis, A., Manuel, C. & Blackden, C.M. 2006. Gender and economic growth in Uganda: unleashing the power of women. Washington, DC, World Bank. Available: http://documents.worldbank.org/curated/en/719941468114871674/Gender-and-economic-growth-in-Uganda-unleashing-the-power-of-women (Accessed 29 July 2019).

Elly, T. & Silayo, E.E. 2013. Agricultural information needs and sources of the rural farmers in Tanzania: A case of Iringa rural district. *Library Review* 62 (8/9)547-566. Available: https://doi.org/10.1108/LR-01-2013- (Accessed 2 May 2019).

FAO. 2011. The state of food and agriculture: Women in agriculture closing the gender gap for development. Available: http://www.fao.org/3/a-i2050e.pdf (Accessed 29 July 2019).

FAO. 2007. e-Choupal connects farmers of India. Available:

http://www.fao.org/e-agriculture/news/e-choupal-connects-farmers-india (Accessed 06 September 2018).

FAO. 2005. E-agriculture: a definition and profile of its application. Available: https://www.slideshare.net/sarper/e-agriculture-a-definition-and-profile-of-its-application (Accessed 29 August 2018).

Fawole, O.P. and Olajide, B.R. 2011. Awareness and Use of InformationCommunication Technologies by Farmers in Oyo State, Nigeria. *Journal of Agricultural & Food Information*. https://www.researchgate.net/publication/272123948_Awareness_and_Use_of_Information_Communication_Technologies_by_Farmers_in_Oyo_State_Nigeria (Accessed 12 Jun 2019).

Fraenkel, J. R. and Wallen, N.E. 2000. *How to design and evaluate research in*

Education. 4th ed. Homewood, IL: Irwin.

Fisher, K.E., Erdelez, S. & McKechinie, L. E.F. (Eds.). 2005. Theories of information behavior. Information Today: Medford.

Frické. M. 2009. The knowledge pyramid: A critique of the DIKW hierarchy. *Journal of Information Science* 35(2): 131–142.

Available: https://arizona.openrepository.com/arizona/bitstream/10150/105670/1/The_Knowledge_Pyramid_DList.pdf (Accessed 20 December 2017).

General Assembly Agriculture Committee. 2013. Is e-agriculture the way to ensure world food security? http://www.studymode.com/essays/Agriculture-The-Way-To-Food-Security-1583554.html (Accessed 22 January 2018).

Geographic Information Systems. 2018. What is GIS. Available: http://www.esri.com/what-is-gis-old/overview (Accessed 26 August 2018).

Ghogare, S.A & Monga, P.M. 2015. E-Agriculture: Introduction and figuration of its application. *International Journal of Advanced Research in Computer Science and Software Engineering*. 5(1). Available: www.ijarcsse.com (Accessed 10 August 2017).

Gill, J. & Johnson, P. 2010. Research methods for managers. London: Sage.

Hayes, WS. 2011. Glossary of research terms. https://www.hayesinc.com/hayes/wp-content/uploads/2011/07/Glossary-of-Research-Terms-7-25-2011-FINAL.pdf. (Accessed 10 October 2018).

ICT Update. 2004. The Cyber Shepherds and livestock in the Sahel. Available: http://ictupdate.cta.int/mobileen/Feature-Articles/The-Cyber-Shepherds-and-livestock-in-the-Sahel (Accessed 19 November 2017).

The Information Society Library. Available: http://textus.diplomacy.edu/portals/isl/Default.asp?FilterTopic=/44586/44683 (Accessed 25 April 2018).

Isife, B.I, Nnodim, A.U & Albert, C.O 2013. The Role of ICT in Poverty Alleviation among Rural Farmers in Abia State. Computer Engineering and Intelligent Systems .4(7). Available: https://www.researchgate.net/publication/314232418_ (Accessed 06 July 2018).

Islam, M.S. & Grönlund, A. 2011. Bangladesh calling: farmers' technology use practices as a driver for development. *Information Technology for Development* 17(2). p95-111. Available: DOI: 10.1080/02681102.2010.526093 (Accessed 10 June 2019).

ITU 2017. ITU releases 2017 global information and communication technology facts and figures. Available: https://news.itu.int/itu-releases-2017-global-information-and-communication-technology-facts-and-figures/ (Accessed 06 September 2018).

Jamwal, S. & Padha, D. 2009. *A Study of Information and Communication Technology in the Area of Agriculture and Rural Development in J&K State.* Available: http://www.academia.edu/482977/ (Accessed 07 July 2018).

Jesson, J.K, Matheson, L. and Lacey, F. M. 2011. Doing your literature review traditional and systematic techniques. London: Sage.

Johnson, B & Christensen, L. 2008. Education research: quantitative, qualitative and mixed approaches. 3rd .ed. Sage: Thousand Oaks.

Kabweza, L.S.M. 2014. Zimbabwe's telecoms stats (2013): 103.5% mobile penetration rate. Available: http://www.techzim.co.zw/2014/01/zimbabwes-telecoms-stats-2013-103-5-mobile-penetration-rate/ (Accessed 03 July 2018).

Karugu, WN. 2011. Kenya Agricultural Commodity Exchange (KACE): linking small-scale farmers to national and regional markets. Available: http://growinginclusivemarkets.org/media/cases/Kenya_KACE_2011.pdf (Accessed 23 July 2018).

Kelepouris, T, Pramatari, K & Doukidis, G. 2007. RFID-enabled traceability in the food supply chain. *Industrial Management & Data Systems 107(2)183 – 200*. Available: http://www.emeraldinsight.com/doi/pdfplus/10.1108/02635570710723804 (Accessed 22 June 2018).

Kibet, C. 2011 Major Challenges facing Kenyan Agricultural sector. Available: http://extensionconference2011.cta.int/node/111 (Accessed 3 July 2018).

Kothari, C.R and Garg, G. 2014. *Research methodology methods and techniques. 3rd. ed.* New Delhi: New Age International.

Koyenikan, M.J. 2011. Extension workers' access to climate information and sources in Edo State, Nigeria . *Scholars Research Library Archives of applied science research*, 3(4): 11-20. Available: https://www.scholarsresearchlibrary.com/articles/extension-workers-access-to-climate-information-and-sources-inedo-state-nigeria.pdf (Accessed 20 August 2018).

Krejcie, R. V. and Morgan, D. W. 1970. Determining sample size for research activities. *Educational Psychological Measurement, 30* (4) 607-610. Available: https://home.kku.ac.th/sompong/guest_speaker/KrejcieandMorgan_article.pdf (Accessed 03 October 2018).

Kuhlmann, F. 2005. IT applications in agriculture: some developments and perspectives. http://departments.agri.huji.ac.il/economics/gelb-appli-2.pdf (Accessed 03 May 2018).

Kumar, R. 2014. *Research methodology: a step-by-step guide for beginners*. 4th.ed. Los Angels: SAGE.

Lwoga, E.T. 2010. Bridging the agricultural knowledge and information divide: The case of selected telecenters and rural radio in Tanzania. *Electronic Journal on Information Systems in Developing Countries* 43(6): 1–14. Available: https://www.researchgate.net/publication/228903288_Bridging_the_Agricultural_Knowledge_and_Information_Divide_The_Case_of_Selected_Telecenters_and_Rural_Radio_in_Tanzania (Accessed 20 December 2017).

Lwoga, E. T, Stilwell, C. & Ngulube, P. 2011. Access and use of agricultural information and knowledge in Tanzania. *Library Review, 60* (5), 3–3. Available: https://www.emeraldinsight.com/doi/full/10.1108/00242531111135263?fullSc=1 (Accessed 21 August 2018).

Lucky, A.T. & Achebe, N.E.E. 2013. The effect of digital divide on information accessibility among undergraduate students of Ahmadu Bello University, Zaria. *Research Journal of Information Technology* 5(1) (01-10). Available: http://maxwellsci.com/print/rjit/v5-1-10.pdf (Accessed 20 April 2019).

Madan, P. Paliwal, V. & Bhardwaj, R. 2011. *Research methodology*. New Delhi: Global Vision Publishing House.

Mahant, M., Shukla, A., Dixit, S., & Patel, D. 2012. Uses of ICT in Agriculture. International Journal of Advanced Computer 2(1). Available:

http://accentsjournals.org/PaperDirectory/Journal/IJACR/2012/3/9.pdf (Accessed 28 June 2018).

Malayea, M. 2017. Smartphones take agricultural data collection to new level: FAO trains extension workers in latest data collection technology. *Daily Observer.* Available: https://www.liberianobserver.com/news/smartphones-take-agricultural-data-collection-to-new-level/ (Accessed 13 October 2019).

Mangstl, A. 2008. Emerging issues, priorities and commitments in e-agriculture. *Agricultural Information Worldwide* 1(1): 1-6. Available: ftp://ftp.fao.org/docrep/fao/010/ai258e/ai258e00.pdf (Accessed 09 May 2018).

Manjengwa, J. and Mazhawidza, P. 2009. Gender Implications of Decentralised Land Reform: The Case of Zimbabwe. *Policy Brief* 30. Available: http://repository.uwc.ac.za/xmlui/bitstream/handle/10566/87/Manjengwa_Gender2009.pdf?sequence=1&isAllowed=y (Accessed 6 June 2019).

Manobi South Africa n.d. Manobi launches in Senegal a free-access SMS market information service. Available: http://www.manobi.sn/sites/za/index.php?M=9&SM=20&Cle=54 (Accessed 15 October 2017).

Masuka. B., Matenda. T., Chipomho. J., Mapope. N., Mupeti. S., Tatsvarei. S. and Ngezimana. W. 2016. *Mobile phone use by small-scale farmers: a potential to transform production and marketing in Zimbabwe.*

Mazur, M. 2016. Six ways drones are revolutionizing agriculture. MIT Technology Review. Available: https://www.technologyreview.com/s/601935/six-ways-drones-are-revolutionizing-agriculture/ (Accessed on 26 January 2018).

Meitei, LS & Devi, TP. 2009. Farmers information needs in rural Manipur: an assessment. *Annals of Library and Information Studies*. 56: 35-40. Available:

http://nopr.niscair.res.in/bitstream/123456789/4165/1/ALIS%2056%281%29%2035-40.pdf (Accessed 18 June 2018).

Ministry of Lands, Agriculture, and Rural Resettlement. Available: http://www.moa.gov.zw/ (Accessed on15 April 2017).

Mittal, S. and Tripathi, G. 2009. Role of mobile phone technology in improving small farm productivity. Agricultural Economics Research Review 22 (451-459). Available: https://ageconsearch.umn.edu/bitstream/57502/2/15-S-Mittal.pdf (Accessed 04 September 2018).

Mittal, S., Gandhi, S., & Tripathi, G. 2010. Socio-economic impact of

mobile phones on Indian agriculture. Indian Council for Research on International Economic Relations. Available: http://www.icrier.org/pdf/WorkingPaper246.pdf (Accessed 19 July 2018).

Morgan, D. L. 2014. Pragmatism as a paradigm for social research. Available: file:///C:/Users/Information/Downloads/PragmatismQualInqaspub%20(1).pdf (Accessed 30 October 2018).

Msoffe, G. E P, Ngulube, P. 2016. Agricultural information dissemination in rural areas of developing countries: A proposed model for Tanzania. African Journal of Library, Archives & Information Science; Ibadan, 26(2) 169-187. Available: https://search.proquest.com/openview/480d074302ebb82ebf6ca3ed8ef03d29/1?pq-origsite=gscholar&cbl=736345 (Accessed 22 August 2018).

Mtega, P., Ngoepe, M. & Dube, L. 2016, 'Factors influencing access to agricultural knowledge: the case of smallholder rice farmers in the Kilombero district of Tanzania *South African Journal of Information Management* 18(1), a679. Available: http://dx.doi.org/10.4102/sajim.v18i1.679 (Accessed 15 April 2017).

Mtega, W.P. 2018. The usage of radio and television as agricultural knowledge sources: The case of farmers in Morogoro region of Tanzania*. International Journal of Education and Development using Information and Communication Technology (IJEDICT)*, 14 (3), pp. 252-266. Available: https://files.eric.ed.gov/fulltext/EJ1201501.pdf (Accessed 12 June 2019).

Mtega, W. P. 2012. Access to and usage of information among rural communities: A case study of Kilosa District Morogoro Region in Tanzania. *The Canadian Journal of Library and Information Practice andResearch, 7* (1), 1-9. Available: https://journal.lib.uoguelph.ca/index.php/perj/article/view/1646 (Accessed 21 August 2018).

Mugenda, O.M. & Mugenda, A.G. 2003. Research methods:qualitative and quantitative approaches. African Centre for Technology Studies. Nairobi.

Mugwisi, T. 2013. The information needs and challenges of agricultural researchers and extension workers in Zimbabwe. Available: http://www.lis.uzulu.ac.za/etds/tmugwisi/Tinashe%20Thesis%20Printed%20June.pdf (Accessed 04 July 2019).

Mugwisi, T, Ocholla, D and Mostert, J. 2014. An Overview of the information needs of agricultural researchers and extension workers in Zimbabwe. *Libri* 64(1):85–108. Available:

https://www.researchgate.net/profile/Tinashe_Mugwisi3/publication/265864589_An_Overview_of_the_Information_Needs_of_Agricultural_Researchers_and_Extension_Workers_in_Zimbabwe/links/541fef150cf241a65a1ae2b6/An-Overview-of-the-Information-Needs-of-Agricultural-Researchers-and-Extension-Workers-in-Zimbabwe.pdf (Accessed 25 June 2018).

Muk, A and Chung, C. 2015. Applying the technology acceptance model in a two-country study of SMS advertising. *Journal of Business Research*. 68(1) 1-6. Available:

https://www.researchgate.net/publication/267640741_Applying_the_technology_acceptance_model_in_a_two-country_study_of_SMS_advertising (Accessed 31 May 2018).

Munyua, H., Adera, E & Jensen, M. 2008. Emerging ICTs and their potential in revitalizing small scale agriculture in Africa. *Agricultural Information Worldwide Journal* 2(1):3-9. Also available:

http://web.ebscohost.com/ehost/detail?vid=4&sid=7cc9fa7e-b905-49a6-ae57-a4c122f069b8%40sessionmgr112&hid=118&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#db=lxh&AN=43248412 (Accessed 9 May 2018).

Musungwini, S. 2016 Harnessing Mobile Technologies for Sustainable Development of Smallholder Agriculture in Zimbabwe: Challenges and lessons learned. Available: https://www.researchgate.net/publication/303693350_Harnessing_Mobile_Technologies for_Sustainable_Development_of_Smallholder_Agriculture_in_Zimbabwe_Challenges_ and_lessons_learned (Accessed 15 June 2017).

Muza. O. 2013. eMkambo: A market -driven agricultural solution platform. Available:

https://www.newsday.co.zw/2013/02/emkambo-a-market-driven-agricultural-solution-platform/ (Accessed on 3 November 2017).

Namisiko, P & Aballo, M. 2013. Current Status of e-agriculture and global trends: a survey conducted in TransNzoia County, Kenya. *International Journal of Science and Research (IJSR*), India Online 2(7) July. Available: https://www.google.co.zw/search?q=Current+Status+of+e-Agriculture+and+Global+Trends:+A+Survey+Conducted+in+TransNzoia+County,+Kenya&ie=utf-8&oe=utf-8&rls=org.mozilla:en-US:official&client=firefox-a&channel=np&source=hp&gws_rd=cr&ei=8MG7U_SlNM750gX1o4HQBg (Accessed 20 June 2018).

National Farmers Information Service. n.d. Available: http://www.nafis.go.ke/ (Accessed 22 June 2018).

NewsDay 2012. Esoko search for local partners. Available: https://www.newsday.co.zw/2012/02/2012-02-28-esoko-search-for-local-partners/ (Accessed 13 July 2018).

Ngulube, P. 2015. Research methodological procedures used in knowledge management studies. *African Journal of Library and Archives & Information Science*. 25(2)125-143.Available: http://eds.b.ebscohost.com/eds/pdfviewer/pdfviewer?vid=0&sid=f94ed44f-f931-49d3-b435-dd1e78be96b3%40pdc-v-sessmgr05 (Accessed 28 October 2018).

Isife, B.I., Nnodim, A.U. & Albert, C.O. 2013. The Role of ICT in Poverty Alleviation among Rural Farmers in Abia State. Computer Engineering and Intelligent Systems.

4(7). Available: https://www.researchgate.net/profile/Ukachukwu_Nnodim/publication/314232418_The_Role_of_ICT_in_Poverty_Alleviation_among_Rural_Farmers_in_Abia_State/links/58bbf55a45851591c5e3aaf2/The-Role-of-ICT-in-Poverty-Alleviation-among-Rural-Farmers-in-Abia-State.pdf (Accessed 29 October 2019).

Noor Agha, B.S. Ghanghas and Chahal, P.K. 2018. Use of Information and Communication Technologies by extension personnel to disseminate agricultural information.*Int.J.Curr.Microbiol.App.Sci.* 7(4): 1369-1376. Available: doi: https://doi.org/10.20546/ijcmas.2018.704.153 (Accessed 29 August 2018).

Norin, P. n.d. Communication Channels for Agricultural Information to Farmers: A Case Study in Kampong Speu Available; http://uc.edu.kh/paper_series/Communication%20Channels%20for%20Agricultural%20Information%20to%20Farmers-%20A%20Case%20Study%20in%20Kampong%20Speu.pdf (Accessed 12 June 2019).

Nyakudya, M. 2017. NGO, govt introduce digital extension for smallholder farmers.

Available: https://www.newsday.co.zw/2017/02/ngo-govt-introduce-digital-extension-smallholder-farmers-2/ (Accessed 27 June 2018).

Nyareza, S & Dick, A.L. 2012. Use of community radio to communicate agricultural information to Zimbabwe's peasant farmers. Aslib Proceedings, 64 (5) pp.494-508, Available: https://doi.org/10.1108/00012531211263111 (Accessed 12 June 2019).

Ocholla, D. N. & Le Roux, J. 2011. Conceptions and misconceptions of theoretical frameworks in Library and Information. 6th Biennial Prolissa Conference Proceedings: Pretoria 9-11 March. Available:

https://pdfs.semanticscholar.org/91d3/c375a42ce9527d41583c7859715c255af697.pdf (Accessed 28 January 2018).

Odunze, D.I. and Hove, TM. 2015. An analysis of the impact of the use of mobile communica tion technologies by farmers in Zimbabwe. A case study of Esoko and EcoFarmer platforms. Available:

http://www.globdev.org/files/SigGlobDev_2015_paper_15_0.pdf (Accessed 30 October 2017).

Ogidi, A. E. 2014. Modern channels of information used for agriculture in rural farm communities in Nigeria. *SCSR Journal of Development*. Available:

https://www.academia.edu/12562998/Modern_Channels_of_Information_used_for_Agriculture_in_Rural_Farm_Communities_in_Nigeria (Accessed 18 April 2018).

Oino, P. G., Towett, G., Kirui, K. K. and Luvega, C. 2015.The dilemma in sustainability of community based projects in Kenya*. Global Journal of Advanced Research*. 2(4):757-768. Available: http://gjar.org/publishpaper/vol2issue4/d177r18.pdf (Accessed 06 September 2018).

Okello-Obura, C., Minishi-Majanja, M. K., Cloete, L. & Ikoja-Odongo, J. R.

2009. Assessment of business information access problems in Uganda.

The Canadian Journal of Library and Information Practice and Research,

2 (2). Available: https://journal.lib.uoguelph.ca/index.php/perj/article/view/306 (Accessed 13 July 2018).

Okello, J., Kirui, O.K., Njirani, G.W. & Gitonga, Z. M. 2012. Drivers of use of

information and communication technologies by farm households: The case of smallholder farmers in Kenya*. Journal of Agricultural Science, 1(1) Available:* http://erepository.uonbi.ac.ke/bitstream/handle/11295/13681/Okello_Drivers%20of%20Use%20of%20Information%20and%20Communication%20Technologies%20by.pdf?sequence=4&isAllowed=y (Accessed 13 July 2018)*.*

Okwu, O.J., Kaku, A.A. & Aba, J.I. 2007. An assessment of the use of radio in agricultural information dissemination: a case study if radio Benue in Nigeria. *African Journal of Agricultural Research* 2(1). Available: https://pdfs.semanticscholar.org/e3ac/581b1e064b6fc5d56ca0793330e0d0332b51.pdf (Accessed 9 July 2018).

Okwu, O.J. & Umoru, B. I. 2019. A study of women farmers' agricultural information needs and accessibility: A case study of Apa Local Government Area of Benue State, Nigeria. *African Journal of Gender and Women Studies* 4 (2) 001-007. Available: http://awdflibrary.org/bitstream/handle/123456789/941/A%20study%20of%20women%20farmers%e2%80%99%20agricultural%20information%20needs%20and%20accessibility%20A%20case%20study%20of%20Apa%20Local%20Government%20Area%20of%2

0Benue%20State%2c%20Nigeria.pdf?sequence=1&isAllowed=y (Accessed 29 October 2019).

Oladele, O.I. 2011. Effects of Information Communication Technology on agricultural information access among researchers, extension agents, and farmers in South Western Nigeria. *Journal of Agricultural & Food Information, 12(2): 167-176*. Available: DOI: 10.1080/10496505.2011.563229 (Accessed 22 October 2019).

Oliveira, T. and Martins, M. 2011. Literature review of information technology adoption models at firm level. *Electronic Journal of Information*, 14(1): 110–121.

Ommani, AR & Chizari, M. 2008. Information dissemination system (IDS) based e-learning in agricultural of Iran: perception of Iranian extension agents. *World Academy of Science, Engineering and Technology* 38:468-472. Available:

ebscohost.com/c/articles/35598909/information-dissemination-system-ids-based-e-learning-agricultural-iran-perception-iranian-extension-agents (Accessed 07 July 2018).

Oxford Reference. 2018. Proportionate stratified sampling. Available: http://www.oxfordreference.com/view/10.1093/oi/authority.20110803100349910 (Accessed 29 September 2018).

Postal And Telecommunications Regulatory Authority Of Zimbabwe (POTRAZ). 2015. Postal and Telecommunications Sector performance report . 4. Available: https://www.potraz.gov.zw/images/documents/Sector_Perfomance_march.pdf (Accessed 6 November 2017).

Palmer, N. 2012. Using ICT to enable agricultural innovation systems for smallholders. Available: http://www.fao.org/docrep/018/ar130e/ar130e.pdf (Accessed 07 July 2017).

POTRAZ. 2017. The status of mobile penetration and active mobile subscriptions in Zimbabwe. Available: https://www.techzim.co.zw/tech_events/ (Accessed 15 March 2018).

POTRAZ. 2018. Abridged postal & telecommunication sector performance report second quarter 2018. Available: https://t3n9sm.c2.acecdn.net/wp-content/uploads/2018/10/Abridged-Sector-Performance-report-Second-Quarter-2018-final.pdf (Accessed 27 May 2019).

Purnomo, SH & Lee, YH. 2010. An assessment of readiness and barriers towards ICT programme implementation: perceptions of agricultural extension officers in Indonesia.

International Journal of Education and Development using Information and Communication Technology (IJEDICT) 6(3):19-36 Available: https://files.eric.ed.gov/fulltext/EJ1085021.pdf (Accessed 27 April 2018).

Raj, S. 2013. Agriculture prototype for knowledge facilitation among tribal farmers of North-East India: innovations, impact and lessons. *The Journal of Agricultural and Extension*. 19(2):113-131. Available: http://dx.doi.org/10.1080/1389224X.2012.718247. (Accessed 25 June 2018).

Ramamurthy, G.C. 2015. *Research methodology*. New Delhi: Dreamtech Press.

Rana, N.P and Dwivedi, Y.K 2015. Citizen's adoption of an e-government system: Validating extended social cognitive theory (SCT). Government Information Quarterly. 32(2) 172-181. Availabe: http://daneshyari.com/article/preview/1024274.pdf (Accessed 30 May 2018).

Rashid, A.T. & Elder, L. 2009. Mobile phones and development: An analysis of IDRC-Supported Projects. *Electronic Journal of Information Systems in Developing Countries*. 36 (2). Available: https://onlinelibrary.wiley.com/doi/abs/10.1002/j.1681-4835.2009.tb00249.x (Accessed 27 June 2018).

Rees, D., Momanyi, M., Wekundah, J., Ndungu, F., Odondi, J Oyure, A. O. , Andima, D. Kamau, M., Ndubi, J., Musembi, Lucy Mwaur, F. & Joldersma, R. 2000. Agricultural knowledge and information systems in kenya – implications for technology dissemination and development. *Agricultural Research& Extension NetworkNetwork* (107). Available: https://s3.amazonaws.com/academia.edu.documents/35788423/agrenpaper_107.pdf?response-content-disposition=inline%3B%20filename%3DAGRICULTURAL_KNOWLEDGE_AND_INFORMATION_S.pdf&X-Amz-Algorithm=AWS4-HMAC-SHA256&X-Amz-Credential=AKIAIWOWYYGZ2Y53UL3A%2F20190704%2Fus-east-1%2Fs3%2Faws4_request&X-Amz-Date=20190704T141058Z&X-Amz-Expires=3600&X-Amz-SignedHeaders=host&X-Amz- (Accessed 04 July 2019).

Richardson, D. 1997. ICTs-transforming agricultural extension: report of the 6th consultative expert meeting of CTA's observatory on ICTs. Available: http://internships.cta.int/observatory2003/Proceedings2003.pdf (Accessed 16 May 2018).

Rimando, TJ. 2004. Fundamentals of crop science. Available: http://www.cropsreview.com/what-is-agriculture.html (Accessed 28 March 2017).

Rogers, E. M. 1995. *Diffusion of innovations. 3rd. ed.* Free Press: New York.

Rogers, E. M. 2003. *Diffusion of innovations. 5th. ed.* Free Press: New York.

Ruderstam, K.E. & Newton, R.R. 2007. Surviving your dissertation: a comprehensive

Rukuni M, Eicher CK & MJ Blackie (eds). 2006. *Zimbabwe's agricultural revolution, revisited*. Harare: University of Zimbabwe Publications.

Salau, E.S & Saingbe, N.D. 2008. Access and utilisation of information and communication technologies (ICTs) among agricultural researchers and extension workers in selected institutions in Nasarawa State of Nigeria. Available: http://patnsukjournal.net/Vol4No2/p1.pdf (Accessed 27 April 2018).

Samhita 2012. Reuters Market Light (RML). Available: http://www.samhita.org/social-organisation/reuters-market-light-rml/ (Accessed 19 July 2018).

Sani, B.M, Omenesa, Z., Sambo, I.Abdullahi, J and Yuguda, M. 2014. Effect of targeted agricultural information delivery approach on farmers' access to agricultural information in Nigeria*. Journal of Agricultural & Food Information* .16(1). Available: https://doi.org/10.1080/10496505.2014.984038 *(Accessed 1 June 2019).*

Saravanan, R. 2011. e-Arik: Using ICTs to facilitate climate-smart Aariculture among tribal farmers of North-East India. Available: http://www.fao.org/e-agriculture/sites/default/files/uploads/media/ICT%20Case%20Study_Climate%20Change_eArik_0.pdf (Accessed 06 September 2018).

Saunders, M.L.P., Lewis, P. & Thornhill, A. 2003. *Research methods for business students.* Harlow: Prentice Hall.

Sekabira, H. & Qaim, M. 2017. Can mobile phones improve gender equality and nutrition? Panel data evidence from farm households in Uganda. Available**:**

https://www.sciencedirect.com/science/article/pii/S0306919217303093 (Accessed 20 July 2018).

Singh, B. Narwal, R.S. Malik, J.S. & Singh, C.C. 2003.Communication sources used by extension personnel and farmers Available: http://agris.fao.org/agris-search/search.do?recordID=IN2006000057 (Accessed 20 June 2018).

Singh, K. 2007. *Quantitative social research methods*. Los Angeles: SAGE

Sturges, J & Sturges, P (eds). 1997. *International encyclopedia of information and library science.* London: Routledge.

Snyder, J. L. and Lee-Partridge, J. E. 2009. Understanding choice of information and communication channels in knowledge Sharing. ICIS 2009 proceedings paper 105. Available: http://aisel.aisnet.org/icis2009/10 (Accessed on 03 September 2018).

Takawira, D. 2018 Challenges and opportunities in climate-resilient agriculture for gender equality and empowerment of rural women and girls. Report from International Fund for Agricultural Development. Available:

https://reliefweb.int/report/zimbabwe/rural-women-and-agriculture-zimbabwe (Accessed 27 May 2019).

Tadesse, G. and Bahiigwa, G. 2015. Mobile phones and farmers' marketing decisions in Ethiopia. World Development, 68, 296–307. Available: https://reader.elsevier.com/reader/sd/pii/S0305750X14004082?token=F4C50A1AC143B5E017D4B6A4A47752C52C2426720C592068BA262DAC2BA6ADB403551DE6802AE4AD70972B48325A40D6 (Accessed 28 June 2018).

Taylor, P.C., & Medina, M.N.D. (2013). Educational research paradigms: From positivism to multiparadigmatic. *Journal for Meaning- Centered Education,1. Available: http://www.meaningcentered.org/journal/volume-01/educational-research-paradigms-from-positivism-to-multiparadigmatic/ (Accessed 22 April 2018).*

TBI Team 2018. What Connects a Corporate Giant, Farmers and we the Consumer? Meet ITC e-Choupal. Available: https://www.thebetterindia.com/126690/connects-corporate-farmers-consumer-itc-e-choupal/ (Accessed 06 September 2018).

Tegegn, M. and Dafisa, A. 2017. Review on potential of mobile phone usage in agricultural information dissemination in Ethiopia. *International Journal of Scientific and Research Publications*, 7(12). Available: http://www.ijsrp.org/research-paper-1217/ijsrp-p7212.pdf (Accessed 22 August 2018).

Tologbonse, D. Fashola, O & Obadiah, M. 2008. Policy Issues in Meeting Rice Farmers Agricultural Information Needs in Niger State. Journal of Agricultural Extension. 12 (2). Available: https://www.ajol.info/index.php/jae/article/view/47053/33437 (Accessed 28 April 2018).

Trevarthen, A & Michael, K. 2007. Beyond mere compliance of RFID regulations by the farming community: a case study of the Cochrane Dairy Farm: proceedings of the

international conference on the management of mobile business, Toronto. Available:

http://www.emeraldinsight.com/doi/pdfplus/10.1108/09593841111158365 (Accessed 22 June 2018).

UK Essays. 2013. Evaluation of the Diffusion of Innovation Theory. Available: https://www.ukessays.com/essays/business/evaluation-of-the-diffusion-of-innovation-theory-business-essay.php?vref=1 (Accessed 13 June 2018).

United Nation High Commissioner for human rights and the World Health Organisation. 2008. The right to health. Available: https://www.ohchr.org/Documents/Publications/Factsheet31.pdf (Accessed 30 July 2019).

Unisa. 2017. Guidelines and procedures for masters and doctorial students. Unisa: Pretoria.

Unwin, T. (ed). 2009. ICT4D: information and communication technology for development. Cambridge: Cambridge University Press. Available: https://books.google.co.zw/books?hl=en&lr=&id=8WMjHA6nkpAC&oi=fnd&pg=PR6&dq=Unwin,+T.+%28ed%29.+2009.+ICT4D:+Information+and+Communication+Technology+for+Development.+Cambridge:+Cambridge+University+Press&ots=sV0cX12epx&sig=N-arcfgaV06l4q3F9sIPn9xZG48&redir_esc=y#v=onepage&q=Unwin%2C%20T.%20%28ed%29.%202009.%20ICT4D%3A%20Information%20and%20Communication%20Technology%20for%20Development.%20Cambridge%3A%20Cambridge%20University%20Press&f=false (Accessed 29 January 2018).

USAID 2012. ICT and AG profile. Available: https://www.marketlinks.org/sites/marketlinks.org/files/resource/files/CocoaLink%20profile.pdf (Accessed 19 July 2018).

Walliman, N. 2005. *Your research project. A step-by-step guide for the first-time researcher*. 2nd.ed. London: SAGE Publications.

Wani, T.A. & Ali, S.W. 2015. Agriculture prototype for knowledge facilitation among tribal farmers of North-East India: innovations, impact and lessons Journal of General Management Research. 3(2). 101–118. Available: https://s3.amazonaws.com/academia.edu.documents/39801044/Tahir.pdf?response-content-disposition=inline%3B%20filename%3DInnovation_Diffusion_Theory_Review_and_S.pdf&X-Amz-Algorithm=AWS4-HMAC-SHA256&X-Amz-Credential=AKIAIWOWYYGZ2Y53UL3A%2F20191023%2Fus-east-1%2Fs3%2Faws4_request&X-Amz-Date=20191023T121549Z&X-Amz-Expires=3600&X-Amz-SignedHeaders=host&X-Amz-Signature=73b210613481434c0e3834194ff01ed39cc4f7151fe3dc2e8a5d72cd89756f24 (Accessed 22 October 2019).

Webster, J. and Watson, T. 2002. Analyzing the past to prepare for the future: writing a literature review. *Management Information Systems* 26(2). Available*:* http://www.jstor.org/stable/pdf/4132319.pdf (Accessed 02 November 2017).

Whelan, B & Taylor, J. 2013. Precision agriculture for grain production systems. http://samples.sainsburysebooks.co.uk/9780643107489_sample_295423.pdf (Accessed 16 May 2018).

Wilson, T.D. 1994. Fifty years of information progress. *Journal of Documentation Review*. Aslib: London. Available: https://www.scribd.com/document/338654592/Wilson-1994-Information-Needs-and-Uses-Fifty-Years-of-Progress (Accessed 29 January 2018).

The World Bank. 2017. Agriculture and food overview. Available: http://www.worldbank.org/en/topic/agriculture/overview (Accessed on 30 October 2017).

WSIS. 2003. https://www.itu.int/wsis/basic/about.html. (Accessed 24 May 2017).

Wyche, S. and Steinfield, C. 2016. Why don't farmers use cell phones to access market prices? Technology affordances and barriers to market information services adoption in rural Kenya*, Information Technology for Development*, 22 (2), 320-333, Available: https://doi.org/10.1080/02681102.2015.1048184 (Accessed 10 June 2019).

Yaseen, M., Xu, S.W.,Yu, W. and Hassan, S. 2016. Farmers' Access to Agricultural Information Sources: Evidences from Rural Pakistan. Journal of Agricultural Chemistry and Environment. 5(12-19). Available: http://dx.doi.org/10.4236/jacen.2016.51B003 (Accessed 20 August 2018).

Zhang, Y, Wang, I & Duan, Y. 2016. Agricultural information dissemination using ICTs: A review and analysis of information dissemination models in China. *Information Processing In Agriculture 3* (17–29). Available:

https://ac.els-cdn.com/S2214317316000020/1-s2.0-S2214317316000020-main.pdf?_tid=f30fbdef-d1c6-4203-aa3e-25dbe027c683&acdnat=1530089363_bcac63260ef6177258ba664b1393060a

(Accessed 27 June 2018).

Zimbabwe Farmers' Union. 2013. Available:

https://www.facebook.com/ZimbabweFarmersUnionZFU/posts/zfu-esoko-as-farmers-continue-to-face-marketing-challenges-the-zimbabwe-farmers-/478176872299384/ (Accessed 27 April 2018).

Zimbabwe National Statistics Agency (ZimStat) 2012. Mashonaland West Province report. Harare: ZimStat

Zimbabwe National Statistics Agency (ZimStat). 2014. Literacy rate Zimbabwe. Available: http://www.zimstat.co.zw/literacy-rate. (Accessed 13 October 2017).

Zimbabwe National Statistics Agency (ZimStat) 2017. Inter-censal demographic survey. Harare: ZimStat.

APPENDIX A

PARTICIPANT CONSENT INFORMATION

53258827 Mabika

TEMPLATE DOCUMENTS

PARTICIPANT INFORMATION SHEET

Ethics clearance reference number: 2018-DIS-0009
Research permission reference number (if applicable):

15 November 2018

Title: **THE USE OF MOBILE PHONES IN DISSEMINATING AGRICULTURAL INFORMATION TO FARMERS IN MASHONALAND WEST PROVINCE OF ZIMBABWE**

Dear Prospective Participant

My name is Benhildah Mabika and I am doing research with Glenrose Jiyane, a professor and Tinashe Mugwisi a doctor in the Department of Information Science towards a Dphil in Information Science at the University of South Africa. We are inviting you to participate in a study entitled **The use of mobile phones in disseminating agricultural information to farmers in Mashonaland West Province of Zimbabwe.**

WHAT IS THE PURPOSE OF THE STUDY?

I am conducting this research to find out if mobile phones can be used in disseminating agricultural information to farmers in Mashonaland West Province of Zimbabwe with a view to improve on the coverage gap created by the available.

53258827 Mabika

WHY AM I BEING INVITED TO PARTICIPATE?

The research is targeting farmers in Mashonaland West Province and by virtue of you being a farmer in this province you are being invited to participate in this research. Approximately 384 farmers will participate in this research.

WHAT IS THE NATURE OF MY PARTICIPATION IN THIS STUDY?

The study involves the answering of a *questionnaire with closed-ended questions*. The questions on the questionnaire are mainly to find out the information needs of farmers in Mashonaland West Province and also find out if the farmers have access to mobile phones and if they are interested in receiving agricultural information updates through their mobile phones. To answer the questions on the questionnaire a maximum of ten minutes will be required.

CAN I WITHDRAW FROM THIS STUDY EVEN AFTER HAVING AGREED TO PARTICIPATE?

Participation in this research is voluntary and there is no penalty or loss of benefit for not participating in this research. If you do decide to take part, you will be given this information sheet to keep and be asked to sign a written consent form. You are free to decide not to participate in this research, however you cannot withdraw from the research once you completed and submitted the questionnaire. The questionnaire does not indicate *the identity of the participant so there is anonymity.*

WHAT ARE THE POTENTIAL BENEFITS OF TAKING PART IN THIS STUDY?

There benefit of taking part in this research is that if the research recommendations will be adopted by policy makers farmers in your community will improve production as they will be accessing instant information on best farming practices through their phones.

ARE THEIR ANY NEGATIVE CONSEQUENCES FOR ME IF I PARTICIPATE IN THE RESEARCH PROJECT?

There are no risks connected to participating in this research.

53258827 Mabika

WILL THE INFORMATION THAT I CONVEY TO THE RESEARCHER AND MY IDENTITY BE KEPT CONFIDENTIAL?

The respondents' confidentiality and privacy is ascertained, as respondents' contributions and identities will not be disclosed and identities of the respondents will not be traceable. Collected data will be used for the purpose of the research only and access to this data will be available to the researcher, people responsible for making sure that research is done properly, and these include the research supervisors and members of the Research Ethics Review Committee. Respondents' names will not be recorded anywhere in the questionnaire to ensure that responses will not be identified with any respondent. Besides using the research data for the purpose of the research at hand, this data anonymous data may also be used for writing journal articles and conference papers.

HOW WILL THE RESEARCHER(S) PROTECT THE SECURITY OF DATA?

Hard copies of your answers will be stored by the researcher for a minimum period of five years in a locked cupboard/filing cabinet *at the researcher' residence in Harare* for future research or academic purposes; electronic information will be stored on a password protected computer. Future use of the stored data will be subject to further Research Ethics Review and approval if applicable. At the expiry of five years *hard copies of the questionnaires will be shredded and burnt.*

WILL I RECEIVE PAYMENT OR ANY INCENTIVES FOR PARTICIPATING IN THIS STUDY?

There will be no payment or incentive for participating in this research.

HAS THE STUDY RECEIVED ETHICS APPROVAL

This study has received written approval from the Research Ethics Review Committee of the *College of Human Sciences,* Unisa. A copy of the approval letter can be obtained from the researcher if you so wish.

53258827 Mabika

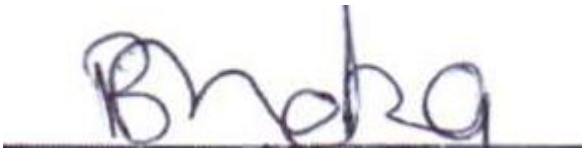
HOW WILL I BE INFORMED OF THE FINDINGS/RESULTS OF THE RESEARCH?

If you would like to be informed of the final research findings, please contact Benhildah Mabika on +263 772 930 819 or email benhildahmasheka@gmail.com The findings are accessible for five years after completion of the research. Should you require any further information or want to contact the researcher about any aspect of this study, please contact contact Benhildah Mabika on +263 772 930 819 or email benhildahmasheka@gmail.com

Should you have concerns about the way in which the research has been conducted, you may contact JiyaneG@unizulu.ac.za or tmugwisi@gmail.com Contact the research ethics chairperson of the College of Human Sciences, if you have any ethical concerns.

Thank you for taking time to read this information sheet and for participating in this study.

Thank you.

 >

Benhildah Mabika

53258827 Mabika

CONSENT TO PARTICIPATE IN THIS STUDY

I, _____ (participant name), confirm that the person asking my consent to take part in this research has told me about the nature, procedure, potential benefits and anticipated inconvenience of participation.

I have read (or had explained to me) and understood the study as explained in the information sheet.

I have had sufficient opportunity to ask questions and am prepared to participate in the study.

I understand that my participation is voluntary and that I cannot withdraw from the research once I responded to the questionnaire.

I am aware that the findings of this study will be processed into a research report, journal publications and/or conference proceedings, but that my participation will be kept confidential unless otherwise specified.

I agree to the recording of the questionnaire.

I have received a signed copy of the informed consent agreement.

Participant Name & Surname…… (please print)

Participant Signature……..Date……

Researcher's Name & Surname……(please print)

Researcher's signature……..Date……

53258827 Mabika

TEMPLATE PERMISSION LETTER

Request for permission to conduct research in Mashonaland West Province

"The use of mobile phones in disseminating agricultural information to farmers in Mashonaland West Province of Zimbabwe"

15 November 2018

Mashonaland West Farmers

Dear Mashonaland West Farmers

I, Benhildah Mabika am doing research with with Glenrose Jiyane, a professor and Tinashe Mugwisi a doctor in the Department of Information Science towards a Dphil in Information Science at the University of South Africa. We are inviting you to participate in a study entitled **The use of mobile phones in disseminating agricultural information to farmers in Mashonaland West Province of Zimbabwe.**

The aim of the study is to find out if mobile phones can be used in disseminating agricultural information to farmers in Mashonaland West Province of Zimbabwe with a view to improve on the coverage gap created by the available initiatives.

The study will entail the collection of data relating to the information needs of farmers in Mashonaland West province of Zimbabwe with intention of investigating whether farmers have access to mobile phones and if these farmers will be interested in receiving agricultural information updates through their mobile phones. Data collection for this research will be done through the use of a questionnaire with closed-ended questions.

The research will be of benefit in that if the recommendations of the research are to reach policy makers and the proposed service is implemented the will be increased production in the farming sector as farmers will be practicing better methods of farming as they will have access to instant information through their mobile phones.

There are no known risks associated in participating in this survey.

Feedback procedure will entail that if you contact the researcher on +263 772930819 or benhildahmasheka@gmail.com

Yours sincerely

Benhildah Mabika

Researcher

APPENDIX B

QUESTIONNAIRE FOR FARMERS

THE USE OF MOBILE PHONES IN DISSEMINATING AGRICULTURAL INFORMATION TO FARMERS IN MASHONALAND WEST PROVINCE OF ZIMBABWE

Date: _____

Part A: Demographic Information

Country: Zimbabwe Province: Mashonaland West

1. District: _____
2. Farm type

○ Communal area

○ Resettlement area

○ Small-scale commercial area

○ Large-scale commercial area

○ Other (specify) _____

3. Gender: _____
4. Age: _____

○ 18-30

○ 31-40

○ 41-50

○ 51 and above

5. Education Level (Highest level attained):

○ None

○ Primary

○ Secondary

○ Tertiary

○ University

○ Other (please specify)_____

PART B: Mobile Phone Access and Use for Agricultural Information

6. Do you have access to a mobile phone?

○ Yes

○ No

7. Do you own a mobile phone?

○ Yes

○ No

8. If the answer in 7 above is yes, what type of mobile phone do you own or have access to? (tick all applicable).

○ Smart phone

○ Ordinary phone

9. Do you have access to the internet on your mobile phone?

- ○ Yes
- ○ No

10. Which network do you subscribe to? (tick all applicable)

- ○ Econet
- ○ NetOne
- ○ Telecel
- ○ Other

11. How good is the Network reception in your area?

- ○ Excellent
- ○ Very good
- ○ Good
- ○ Bad
- ○ Very bad

12. Besides the mobile phone what other ICT tools do you have access to and what do you use them for?

_____
_____
_____
_____
_____
_____

13. What do you use the mobile phone for? (Tick all applicable)

- ○ Making and receiving calls
- ○ Making and receiving messages
- ○ Playing games

○ Internet access

○ Other (specify)_____

14. Do you receive agricultural information on your mobile phone?

○ Yes

○ No

15. If the answer in 14 above is no, would you like to receive agricultural information through your mobile phone?

○ Yes

○ No

16. If the answer in 14 above is yes, what information are you currently receiving through the mobile phone? (Can tick more than one).

○ Crop production

○ Livestock production

○ Poultry production

○ Horticulture

○ Bee farming

○ Aquaculture

○ Crop insurance

○ Credit and loans

○ Weather forecasting

○ Agricultural products markets and prices

○ Agricultural machinery

○ Planting methods

○ Pesticides

Other (please specify)_____

17. Which mobile agricultural information dissemination platforms are you aware of? (can tick more than one)

○ Eco-Farmer

○ Esoko

○ e-Mkambo

○ Kurima Mari

○ None

○ Other (Specify)_____

18. What are the factors limiting the use of mobile phones by farmers in getting agricultural information?

○ Lack of access to mobile phones

○ High costs of mobile phone data

○ Language

○ Other (specify)_____

Part C: Information sources, channels and formats

19. Besides the mobile phone from which other sources and channels are you currently accessing agricultural information? (tick all applicable).

○ Extension workers

○ Field days

○ Other farmers

○ Friends

○ Neighbours

○ Radio (indicate which programmes you listen to).

_____
_____
_____
_____

○ Television (indicate which programmes you view)

_____
_____
_____
_____

○ Newspapers (indicate which newspapers you read)

_____
_____
_____
_____

○ Newsletters (indicate which newsletters do you read)

_____
_____
_____
_____

○ The internet

○ Other
(specify)_____
_____
_____
_____

20. In what format(s) are you receiving this information? (tick all applicable).

○ Print

○ Voice

○ Video

○ Audio-visual

○ SMS

○ MMS

○ Other
(Specify)_____

21. In what format(s) would you prefer receiving agricultural information? (tick all applicable).

○ Print

○ Voice

○ Video

○ Audio-visual

○ SMS

○ MMS

○ Other
(Specify)_____

PART D: Farmers' Information Needs

22. How often do you search for agricultural information?

○ Daily

○ Weekly

○ Every two weeks

○ Monthly

○ Never

23. What agricultural information would you like to be frequently updated on? (can tick more than one)

○ Crop production

○ Livestock production

○ Poultry production

○ Horticulture

○ Bee farming

○ Aquaculture

○ Crop insurance

- ○ Credit and loans
- ○ Weather forecasting
- ○ Agricultural products markets and prices
- ○ Agricultural machinery
- ○ Planting methods
- ○ Pesticides
- ○ Other (Specify)_____

24. Besides agricultural information what other information do you search for and would you like to receive?

_____
_____
_____
_____

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

- ○ English
- ○ Shona
- ○ Ndebele
- ○ Other (please specify) _____

26. What do you suggest should be done to close the mobile phone information dissemination gap which was created by the available platforms like EcoFarmer, Esoko, e-Mkambo and Kurima Mari?

_____
_____
_____
_____
_____

27. Do you think that mobile phones can be used to meet the information needs of farmers?

○ Yes

○ No

28. If your answer is yes to question 27 above, how can mobile phones be used to meet the information needs of farmers?

_____
_____
_____
_____
_____

29. In your opinion what do you think are the benefits of receiving agricultural information through the mobile phone?

_____
_____
_____
_____
_____
_____
_____

Thank you for sparing time to answer this survey!

APPENDIX C

QUESTIONNAIRE FOR NETWORK PROVIDERS AND OTHER AGRICULTURAL STAKEHOLDERS

THE USE OF MOBILE PHONES IN DISSEMINATING AGRICULTURAL INFORMATION TO FARMERS IN MASHONALAND WEST PROVINCE OF ZIMBABWE

Date: _____

Country: Zimbabwe Province: Mashonaland West

6. District: _____
7. Organisation Name _____
8. Type of service provided to farmers

   ○ Agricultural machinery

   ○ Seed

   ○ Fertilisers

   ○ Agro-chemicals

   ○ Network provider

   ○ Other (please specify)_____

9. Do you provide any information to farmers?

   ○ Yes

   ○ No

10. If the answer is yes to 4 above what information are you providing to the farmers and who generates this information?

_____
_____
_____
_____
_____
_____

11. How do you transmit this information to the farmers?

- ○ Radio
- ○ Television
- ○ Farming magazines
- ○ Mobile phone
- ○ Newspapers
- ○ The Internet
- ○ Through farmer field days/gatherings
- ○ Agricultural shows
- ○ Other
  (specify)_____
  _____
  _____
  _____
  _____
  _____

12. In what format(s) are you availing this information? (tick all applicable).

- ○ Print
- ○ Voice
- ○ Video
- ○ Audio-visual

○ SMS

○ MMS

13. Other (Specify)_____

14. In which language(s) do you transmit this information?(tick all applicable).

○ Shona

○ English

○ Other
(Specify)_____
_____

15. How do you view the utilisation of modern technology, and more specifically mobile phones as channels for transmitting agricultural information to farmers?

_____
_____
_____
_____

16. Which mobile agricultural information dissemination platforms are you aware of? (can tick more than one)

○ Eco-Farmer

○ Esoko

○ e-Mkambo

○ Kurima Mari

○ None

○ Other (Specify)_____

17. From the platforms selected in Q.11 above, which ones do you use in disseminating information to farmers?

_____

_____

18. What challenges do you face in transmitting agricultural information to farmers and how can these challenges be solved?

_____
_____
_____
_____
_____

The questions below are for Network Providers only

19. Does your Network cover the whole of Mashonaland West Province?

20. What are the current levels of mobile phone access?

_____
_____
_____

21. What are the current charges for data, voice, sms?

_____
_____
_____
_____
_____
_____

22. Are there any special provisions to groups (farmers included)?

_____
_____
_____
_____

23. What challenges are currently being experienced in service provision?

_____
_____

Thank you for sparing time to answer this survey!