Evaluation of Small-scale Farmers' use of Information Communication Technology for Farm Management in Mahikeng Local Municipality

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Dissertation submitted in fulfilment of the requirements for the degree *Master of Science in Agricultural Extension* at the North West University

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Examination: 20 November 2018

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DECLARATION

I the undersigned declare that:

"Evaluation of Small-scale Farmers' use of Information Communication Technology for Farm Management in Mahikeng Local Municipality"

Is my own work, that all the resources used or quoted have been indicated and acknowledged by means of complete reference, and that this Dissertation has not previously been submitted to any other University in partial or entirely for the award of any degree.

…… …..……

SHEMFE AYOTUNDE OLAITAN **DATE**

DEDICATION

I dedicate this research to God Almighty for giving me the strength and courage to persevere and for His ever sufficient grace. I also dedicate this work to my father and mother for their relentless support spiritually, morally and financially, without your support and encouragements, I would not have possibly made it this far or have the courage to carry on. There were nights I felt like giving up, but your kind words of advice had a way of motivating me: I am forever grateful.

ACKNOWLEDGEMENTS

My sincere thanks go firstly to God Almighty for giving me the grace and strength to persevere, secondly my supervisor, Dr. Sinah Modirwa for her patience and contributions to this research. I am also thankful to the director Rural Environment and Agricultural Development (READ) Mr K.F Mabiletsa for granting the permission and access to small-scale farmers who voluntarily participated in this research. I am also Thankful to Dr. Ayorinde Kolawole, Dr. Olushola Omotayo, Dr. David Olorunshogo, Miss Dieketseng Palesa Maleke, Mr Kenny Lepedi, Mr Iyatuiyi Enioluwa, Mr Christopher Tshwane and Miss Bontle Mokone for all their numerous supports, efforts and contribution at various stages of this research project.

Lastly, I am thankful to the one hundred and twenty-one (121) respondents that voluntarily participated in the project because, without their time and cooperation this entire process wouldn't have been successful: I appreciate your support.

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AIS	Agricultural Innovation System
AKIS	Agricultural Knowledge and Information System
ALIN-EA	Arid Lands Information Network-East Africa
APDIP	Asia-Pacific Development Information Program
ARC	Agricultural Research Council
CD-ROM	Compact Disc-Read Only Memory
CGAP	Consultative Group to Assist the Poor
COLME	Commonwealth of Learning Media Empowerment
CTA-EU	Technical Centre for Agricultural and Rural Cooperation
DAFF	Department of Agriculture Forestry and Fisheries
DOI	Diffusion of Innovation
DVD-ROM	Digital Versatile Disc Read Only Memory
ERP	Extension Recovery Plan
FACET	Fostering Agricultural Competiveness Employing Information Communication Technologies
FAO	Food and Agriculture Organization
FVR	Farmer Voice Radio

GSM	Global System Mobile
I4D	Innovation for Development
ICT	Information Communication Technology
IML	Information Mark-up Language
IPM	Integrated Pest Management
IRRI	International Rice Research Institute
MLM	Mahikeng Local Municipality
NSSO	National Sample Survey Organisation
PAS	Public Address System
PC	Personal Computers
PDA	Personal Data Assistant
SABC	South African Broadcasting Cooperation
SANHANES	South African National Health and Nutrition Examination Survey
SPC	Secretariat of the Pacific Community
TIST	The International Small Group and Tree Planting Alliance
UNCTAD	United Nation Conference of Trade and Development
UNDP	United Nation Development Program

ABSTRACT

The effectiveness and efficiency of small-scale farmers' agricultural production as a means of improving rural livelihood hinges on their access to timely and adequate agricultural information. The study focused on the evaluation of small-scale farmers' use of Information Communication Technology (ICT) for farm management in Mahikeng Local Municipality. Simple random sampling technique was adopted for the study and 320 respondents were randomly selected out of the selected respondents, 121 respondents volunteered to participate and data were collected with a structured questionnaire. The result revealed that farming was male dominated in the study area 63% and the educational level of most respondents were primary education 33%, the majority of respondents were married 51% and their age distribution was mostly 50 years and above 49% and 41 to 50 years 40%. House hold size was mostly 4 to 6 members 59.5%. The farming experience was found to be majorly 11 to 20 years 39.67% and 2-10 years 33.06%. Their farm sizes were mostly 0-2 hectares 47% and 3-6 hectares 39%. In the study, the annual income of respondents was mostly 10,000 to 30,000 Rands 46.3% and 31,000 to 50,000 Rands 32.2%. The majority of respondents were into both crop and animal production 72%, and their major information sources were fellow farmers 35% and extension agents 36%.The majority of respondents 92% in the study were aware of the use of ICT for extension service delivery and 86% of the respondents used ICT in accessing extension services, however, the most available and accessible ICT tools used by respondents were majorly conventional ICT tools such as television 30.87%, radio 27.7% and mobile phone 27.18% Most respondents in the study had a high perception of the use of ICT for farm management this is because none of the mean value was less than 3. Majority of respondents were knowledgeable about the conventional ICT tools such as television 97%, radio 98% and mobile phone 87% but were not knowledgeable on contemporary ICT tools such as the internet 64.5% and video conferencing 90%. Major constraints identified by respondents were poor infrastructures in rural areas 85%, lack of ICT related facilities 79%, data bundles are expensive to purchase 73%, lack of internet connectivity 71%, ICT tools are expensive to purchase 71.1%, The result further showed that educational level was positively significant at $P \leq 0.01$, awareness on the use of ICT for extension and ease of use were both positively significant at $P \leq 0.10$. Gender had a negative significance at $P \leq 0.10$ this implies that the more increase of female farmers in the study area the lesser the use of ICT as most women have little access to ICT devices as compared to men. Information sources also had a

negative significance of P≤0.05. Furthermore, farm size had positive significance P≤0.10 which implies that an increase in farm sizes results in an increase in annual income which makes ICT devices purchasable for respondents with large farm sizes. ICT tools were expensive and had a negative effect at P≤0.10 on respondents' use of ICT. This implies that an increase in the cost of ICT tools will result in small-scale farmers' inability to purchase or use ICT. Lack of internet connectivity had a negative significance at P≤0.10, data bundles are expenses to purchase and lack of ICT related facilities both had a positive significance at P≤0.05. Based on findings it is apparent that small-scale farmers have a high perception on the use of ICT for farm management as it is perceived to enhance their agricultural productivity as well as creating a broader network that helps them make good decisions during transactions. Therefore, it is important for the government and other voluntary organisation to assist small-scale farmers to build ICT infrastructure in the study area.

CHAPTER ONE

INTRODUCTION

1.1 Background of Study

Information is of crucial significant in empowering farmers to improve their livelihood. This implies that essential information such as weather information, storage information, sowing, improving soils, on the lookout for the finest cost of produce, pest control all empower farmers and influences their decision-making. This is because inadequate information on weather conditions, soil erosion, floods, droughts, pests and outbreak of diseases make decision making difficult for farmers (Lokeswari, 2016). However, the timeliness of such information and its relevance to farmers' specific field needs is an uphill task in the face of an increasing shortage of extension staff and other physical and policies related challenges bedevilling extension service delivery. As a result of these problems that are encountered by small-scale farmers, the emergence of Information and Communication Technology (ICT) becomes timely (World Bank, 2011). Nonetheless, farmers' ability to efficiently use these information communication technology platforms in accessing extension services remains very sacrosanct to maximizing the gains of this service delivery option. Furthermore, a forum that provides farmers with the opportunity to reach new markets and power to bargain by interacting with trader and government agencies through information communication technology is lacking (Srivastava, 2018).

In agriculture ICT tools are utilized to disseminate recent information and to enhance the usage of the existing ones. In Many developing countries, different technologies are used for agricultural and economic development (Chhachhar et al., 2014). Kabir (2015) asserted that information and skills gap inhibit the adoption of new technologies by farmers and reduces their technical efficiency. This implies that improved productivity by farmers demands that farmers get relevant information at the right time. However, little success has been accomplished hence broad utilization of contemporary information technologies has to be encouraged and implemented as information is fundamental for encouraging agrarian, rustic advancement and bringing around social and financial changes (Oladele, 2015).

Several efforts have been put in place by agricultural extension agencies, especially the public extension services which have used various approaches, strategies as well as

programmes to make sure that farmers adopt advanced technologies, for instance, the Department of Agriculture Forestry and Fisheries (DAFF) in an endeavour to rejuvenate the outlook of extension service in South Africa launched an Extension Recovery Plan (ERP) in 2011, the programme hinged on 5 principles which included; to guarantee responsibility and detectable quality of extension , to ensure competence and improve the outlook of extension and the involvement of other stakeholders, selection and training of extension officers, re-skilling and re-orientation of extension and to make available ICT infrastructure such as laptops, mobile phones, digital pen and Extension Suite Online (Liebenberg, 2015) .

Consequently, the integration of ICT in agriculture as embedded in the program has rapidly changed the way agricultural technologies are transferred. This therefore, resulted in a transformation in agricultural practices due to farmers improved access to timely and relevant information and sharing knowledge (Agha et al., 2018). Furthermore, the favourable attitude of farmers is required to achieve the benefits of ICT in extension program planning (Raghuprasad et al., 2012). Attitude is described as an intricate group of beliefs, values, feelings and dispositions, which are personified by the way, we reason or feel about certain people, situation or thing, which are a product of a person's life experience (Aiden and McCarthy, 2014). Otherwise stated, attitude is a predisposition to act in one way or another toward an object, situation or person (Johnston, 2011).

According to Shiro (2008), rural dwellers have a positive attitude towards ICT and accept any ICT developments in their communities. Nevertheless, ICT usage amongst this group of people (farmers) is at minimal due to lack of ICT knowledge. This study therefore attempts to assess small-scale farmers' use of ICT for farm management as a means of reliaable and appropriate information about best production practices. The positive attitude of farmers towards ICTs as a support tool that is effective and efficient would result in an effective extension program planning which will in turn change agricultural and rural environment.

1.2 Statement of Problem

Information and knowledge are key elements in the development of agriculture (Munyua, 2007). Although, South African agrifood system is sophisticated, (26%) of South African population is food insecure (Labadarios et al., 2011; SANHANES-1, 2013). Consequently, small-scale farmers are at risk due to limited access to infrastructure, markets, inputs and

small farm holdings of less than two hectares (Von Loeper et al., 2016). This implies that farmers who did not have access to ICT might encounter "digital poverty", which increases vulnerability as well as costs of transactions and these factors could limit small-scale farmers' capability to be inventive as well as partake in markets (Okello et al., 2011). According to Ortmann and King (2006) In South Africa, small-scale farmers access to factors of productions such as credit and relevant information are very limited and these factors constraints market transaction as farmers are confined to sell their produce at prices below the market standard due to lack of adequate information. Small-scale farmers function amidst a composite environment that is influenced by cash flow controlled by banks, retailers, traders, insurance companies and millers (Von Loeper et al., 2016). There is therefore, a need for additional and more robust information access platforms that will make them function well in that context. Oladele (2015), reported that there is much relevant information useful to small-scale farmers. However, such relevant information is dispersed and difficult to locate (Bertolini, 2004). In Africa, the majority of small-scale farmers rely on mediators such as non-governmental organizations (NGOs), extension officers and producer organizations to acquire and share information on the invention in soil fertility, weather forecasting, pest management, irrigation and crop varieties among others. Therefore, priority needs to be given to ensure small-scale famers have broader access to that relevant information in a manner that is cost effective (Oladele, 2015). Although, there have been several kinds of literatures evaluating the use of ICT in the dissemination of information to farmers, little attempt has been made to evaluate small-scale farmers' use of ICT in farm management. This study therefore attempts to evaluate small-scale farmers' use of ICT for farm management by asking the following pertinent policy questions:

1.3 Research Questions

- What are the socioeconomic characteristics of small-scale farmers?
- What are the available information communication technologies accessible to small-scale-farmers?
- What are the small-scale farmers' perceptions of the identified information communication technologies?
- What are the small-scale farmers' knowledge of the prominent information communication technologies?

- What are the constraints to small-scale farmers' use of information communication technology?

1.4 Research Objectives

The main objective of this study is to evaluate small-scale farmer' use of information communication technology for farm management in Mahikeng Local Municipality. The specific objectives are:

- To describe small-scale farmers' socioeconomic characteristics.
- To identify the available information communication technologies accessible to the small-scale farmers.
- To determine small-scale farmers' perceptions on identified information communication technologies
- To determine small-scale farmers' knowledge of the identified information communication technologies.
- To identify the constraints to small-scale farmers', use of information communication technologies.

1.5 Hypothesis of the Study

The hypotheses are stated in their null forms

HYPOTHESIS 1: there is no significant relationship between small-scale farmers' socio-economic/personal characteristics and their perception towards the use of ICT for farm management.

HYPOTHESIS 2: there is no significant relationship between small-scale farmers' socio-economic/personal characteristics and their constraints in the use of ICT.

1.6 Justification of the Study

ICT is an important tool in the dissemination of agricultural information to farmers. Through ICT the gap between agricultural extension agents and farmers could be bridged easily as farmers can have access to adequate information in a timely manner. The study is therefore expected to contribute to the advancement of knowledge to farmers for the adoption of better farming practices. Adequate development and implementations of ICT agricultural communication sources and channels were examined. The study therefore should accelerate small-scale farmers' adoption of agricultural technology by the findings. This will be ensured by improving dissemination and access of ICT agricultural based information amongst the rural communities in the study which would assist in developing small-scale farmers towards food security in the form of optimal production and profit making.

1.7 Limitation of the Study

In research, a limitation of the study is an aspect of the study, which the researcher knows, may undesirably affect the results of the study, but over which the researcher cannot control (Orodho, 2010). The study dealt with selected ICT tools; radio, TV, mobile phone, computer, internet, video conferencing, digital camera, CD-ROM/DVD-ROM used in communicating agricultural information to small-scale farmers. The study was limited to small-scale farmers in Mahikeng Local Municipality due to financial, time and transport constraints.

1.8 Outline of chapters

The dissertation consists of five chapters. Chapter one discusses the background of the study, the statement of problem, research questions, objectives of the study, hypothesis, justification of study as well as its limitations. Chapter two provides a theoretical and conceptual framework of the study, which is followed by a review of previous literature which includes a brief introduction to ICT, providers of agricultural information, use of ICT in agricultural extension services, types of ICT tools used for extension service delivery and constraints to small-scale farmers use of ICT. In the third chapter, the first section highlights the geographical description of the area as well as their economic activities while the other

sections dealing with research methodologies and procedure used for the study. Chapter four presents the results and discussion. Chapter five consists of the summary, conclusions and recommendations.

1.9 Definition of terms

Information Communication Technology (ICT): Theses can be described as devices, tools or application that supports the exchange or collection of data through interaction or transmission.

Small-scale farmers: A group of individuals who reside mostly in the rural areas and engage in agricultural production of crops and livestock on a small piece of land without using advanced and expensive technologies.

Farm Management: these are activities carried out by a farmer in the on-going management of his or her farm and for which advice may be available from professional specialist and extension agents. It is the science (and art) of optimizing the use of resources in the farm component of farm-households.

Extension service: An organisation established by the Department of Agriculture to support and educate farmers on best agricultural practices and technologies for optimal production and profit making to improve rural livelihood.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter examines relevant literature based on the objectives of the study. The essence of literature review is to look at previous and recent literatures in comparison with current research. The aim is to indicate the loop holes in the previous and recent literature so as to have a better knowledge of the phenomenon. The literature review for this study covered sections on sources of agricultural information, use of ICT in extension service delivery, types of ICT tools used for extension service delivery as well as constraints to farmers' use of ICT.

2.1 Providers of Agricultural information

Agricultural knowledge sources comprise both scientific research and indigenous knowledge. After creating, sourcing and gathering information, the information needs to be transmitted to consumers to aid the innovation process (Muburu, 2013). Consequently, ICT is a key element in the promotion of fast, well-organized and cost-effective knowledge management. In some countries in Sub-Saharan Africa, small-scale farmers receive advice relating to technology, markets, cost of inputs and outputs through ICT kiosks United Nations Development Program (UNDP, 2012). This implies that ICT is a key player in agriculture because it facilitates sharing of information within as well as among 12 varieties of agricultural sector networks together with researchers, exporters, extension services and farmers (Jayathilake, 2008). Furthermore, information is a vital resource in rural and agricultural development

because it emphasises the need for information communication in extension aimed at promoting agricultural development (Sanusi, 2010). Also, the recent use of new ICT, particularly computers, the internet and mobile phones, has led to an ongoing change in agriculture through innovation that is largely supported through information sharing and exchange between agricultural stakeholders (Maru and Pesce, 2008). However, the emergence of a digital split in the world's population is not just a problem of ICT accessibility, but the lack of skills required to utilize ICT effectively (Xiaolan, 2011).

2.1.1 Public service extension

According to Singh et al. (2013), the Directorates of Extension Education in Agricultural Extension in India is faced with revitalising the quality and adequacy of information disseminated to farmers by organising fairs and field days for farmers. Through this platform, farmers are opportune to see recent innovation and technology that has been tested and certified as relevant to farm activities. These innovations have been displayed for farmers to have better knowledge in order to enable a face to face interaction between farmers and researchers. In addition, the directorate organises training programmes on crop production, protection, and storage etc. for men and women that engaged in farming. This familiarises them with the innovation and serves as a means of increasing farmers' income through the adoption of new technologies. Also, in South Africa through the use of ICT the government has facilitated the agricultural sector by improving public service delivery as well as socio-development (Maumbe, 2010).

2.1.2 Universities as providers of agricultural information

According to Singh et al (2013), the Directorate of extension education in collaboration with agricultural universities in India usually hosts a talk show where university agricultural experts discuss issues and trends in farming and agriculture in general and this programme has been broadcasted simultaneously in all radio stations in India. Also, researchers host radio and television talks frequently so that rural communities can benefit as well as ask questions on their experiences during farming. The university employs the radio and a public

television station was known as “Doordashan” to cover specific practices such as farm field days and farmers training etc.

2.1.3 Private Sectors Extension Services

According to the World Bank Group (2017), several private extension officers have adopted the use of ICT in facilitating farmers’ access to relevant agricultural information. The introduction of ICT particularly the mobile phone has reduced challenges in supply chain management. By so doing, this platform allows farmers more access to information on cost of products, weather, seed inputs as well as most suitable practices in agriculture. Also, the private sector extension through ICT has been able to connect small-scale farmers on a more global level which enables them to share their knowledge and experiences with fellow farmers which in turn increases their agricultural productivity and livelihood (World Bank Group, 2017).

2.2 Use of Information Communication Technologies in Extension Service Delivery

Agriculture is encountering new challenges as the rise in prices of food have resulted in poverty for over 40 million people since 2010. Consequently, there is a need for a more efficient strategy to address these problems (The World Bank, 2011). The increasing growth of the world population which is estimated to reach nine (9) billion by 2050 has resulted in increased demand for food which puts pressure on the little available resources for consumption. To meet this demand food production has to be increased to about 70 percent (FAO, 2009). Subsequently, the emergence of information communication technology is timely (The World Bank, 2011). This means ICT has the potential to improve social organisations and productivity in agriculture if nurtured effectively. Although, the quest to find solutions to agricultural production challenges and answers to abundant information needs of farmers as being an uphill task for both actors in the public and private sector, this gap has been narrowed with the emergence of ICT which depicts unbelievable prospects in the improvement of agriculture especially in countries that are developing (The World Bank, 2011).

The terms information and communication technology encompass electronic devices such as television, fax, telephone, video and voice information systems (Warren, 2002). Also, ICTs consist of a set of varieties of technologies such as microprocessor, computer, multimedia and information processing, World Wide Web technologies, broadcasting network and telecommunication (Dzidonu, 2010). Inclusively, ICTs are a collection of electronic technologies which when joined in new configurations are adaptable, flexible, enabling and have capabilities of changing organizations and redefining social relations (Ahuja, 2011). Furthermore, ICTs are genuine sources of information and knowledge for people and farmers inclusively, which decreases the detachment among different communities of the world (Herselman, 2003).

Since the emergence of ICT there have been substantial changes in agriculture specifically the way knowledge and information has been shared and transferred amongst farmers through the use of various technologies. Additionally, ICT embodies the formation of knowledge in rural areas of developing countries which has the capacity to transfer information and knowledge well gathered for rural and agricultural development (Chhachhar et al., 2014). This implies that the role of ICT in agriculture as a means rural development is significant and cannot be overemphasized.

Over the past two decades, the use of ICT in agriculture and rural development has spread rapidly in all sectors of the society and also played a key role in rural development as well as generating remarkable outcomes in nearly all parts of rural life (Fawole and Olajide, 2012). Taragola and Van Lierde (2010) affirm that the use of ICT has played a significant and efficient role in developing agriculture and influencing decisions made by farmers in different communities in various countries.

According to Ekbia and Evans (2009), ICT has the prospects to transfer adequate information amongst small-scale farmers. Likewise, the television, mobile phones, internet and radio are all capable of transferring information that is timely to assist in decision making on how to use resource judiciously to enhance productivity and maximize profit. Furthermore, in recent times ICT has been integrated into agricultural projects and this has generated fruitful results in rural and agricultural development (Chhachhar et al., 2014). Evidently, ICT can be utilized for distance learning programs which can assist farmers to learn new approaches and technologies in improving their agricultural practices which results in agricultural and rural development in developing countries (Chhachhar et al., 2014).

Previous researches revealed that farmers who use ICT for agricultural practices have successfully increased their production, information and knowledge. Likewise, those who utilized the e-services and e-commerce applications also have an increase in their income (Sideridis et al., 2010). This implies that if ICT is effectively distributed, it will make agriculture more attractive through improved production and costs of the transaction which will in turn increase income of farmers by supplying valuable agricultural information useful to stakeholders (Rao, 2007).

Swanson and Rajalahti (2010) believe that ICT is not a remedy to the problems of rural development, but it has the prospect of enabling rural communities in bridging traditional barriers to development, by increasing access to information, enlarging the market base, creating employment opportunities and making government services work better. From the above review of the literature, it is evident that the adoption and use of ICT in Africa over the past two years has been exceptional. Furthermore, information communication technologies, specifically mobile communication technology has led to an increase in the growth of communications in Africa (Kayisire and Wei, 2016). In 2012, Mobile phones subscribers in Africa were estimated to be around 650 million which was way higher compared to subscription rate in the United States of America and the European Union. These statistics show that Africa has rapid telecommunication growth (Yonazi et al., 2012). In spite of the substantial increase in ICT adoption rate in Africa, the ability to transform its effectiveness to increase production and maximise profit has not been achieved (UNCTAD, 2008). Consequently, studies have examined the factors that determine the adoption and use of ICT in Africa.

2.3 Types of ICT Tools Used for Extension Service Delivery

The Food Agricultural Organization (FAO, 2006) has expressed that the combination of conventional information and techniques of dissemination with innovative forms of extension delivery will support and increase information accessibility to farmers and cultivating communities. ICT tools, for example; phone (GSM), radio, TV, the net, cameras, video, e-mail, computer, contact databases and system, Compact disc ROM, DVD, video conferencing and rural radio have exceptional potential for utilization in agricultural extension. Above all, the primary focus must be on the general population who will use these innovations and

substance as opposed to the advancements themselves (Mabe, 2011). Most farmers depend upon a few sources of information and technologies. In many social orders, the utilization of face-to-face interaction is as yet the most generally utilized method of correspondence. Notwithstanding, because of the vast populace to be taken care of by the extension agents, the uniqueness and distant locations of farmers, the utilization of a face-to-face method of communication is not always possible. Thus, different strategies and communication channels, for example, radio, print, video, TV, mobile phones, phones, web and so forth are combined to guarantee productive extension services delivery.

As indicated by Rivera and Sulaiman (2009), distinctive methods of conveying extension services utilizing ICT channels in a maintainable and scalable way have been recognized. As often as possible, a recent ICT tool such as cell-phone administration is joined with older ICT tool for instance the radio that has been in vogue for a long time in sub-Saharan Africa and for quite a long time all around the world. It is consequently critical to promoting the utilization of ICT combined with the strategic utilization of conventional media so as to reduce the margin between those who have access to extension services as well as those who do not have access because the use of ICT is presently progressively accessible and more moderate (Mabe, 2011). Nonetheless, the link between ICT apparatuses and other conventional mediums of communication depends on the nearby circumstances and realities. ICT enables access to information and networks which is one of the shortcomings of the present extension systems.

The recent model of extension service delivery highlights bottom up approach as well as the relevance of native culture. Secondly, the new ICT such as internet and mobile phone is not designed to only reach a large number of people at a time, they are also designed to serve particular audiences which could be a small group of people who share common interests and this platform makes it possible to share useful information. Additionally, the mass media majorly focuses on the development of the nation as a whole, contemporary ICTs can however serve as tools for development at local and community levels. Subsequently, for technology to be implemented successfully, voluntary and sustainable participation is essential. Though contemporary ICTs can be difficult to implement, it has the ability to reach specific individuals compared to the conventional ICTs such as television, which operates mostly within a national power driven environment.

This implies that the most critical distinction between conventional and contemporary ICTs is within the ability possessed by this innovation. The conceivable outcomes of the ICTs have become flexible as it embodies "speed, the convergence of media forms; interactivity and specificity" (Lie, 2006). Besides, Lie (2006) posited that within Agricultural Extension Frameworks, one of the developing transformations is the recent innovations in information and communication.

The real focal point of introducing ICTs to rural dwellers appears to lie upon tele-centres or cybercafés. The two noteworthy ICTs in discourses appear to be the utilization of the web and the utilization of cell phones, in spite of the fact that there is by all accounts a lesser fixation on cell phones.

2.3.1 Radio

The use of Radio has yielded remarkable outcomes in the supply of information that is useful to farmers and farming communities at large. It is considered a powerful tool for communication because of its ubiquitous nature. For instance, previous study of fifteen (15) villages in Nepal indicated that radio was generally used in all the villages as farmers listen to them while working in the fields. Moreover, in Zambia where another survey was carried out twenty-one thousand (21,000) farmers joined in farm forums which were radio based and 90 percent affirmed that radio programmes were useful and while 50 percent acknowledged that the platforms have assisted in improving their agricultural productivity (Dodds, 1999). The relevance of ICTs in achieving the objectives of extension officers and farming communities has been indicated through community radio projects. For example, two-community radio stations were created in Nepal, radio Lumbini in Manigram west of Nepal and radio Madan Pokhara in Palpa District. As indicated from the survey, there has been a (68%) increase in the number of those who have personal radio receivers which they use to listen to agricultural programmes. Such radio programmes include valuable improvement messages: in the case of Sri Lanka, the Kothmale community radio station serves as a cross point amongst small-scale farmers in distant areas. Subsequently, when programmes are aired, community members are given the privilege to request for information related to agriculture, while the host of the programme search the internet sources for answers to the caller requests which is then described for better understanding of the listeners (UNDP, 2004). In the case of Ghana for example, farmers are provided with agricultural information about agricultural practices through the use of the community radio station. Also, extension officers organise

programmes that entail agricultural activities where they engage with rural community members on key issues that affect the community as well as agricultural practices (Mabe, 2011). Comprehensively, small-scale farmers are opportune to listen to individuals within their communities talking over the prioritized issues in their native language. Arid Lands Information Network-East Africa (ALIN-EA), collaborated with World Space Foundation. Alin-EA utilizes advanced satellite radio broadcasting to supply web-based information to small-scale farmers in Ethiopia, Kenya, Tanzania and Uganda (Mabe, 2011).

In Kenya, smallholder farmers have access to agricultural news and information relating to business and market needs through a weekly hour long radio program known as "Mali Shambani". This program encompasses numerous issues such as financing opportunities, funding, price of produce, seed inputs, land use, weather and seasonal issues and others. Additionally, a phone-in section is implemented in the programme so that farmers can ask agricultural questions to experts. This could be either through a voice call or text messages (FACET, 2010). Furthermore, Rivera and Sulaiman (2009), posit that Farmer Voice Radio (FVR) is a radio extension service currently functioning in Kenya, Malawi, Tanzania, Mali, Ghana and Zambia and its targets are small-scale farmers. FVR's radio extension agents influence available regular, on-site extension support prepared to help the small group of pre-selected farmers, the information gathered is then recorded and communicated using radio.

2.3.2 Television, Videocassette, VCD and DVD

Television as reported by the United Nations Development Programme (UNDP, 2004), is commonly cited as having significant potential for development. It offers programs with motion pictures and sounds that are not available to smallholders, using standardized technologies that are readily available. Television programs are either recorded before or live and interactively, whereby smallholders can phone in for relevant contribution. In recent times, television programmes can be screened on the internet. Also community groups, families and individuals can share Videocassettes, VCDs and DVDs amongst one another for self-learning. The use of television for disseminating and sharing agricultural information aimed at enhancing agricultural development and growth is evident and pre dominantly used in China, it includes the TV University and agricultural TV stations. Additionally, as evident in Vietnam, the local Television stations work with two universities in the Mekong Delta Region to broadcast week after week farmers' workshops that are seen via numerous farmers

and the rural communities at large (UNDP 2004). In the same manner, the South African Broadcasting Cooperation (SABC) collaborated with the Department of Rural Development and Land Reform in showcasing various Agricultural television programmes. The particular point of this farming television programme is to give applicable information identified with agribusiness, land reform and rural development. It is additionally focused at informing viewers of the most recent development and land reform whereas teaching by strategies of practical information on topics ranging from irrigation system innovation, animal health and vegetable production.

2.3.3 Video and digital video cameras

In extension service, the use of video and digital video cameras is evolving as useful tools for extension service delivery. With the support of these tools, small-scale farmers can capture visuals and converse with subject matter specialists on the challenges they encounter during farming. The recorded video and photographs could be shared via email or instant messaging which subsequently supports interactive and joint problem solving (Mabe, 2011). According to Commonwealth of Learning Media Empowerment (COLME) while working with in-country agencies in the Caribbean and Ghana, it identifies rural community needs and trains extension workers in shooting and editing videos using local content. A large number of farmers are served with these tapes which balance the extension services coverage. Through the programme literacy training is provided for small-scale farmers, women in Ghana, and those who engage in agricultural businesses and a sustainable environment in the Caribbean. This is evident in India; specific information that encompasses agriculture is disseminated by the Digital Green via digital media to small-scale and marginal farmers. The system consists of a digital video database designed for farmers by farmers. Participants for each village are given television, digital visual display (DVD) player as well as video cameras operated by local NGO staffs which are managed by farmers, alongside the DVDs shipped to the villages. On a rotational basis, nightly viewings are set up at various regions in the village for small groups of farmers ranging from 10 to 20 (FACET, 2010).

2.3.4 Telephone

In many countries, governments attempt to implement certain polices to ensure affordable telephone services so as to increase its accessibility, sadly some countries do not have

adequate telephone lines. In Bangladesh, there is a microfinance organization called “the Grammeen Bank” that supports farmers and community members by leasing mobile phones to them, this development has benefited both farmers and the rural communities at large. Phones serve as tools for sharing information relating to price, health and business. Besides, the information that has been generated and shared has led to better costs for outputs and inputs, made it easier to search for jobs, better return on investment and reduction in death of poultry and livestock (Mabe, 2011). Ownership of telephone serves as additional income as they provide services to others within the community and rural individuals account for one-fourth of all the phone calls made (Bayes et al., 1999.). According to Bayes et al. (1999), in rural communities the availability of phones gives additional benefits to the community such as improved law enforcement, reduction in inequality, and faster and efficient communication during disasters, and stronger kinship bonds.

The United Nations Development Programme (UNDP, 2004) collaborated with the Government of India in a research on villages in India, which discovered that villages, where telephones were available had encountered a reduction in the purchase price of various agricultural commodities and lower future price variability (Mabe, 2011). Furthermore, it was noted that the cost of production was higher in prices in villages that had telephones compared to those that did not have telephones. The farmers affirmed that telephone enabled them in making more appropriate decisions on production choice, and those who used agricultural inputs gained from efficient and reliable supply. Inclusively, better information also improved some sellers’ perception of their position to bargain as both traders and intermediaries (UNDP, 2004). The emergence of telephones in villages provides job searches, emergency therapeutic care becomes accessible and there is the increased capacity to handle unforeseen agricultural hazards (Eggleston et al., 2002). In Nigeria, the use of telephone in extension and rural advisory is yet to be achieved despite the recent emergence of mobile phones as a benefit of democracy. Consequently, this has affected the network of agricultural information within organizations as there is little access to efficient telephone lines (Arokoyo, 2010).

2.3.5 Mobile phones

According to Rivera and Sulaiman (2009), at present varieties of approaches in extension services have tried the use of mobile phones for extension services. However, only a few

have been able to achieve this objective of reaching a large number of farmers, this is due to the time frame of implementation and inadequate research on the approach that is most suitable (Rivera and Sulaiman, 2009).

Apparently, numerous approaches have suitable potentials. However, they vary in numerous ways; it could be either voice calls or text messages. It is therefore important to consider whether the voice call has a "pull effect" on farmers, whereby farmers have an opportunity to ask questions or a "push effect" where by information is sent to farmers or intermediaries through an SMS or voice call (Mabe, 2011). The ability to support a two-way exchange is a significant improvement to service delivery in extension because it permits the service providers a platform for receiving feedbacks frequently in relation to information disseminated to farmers and how well they understand them (Rivera and Sulaiman, 2009).

In the Pacific, the use of mobile phones by extension workers offers much potential, with about 50% of Pacific Islanders having access to mobile phones. The use of mobile phones by extension workers could support disseminating relevant information on price of crops, pests and diseases encountered by farmers. Additionally, the use of mobile phones has been able to link extension agents and farmers in Tonga. Furthermore, The United Nations Conference on Trade and Development (UNCTAD) is assisting to create an effective market information system and a user friendly platform to share information through the use of mobile phones. UNCTAD supports the establishment of a regional information hub that would be based at Secretariat of the Pacific Community (SPC).

2.3.6 Public address systems (PAS)

The public address system is predominantly used in China and Vietnam to deliver public information, announcements and daily news. According to UNDP (2004), one of the communities in Vietnam is preparing to increase its PAS by linking it to the internet in order to acquire relevant information to be broadcasted to the community. The use of a public address system in local areas is prevalent than radio which is less expensive and technically simple. Although studies on communities that are less developed indicate that the use of radio and telephone is the most important ICT tool that can provide small-scale farmers and rural settlers direct access to ICT tools required for changing their lives (Heeks, 1999).

2.3.7 Telecentres, Internet, Computers and SIMputters.

The use of computers and internet will assist extension officers to analyse data, write scientific papers, draw budgets, produce curricula, prepare plan of work and design hand-outs and reach out to farmers more easily (Aboh, 2008). The use of the internet has become the world's most important and efficient medium of communication. It is a two way medium of communication, very fast in nature, a powerful storage tool, reliable for retrieving documentations, less expensive, good for publishing and efficient for disseminating information (Mabe, 2011). Furthermore, through the use of internet new information resources and communication channels can be introduced to rural farmers. In addition, with the use of the internet, documents can be sent by extension agents for example a topic can be discussed in internet groups, and they could publish it afterwards on the website for references and viewing. According to FACET (2010), a computer can be described as a device which has a group of integrated parts that has the ability to modify and interpret data. On the other hand, the web is a free amalgam of PC systems connecting a large number of sites and a huge number of clients around the world.

In a survey carried out by the Asia-Pacific Development Information Programme (APDIP) which was organized by UNDP (2004) in collaboration with the Government of India, the survey indicated that computers and internet are generally made available to rural settlers in the form of community- based telecentres. The establishment of these telecentres provides shared access to computers and the internet. However, these telecentres have various forms, although the key elements are public access and a development orientation. These two key elements are specific characteristics that distinguish cyber cafes from telecentres (Mabe, 2011). According to Mabe (2011), cyber café is a place where people can connect to the internet through the use of publicly accessible computers. Although, the major activity at the cyber café is the internet which enables users to access news feeds, emails, and website browsing, there are also offline applications that are relevant and available to users; Microsoft office suites used to type documents, spreadsheets, PC video games, it can also be used to scan and print documents. Besides, Alao (2010) noticed that cyber cafes can fill in as a successful device for supporting improvement through ICTs, however, the disparity is central, this is on account of telecentres that are development-oriented, have the standard of giving access to a reason and that of actualizing a development agenda. Along these lines, to accomplish this development objective, a community outreach needs to be performed by the telecentres to help decide the types of information used to advance activities for development.

Staffs at the telecentres that have PC abilities act as mediators to assist farmers and community members in accessing and interpreting relevant information to serve its intended purpose.

According to UNDP-APDIP (2004), ICT based service can be provided via telecentres which in turn can generate income, such ICT services include, use of telephone, faxing, emailing, printing , photocopying, word processing and emails. These services provide self-sustainable incomes for telecentre operators. However, there are contradicting opinions which suggests that rural settles used to have free access to ICT based development services provided as public services (Mabe, 2011). Furthermore, the use of telecentres has generated considerable benefits for their set audience as it enables rural farmers to gain skills that can help to increase their productivity, manage simple transactions such as placing orders for inputs, make enquires and search for opinions that can influence their decisions for group or self-development.

Comprehensively, the services given by telecentres have a generally beneficial outcome on rural communities as it promotes improvement which leads to social change (UNDP, 2004). For instance, the International Rice Research Institute (IRRI) provides a comprehensive resource links with the IRRI Rice Web through the Rice Knowledge Bank, which gives information that relates with ongoing practices in the field, for example, new research findings, skills needed for support, methods of technology transfer, materials for training, valuable information and statistics (Mabe, 2011).

In Kenya, there is a call centre known as Kencall which is intended to help farmers and it is staffed by agricultural experts who give agricultural information, support and advice to small-scale farmers via telephone, utilizing voice call to farmers particularly with the exception of text messages (McGuire et al., 2010).

According to Lie (2006), Simputer is a means by which ICT can reach the common man because it is less expensive compared to PCs. Simputers can be described as computers that are handheld in which a SIM card can be inserted for the transmission of data. An extension agent can use simputers to provide relevant market information on prices of inputs which is accessed through a central server. Simputers were designed and developed in India. They play a key role in the developing nations as they it eradicates the perception of illiteracy as it has a hindrance to operating the computer. The basic way to bridge digital split is to create shared devices that are simple and have natural user interfaces based on sight, touch and

audio. The Simputer has the capacity to execute these demands through use of a browser for the Information Markup Language (IML). IML was designed to serve as a uniform experience for users and it permits rapid development of solutions on any platform. The use of this ICT has been tested successfully in Thailand by the Bank for Agriculture and Agricultural Cooperatives (Mabe, 2011). Furthermore, the Simputer was created to serve as a device that enables the masses to access information and most importantly rural farm communities, although, there has been uncertainty from critiques about the intended target groups. As a result, technical issues; power problem, sales and production cost problems as well as economic and socio-cultural issues remain vague. In addition, there are few records of adoption of Simputers in rural change projects. The gap in digital split can be closed through the use of Simputer that runs on Linux, by introducing ICTs and providing infrastructure (Lie, 2006).

In July 2003, a total of six hundred (600) Simputers were sold and about one thousand five hundred (1,500) to two thousand (2,000) were ready for sale by September the same year. (Ganapti, 2003). The only information that appears to be possible on existing undertakings that make utilization of Simputers is the information given by PicoPeta, one of the associations involved in the production of the Simputer (I4D, 2004). At the rise of the new Amida Model of the Simputer in April 2004, the market appears to have floated somewhat to urban dwellers who do not have the purchasing power to possess a personal digital assistant, however, can afford to purchase a Simputer. For urban rich and urban youthful, the Simputer is a reasonable option considering the low value cost. This shift in the market is portrayed by the advertisement strategy utilized (Lie, 2006).

2.3.8 Intranet

The use of intranet is a process that links the internet and rural radio stations together. It entails a group of communication experts who are particularly trained to gather and disseminate information on the internet and also modify the information to fit into the local and cultural context. This group of experts is also trained on radio scripting, interviewing techniques and management of network stations (Mabe, 2011).

2.3.9 Web-based information and learning resources

According to Mabe (2011), web-based information and resources for learning such as customisable information or instructional packages that have text, images, animations or movie clips are growing speedily in number and availability. This customisable information and instructional packages enable smallholder farmers and rural settlers to have their own learning methods and areas of interests, however, computer literacy, internet and cost of products could be an issue that determines farmers' use of these instructional packages. Inclusively, smallholders also need to plan and manage their own learning, differentiate between relevant and false source material and make sound decisions afterwards from the available resources. Zijp (1994), stated that program developers must have the ability to use advanced authoring tools to modify courses for individual needs, while achieving economies of scale by designing for large learning groups.

2.3.10 CD-ROM and DVD-ROM

According Mabe (2011) Compact Disc-Read Only Memory (CD-ROM) and Digital Versatile Disc or Digital Video Disc-Read Only Memory (DVD-ROM) are ICT tools that have storage facilities that when combined with microcomputers, delivers a very fast access to a very large volume of data, which includes, texts, audio, graphics, animation, slides and video in computer accessible learning and demonstration documents. These tools are interactive in nature and can facilitate feedbacks between farmers and extension agents. These programmes are regarded as "multimedia" because they can combine various features such as visual, text, graphics and sound and active learning tasks (Zijp, 1994). Developing agriculture hinges on farmers and those in the rural communities who are accessible to information that could aid their agricultural productions effectively. However, the existing poor communication systems make the dissemination of useful information amongst agricultural stakeholders an uphill task. Furthermore, smallholder farmers need to be computer literate to function effectively, or can be assisted to use the technology although access to computer is a barrier to its operation, mobile computers such as laptops and notebooks serve as potential alternatives for developing nations with little income (Zijp, 1994). Zijp (1994), indicated that CD-ROM is widely utilized in various areas, which includes agriculture, management of natural resources, social sciences as well as medicine. This ICT toot has applications that can store large amounts of materials which are easily retrievable. The use of CD-ROMs facilitates access to enormous and relevant agricultural information to farmers on pests and diseases, which

enables agricultural stakeholders in making decisions on crop management and integrated pest management (IPM), which subsequently will result in increased productivity and reduced environmental effect on agricultural production. CD-ROMs can also be used to provide adequate information on crop protection to extension agents, agricultural intermediaries and farmers as well. For instance, CTA – EU chose agricultural information services in some African countries such as Kenya, Zimbabwe and Zambia. as well as Trinidad and Tobago in the Caribbean to share in an organized project targeted at enhancing national independence in the transfer of scientific agricultural information and to launch PC innovation in the information service of developing nations (Mabe, 2011).

2.4 Constraints to Farmers Use of ICT

Bagchi and Udo (2007) revealed that education, infrastructures and economic development play a key role in ICT adoption. However, Zhao et.al (2008) revealed that adoption of ICT can be determined and influenced based on cultural settings of a society. Inclusively, Andoh-Baidoo et.al (2014) argued that investment in ICT by private sector solely relies upon human development factors. Also, Kapurubandara and Lawson (2008), discussed that the spread of e-commerce has been impeded due to low levels of technological skills. Worku (2010) affirmed that low a literacy rate hinders the adoption of e-banking services in Ethiopia.

Mwessige (2003) identified poverty, high cost of computers and telephones as factors which hinder internet penetration in Uganda and probably in other African countries. Also, Thlabela et al. (2006) stated that ICT access in South Africa can only be improved if the cost of telecommunication services is reduced and issues of infrastructure resolved. Thus, cultural and political conditions should be noted when reviewing ICT adoption in developing and African countries inclusively (Erumban and De Jong, 2006).

Corrales and Westhoff (2006), stated that the political system of a nation determines the use of ICT; this is because ICT adoption causes political concerns. However, Bruno et al. (2003), insist that the determinant factors of ICT adoption in developing countries include cultural conditions, infrastructure, business environment (financial, legal), and social components (e.g. poverty, illiteracy, rate of urbanization and level of education). Furthermore, Raghuprasad et al. (2012), propose that the effective and efficient usage of ICT tools in rural

regions depends solely on the preparedness of the rural people through proper knowledge and attitude in using these tools. Although, studies from Shiro (2008) revealed that people in rural communities have a positive attitude towards ICT and they welcome any project to be built in their areas, their lack of ICT knowledge reduces their usage. Thus, this research is aimed at evaluating small-scale farmers' use of ICT for farm management in Mahikeng Local Municipality, Northwest Province, South Africa.

2.5 Theoretical Frame work of the study

Rogers's theory of Diffusion of Innovation (DOI) examines how information and invention are conveyed over a period. It observes the elements that makes an individual or group accept or reject certain invention. According to Rogers four elements determines the sustainability of an innovation, which are the innovation itself, the channels of communication, time and the social system. In addition, Rogers's theory of Diffusion of Innovation is based on five aspect, which are characteristics of the innovation i.e. of what use is the innovation and how applicable is it?, the decision making process which is mainly influenced by the individual or group knowledge about an innovation, persuasion which is determined by how interested an individual or group is about an innovation which makes them enquire more about the innovation, the actual decision which occurs when individual or group weighs benefit over cost, implementation which occurs after individual or group have decided to try and observe innovation while seeking further information on the innovation and confirmation which occurs after and individual or group has affirmed the usefulness or irrelevance of the innovation. This implies that for small-scale farmers to adopt new technology the perceived usefulness and perceived ease of use and cost of the innovation plays a huge role, this because must smallholder farmers have little education and are likely to reject any innovation that may be perceived as complex or too expensive this could be because must small-scale farmers do not have access to credit and funds. According Freeman and Mubichi (2017) in a study on precision agriculture adoption in Canada affirmed that the "perceived" usefulness and ease of utilizing of technology were significant determinants in the adoption of technology.

2.6 Conceptual Framework of the study

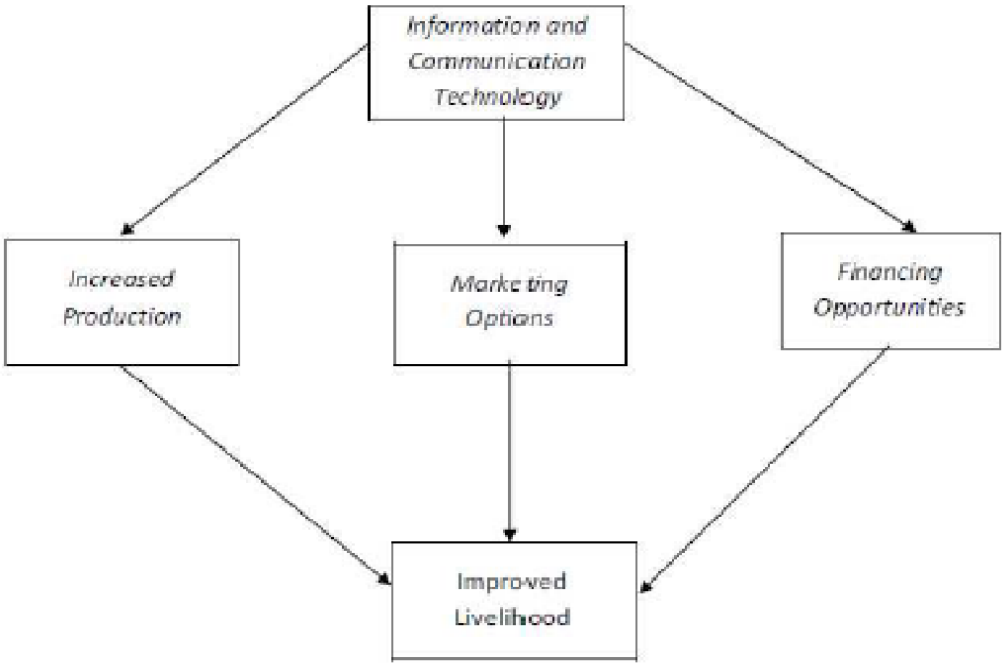

FIGURE 1: Conceptual framework of ICT: Source: Lokeswari (2016)

The conceptual framework of the study as seen in the above figure characterizes the role of ICT in influencing the decision of small-scale farmers who engage in both animal and crop production. The decisions made by small-scale farmers by ICT could lead to the adoption of modern technologies or approaches, which would result in increased production because through ICT small-scale farmer will become aware of more sophisticated and advanced farming practices, which as a result will improve their productivity. In addition, better market options i.e. through ICT small-scale farmers have knowledge about actual prices of produce and inputs, which eliminates risks of high transaction costs and gives small-scale farmers more bargaining power. In addition, the adoption of ICT by small-scale farmers will improve financial opportunities by creating broader network among farmers and subsequently increase farmers' income as well as their livelihood. This implies that the use of ICT by smallholder farmers ICT permits the use of new ideas and knowledge from various sources through improved communication, information and interaction (Mwombe et al., 2013).

2.7 Conclusion

The impact of ICT on agricultural productivity of small-scale farmers which results into improved livelihood as seen from the review of literature cannot be overemphasized. However, for small-scale farmers to adopt new technology, diffusion of Innovation (DOI) ought to be considered as perceived ease of use and perceived usefulness seems to play a major role in adoption of new technology and agricultural practices. This implies that small-scale farmers are likely to adopt new technologies that are considered to be important and easy to operate as most small-scale farmers reside in the rural settlements and have limited skills required due to little or no education, lack of technical know-how and ICT infrastructures.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter is aimed at orientating the reader on the study area such as the demographic characteristics and economic activities of the population of study. Moreover, it outlines the research design, research method as well as data collection strategy which includes, information sources, sampling procedure, data collection tools, reliability of results as well as data analysis.

3.2 Study Area

This study was carried out in Mahikeng Local Municipality which is located in the North West Province of South Africa, 20 kilometres south of the Botswana Border. Mahikeng is the capital city of North West Province and was formally called the city council of Mafikeng, Mafikeng local Municipality. The Municipality is the biggest compared to the other four local municipalities located within the Jurisdiction of Ngaka Modiri-Molema District Municipality. The other four local municipalities which comprise the Ngaka Modiri-Molema are: Ramotsere Moliloa Local Municipality, Tswaing Local Municipality, Ditsobotla Local Municpality. The total area of the municipality is approximately 3 703km^2.The Muncipality is divided into 35 Wards consisting of 107 villages and suburbs. The 2011 official census indicated that the population of Mahikeng Local Municipality was 314 000 (Community Survey ND). It is estimated that the population growth has been 1.16% and there are more women than men in the municipality (Mahikeng Local Municipality, Mid-year annual report 2018). Statistics also indicate that the municipality has the highest population of youth (Mahikeng Local Municipality, Mid-year annual report 2018). The economic activities within

the municipality are Agriculture, Mining Manufacturing, culture, tourism, service and trade (FEED not dated)

Figure 2: Map of Mahikeng Northwest Capital

Source: https://www.sa-venues.com/maps/northwestprovince/mafikeng.php 2013

3.3 Research design

In this study, a descriptive research design was used and this type of design is known as survey research design, which is suitable for investigating a variety of issues and problems. Therefore, a descriptive research design is defined as a scientific method that entails the observation and description of a subject's behaviour without influencing it in any way (Shuttleworth, 2008). For this study, the researcher is focusing on small-scale farmers' use of ICT for farm management in Mahikeng Local Municipality.

3.4 Research method

For this study, the research method used was the quantitative method. The quantitative method can be defined as an examination of social or human problems based on testing of a theory composed of variables measured with statistical numbers and analysed with statistical procedures (Awino, 2009).

3.5 Population of Study

Mugenda and Mugenda (2003) define the target population as the selected population to which a researcher wants to generalize the results of the study. The population of the study area was all small scale farmers in Mahikeng Local municipality and according to records given at the Rural Environment and Agricultural Development (READ), there are 1449 small-scale farmers in Mahikeng local Municipality.

3. 5. 1 Sampling Size and Sampling Technique

According to Sarantakos (1998), the purpose of sampling is to give the researcher a relatively small number of units representing the entire population. To determine the sample size, a table designed by Krejcie and Morgan as quoted by Mburu (2013) was used. The table gave the required sample size for various population sizes and Mahikeng Local Municipality with a population of 1449 small-scale farmers fell under 302 and of the 302 samples only 121

small-scale farmers volunteered to participate. Simple random sampling was used to select respondents for the study to give all respondents equal chances of the being selected.

3.6 Data Collection

A structured questionnaire was used to collect data. The questionnaire consists of five (5) sections. The first section identified the socio economic characteristics of respondents such as age, gender, educational level, marital status, household size, farming experience, farm size, and annual income, type of farm enterprise and sources of agricultural information. The second section focused on the awareness of farmers on the use of ICT in extension service delivery and whether the small-scale farmers use ICT in accessing extension service delivery and the various ICT tools available and accessible by small-scale farmers. The third section elicited information on perception of small-scale farmers' on the use of ICT, while the fourth section focused on Farmers knowledge level on the use of ICT and the fifth section identified the constraints of small-scale farmers in the use of ICT. The questionnaires were self-administered by the researcher.

3.7 Validity and Reliability

A face validity of the questionnaire was done by a panel of experts in Agricultural Extension, Development studies and Agricultural Research. The panel consisted of a Lecturer in Agricultural Extension, Community and Senior Management Officers in the Rural, Environment and Agricultural Development as well as other researchers. To ensure the reliability of the questionnaire, a split half technique was used to determine the reliability coefficient with R=0.61. The questionnaire was tailored to the needs of the subjects to whom it was intended (Bless and Higson-Smith, 2000)

3.8 Measurement of Variables

For the purpose of the study, the independent and dependent variables were measured as follows.

3.8.1 Section 1 (Independent Variables)

The first section of the questionnaire, which consisted of the social economic characteristics of respondents, were measured as follows:

Gender: was measured in a dummy form of 0= Male 1= Female.

Educational Level: was measured on ordinal scale of (0) Informal education (1) Primary education (2) Secondary education (3) College education (4) University education.

Marital Status: was measured on ordinal scale of (0) Single (1) Married (2) Divorced.

Age: was measured at an interval scale of (0) 20-30 (1) 31-40 (2) 41 -50 (3) 51 and above.

House Hold size: was measured at an interval scale of (0) 0-3 (1) 4 -6 (2) 7-10 (3) 11-13 (4) 14 and above.

Farming Experience: the years of respondents' farming experience was measured at an interval scale of (0) 2- 10 (1) 11- 20 (2) 21-30 (3) 31-40 (4) 41-50 (5) 51 and above.

Farm Size: this was measured an interval scale of (0) 1-2 hectares (1) 3-6 hectares (2) 7-10 hectares (3) 11-15 hectares.

Annual Income: was measured at an interval of (0) 10,000- 30,000 Rands (1) 31,000- 50,000 Rands (2) 51,000-70,000 Rands (3) 71,000-90,000 Rands and 91,000 Rands and above.

Type of farm enterprise was measured on a nominal scale of (0) Crop production (1) Animal production (2) Both.

Sources of agricultural information was measured on a nominal scale of (0) extension agent (1) fellow farmers (2) radio.

3.8.2 Section 2 (Dependent Variable)

This section of the questionnaire which focused on awareness of small scale farmers use of ICT for extension service delivery, and whether small scale farmers use ICT in accessing extension services was both measured in a dummy form of (YES or NO), while the various prominent ICT tools used by small-scale farmers were identified using a nominal scale and respondents were allowed to pick more than one ICT tool.

3.8.3 Section 3 (Dependent Variable)

This section of the questionnaire which consisted of farmers' perception on the use of ICT for farm management was measured on a 5point Likert-Scale using strongly agree, agree, undecided, strongly disagree and disagree. Assigned values of 5, 4, 3, 2 and 1 were used to analyse objective 3 which is mathematically represented as:

$$\frac{5+4+3+2+1}{5} = \frac{15}{5} = 3$$

Therefore, a mean of 3 and above was adjudged okay and accepted while any value below 3 were not accepted.

3.8.4 Section 4 (Dependent Variable)

This section of the questionnaire which consisted of small-scale farmers' knowledge level on the services these ICT tools provide was measured in a dummy form of (Knowledgeable or Not Knowledgeable) and it consisted of 12 knowledge statement.

3.8.5 Section 5 (Dependent Variable)

This section which consisted of the constraints to small-scale famers' use of ICT for farm management was measured on 3 point scale using major constraint, minor constraint and not a constraint.

3.9 Data Analyses

3.9.1 Descriptive Statistics

For the purpose of this study collected data were sorted, then coded with Microsoft Office Excel and analysed with Stata 11. Descriptive instruments such as percentages, frequency tables, mean and standard deviation were used in the study. Descriptive statistics was used for objectives (i, ii, iii, ív and v) which are the socio-economic characteristics of the respondent, the perception of the respondents, knowledge and the constraints they encounter in the use of ICT.

3.9.2 Inferential Statistics

Probit regression model of analyses was used for the study. A Probit analysis is a type of regression used to analyse binomial response variables (e.g. Yes or no, success or failure) Finney (1952). The Probit model was used to analyse hypothesis one (1) which assumes that there is no significant relationship between socio economic characteristics of respondents and their perception on the use of ICT for farm management and hypothesis two (2) which assumes that there is no significant relationship between socio-economic characteristics of farmers and their constraints to the use of ICT.

The Probit model is shown as:

$$Zj = \alpha + \beta j \sum_{i=1}^{n} Ij \quad + Ej$$

$$\text{Zi} = \alpha\text{o} + \alpha\text{1X1} + \alpha\text{2X2} + \alpha\text{3X3} + \alpha\text{4X4} + \alpha\text{5X5} + \alpha\text{6X6} + \alpha\text{nXn} + .. + \text{ej}$$

Where Z_j is the binary dependent variable indicating the knowledge level of respondents; 1 if respondent is knowledgeable and 0 otherwise

α and β_j are the parameters of the estimates

n = number variables,

E_j = Error term

I_j = The independent variables are socio-economic characteristics of respondents' gender, educational level, age, household size, farming experience, farm size, and annual income, type of farm enterprise and sources of agricultural information.

Logit Model: Logit model was employed for hypothesis one which suggests that there is no significant relationship between socio economic characteristics of respondents and their perception on the use of ICT. Logit model is stated as:

$$\text{Yi} = \beta 0 + \beta 1 X1 + \beta 2 X2 \ldots . + \beta n Xn \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (3.12)$$

Yi is the binary variable with value 1 if respondents have a positive perception and 0 if respondents have a negative perception. $\beta 0$ Is the intercept (constant), and β1, β2, to βn are the regression coefficients of the predictor variables, X1, X2, and Xn.

3.10 Ethical Considerations

In this study ethical considerations were ensured through voluntary participation of respondents. Participants' right to privacy was exercised and Respondents were informed of the positive and negative aspects of participation, after which they signed a consent form. Anonymity was also ensured to avoid biasness of response from respondents. Also, permission was required and granted by the Rural Environmental and Agricultural Development (READ) and the University Ethics Committee. Participants were also assured the right of withdrawal from participation at any point in time should they desire to do so. A translator was in the collection process to translate questions into local language for the convenience of the respondents.

CHAPTER FOUR
RESULTS AND DISCUSSIONS

4.0 Introduction

In this chapter, the findings of the study are presented. The chapter is divided into two sections. The first section focuses on the results and discussions of the descriptive statistics of the respondents while the second section presents the regression analysis.

4.1 Results and discussion of the descriptive statistics of the respondents

The following section outlines the different variables that were analysed and discussed. These variables are gender, educational level, marital status, age, household size, farming experience, farm size, annual income, type of farm enterprise, sources of agricultural information, awareness of the use of ICT, use of ICT for accessing extension services, prominent ICT tools used by respondents.

4.1.1 Gender

The majority (63%) of respondents were males and (37%) were females. This implies that small-scale farmers were predominately male in the study area. This finding is corroborated by Consultative Group to Assist the Poor (CGAP, 2016) which indicates that in Mozambique small-scale agriculture is predominately male (77%) and female (23%). Also, Okoedo-Okojie (2015) posited that agriculture is dominated by men.

Table 1: Gender of respondents

Gender	***Frequency***	***Percentage (%)***
Male	*76*	*63*
Female	*45*	*37*
Total	***121***	***100***

4.1.2: Educational Level of respondents

The study reveals that the majority of respondents (33%) had primary school education, while 31% had been through secondary education. Furthermore, (20%) had informal education while the least percentages of respondents were those who had university education (7%) and college education (9%). According Siulembe and Moodley (2014) small-scale farmers that have formal education are likely to adopt and use new technologies for agricultural practices. However, DAFF (2012) stated that small-scale farmers in South Africa are mostly illiterate and this poses barriers to accessing formal institutions that disseminate technical knowledge. The lack of formal education amongst small-scale farmers affects their ability to meet the quality standards set by fresh produce markets and food process because they lack financial and marketing skills (DAFF, 2012). As seen from the samples, only (20%) of the respondents had no formal education. This posits that small-sale farmers in the sampled areas may use ICT if accessible to them and affordable.

TABLE 2: Educational level of respondents

Educational level	***Frequency***	***Percentage (%)***
Informal	*24*	*20*
Primary	*40*	*33*
Secondary	*38*	*31*
College	*11*	*9*
University	*8*	*7*
Total	***121***	***100***

4.1.3: Marital status of respondents

The results in table 3 indicate that majority of the respondents are married (51%), while (33%) are single and the remaining (16%) are divorced. According to Makhura (2001) marital status of small-scale farmers is a significant attribute in sustainable farming as this indicates the importance of farming within families. This is supported by the study by Omotayo (2011) that indicates that most of the farmers are married, this can have a positive

effect on productivity and welfare of the business as other family members such as wives and kids can serve as a source of labour. Furthermore, Chisasa (2014) states that people with families take farming seriously to generate extra income to look after their families.

Table 3: Marital status of respondents

Marital status	***Frequency***	***Percentage (%)***
Single	*40*	*33*
Married	*62*	*51*
Divorced	*19*	*16*
Total	***121***	***100***

4.1.4: Age of respondents

In the study, respondents' age ranged from 20 to 50 years and above. The results show that the majority of the respondents are 50 years and above (49%), while (40%) of the respondents are between the ages of 41-50years, only (8%) of the respondents are between the ages of 31-40 years and the least was (3%) of the respondents who fell between the ages of 20-30 years. These results indicate that farming is still mostly practiced by the aged population as compared to the young population. This is supported by the study by Cele (2016), which suggests that young people are not interested in farming. They have an outlook that farming is for the aged people. This implies that young people need to be encouraged to engage in farming so that rural development can be sustained through farming.

Table 4: Age distribution of respondents

Age (years)	***Frequency***	***Percentage (%)***
21-30	*4*	*3*
31-40	*10*	*8*
41-50	*48*	*40*
50 and above	*59*	*49*
Total	***121***	***100***

4.1.5 Household size of respondents

Household is a group of related or unrelated persons who live together in the same dwelling unit, eat together from the same pot, and share most household expenses. The result shows that the majority of respondents had a house hold size of 4-6 members (59.5%), while (23%) of the respondents had a house hold size of 1-3 members, (16.5%) of respondents had a household size of 7-10 members, the least percentage was 1% of respondents who had a household size of 11-13 members. None of the respondents had a household size that's composed of 14 members. Household size could be seen as means of enhancing productivity through labour. However, Ajani and Ashagidigh (2008) stated that the contribution of the household to productivity could be based on personal view of interest. This is because an increase in house hold size would result in an increase in household expenditure which decreases the annual income of farmers.

Table 5: House hold size distribution of respondents

House hold size	***Frequency***	***Percentage (%)***
1-3	*28*	*23*
4-6	*72*	*59.5*
7-10	*20*	*16.5*
11-13	*1*	*1*
14 and above	*0*	*0*
Total	***121***	***100***

4.1.6: Farming experience of respondents

The significant percentage of respondents was (39.67%) having a farming experience of 11-20 years, followed by (33.06%) of respondents who had a farming experience of 1-10 years. Furthermore, 19.83% of respondents had a farming experience of 21-30 years while the respondents with the least percentages were (4.96%) which had 31-40years of farming experience, (1.65%) of respondents had 41-50 years of farming experience while only

(0.83%) had more than 50 years of farming experience. Makhura (2001) suggests that when conducting a research about agricultural practices among smallholder farmers, it is essential to include characteristics such as the number of years involved in farming as it is a factor that contributes to involvement in agricultural practices.

Table 6: Farming experience of respondents

Farming experience in years	***Frequency***	***Percentage (%)***
2-10	*40*	*33.06*
11-20	*48*	*39.67*
21-30	*24*	*19.83*
31-40	*6*	*4.96*
41-50	*2*	*1.65*
50 and above	*1*	*0.83*
Total	***121***	***100***

4.1.7 Farm size of respondents (Ha)

The results revealed that the majority of the respondents (47%) had a farm size of 1- 2 hectares while (39%) had a farm size of 3-6 hectares. Only a few respondents (9%) had a farm size of 7-10 hectares while the respondents with the least percentages (2%) had a farm size of 11-15 hectares and (3%) had a farm size of 16hectares and above. This shows that the majority of respondents in the study area do not have large farm sizes. This is supported by a national survey carried out in Mozambique by Consultative Group to Assist the Poor (CGAP, 2016) which revealed that the majority of small-scale farmers (31%) had a farm size of 1-2 hectares while only (20%) of the small-scale farmers had farm sizes of 3-5hectares which were the largest in the survey. According to Munyua (2007), small-scale farmers in Africa have small farm sizes and this could lead to diseconomies of scale and a weak knowledge-base. Additionally, Sebeho (2016) suggests that farm sizes could have an impact on production and income of the farm. Furthermore, bigger farms are usually more profit-driven

than small farms; this implies that farmers with big farms are in better positions to invest in more sophisticated agricultural technologies (Stevens and Ntai, 2011).

Table 7: Farm size of respondents (Ha)

Farm size (Ha)	*Frequency*	*Percentage (%)*
0-2	*57*	*47*
3-6	*47*	*39*
7-10	*11*	*9*
11-15	*2*	*2*
16 and above	*4*	*3*
Total	***121***	***100***

4.1.8 Annual Gross income of respondents (Rands)

The majority of respondents (46.3%) in the study area had an estimated annual income of 10,000 -30,000, while (32.2%) had an estimated annual income of 31,000-50,000 very few respondents 10% had an estimated annual income of 51,000 – 70,000, (4.1%) of respondents had an estimated annual income of 71,000 – 90,000 and (7.4%) had an estimated annual income of 91,000 and above. The results imply that majority of the respondents do not earn much annually.

Table 8: Annual Gross income of respondents (Rands)

Annual income	*Frequency*	*Percentages (%)*
10,000-30,000	*56*	*46.3*
31,000-50,000	*39*	*32.2*
51,000-70,000	*12*	*10*

71,000-90,000	*5*	*4.1*
91,000 and above	*9*	*7.4*
Total	***121***	***100***

4.1.9 Types of farm enterprise of respondents

The result indicates that the majority of respondents (72%) in the study area practised both animal and crop production. Only 16% of respondents practised animal production solely while the remaining (12%) of respondents indicated that they were only into crop production. This indicates that the majority of respondents practise both crop and animal production. This is supported by the study by Mburu (2013), which indicated that small-scale farmers in Deiya Location Kiambu County in Kenya practised both crop and animal production as majority of the farmers (87%) were into maize farming and (82%) were into beans farming while (89%) were into cattle farming and 85% practised goat rearing.

Table 9: Types of farm enterprise of respondents

Farm enterprise	***Frequency***	***Percentage (%)***
Crop production	*15*	*12*
Animal production	*19*	*16*
Both	*87*	*72*
Total	***121***	***100***

4.1.10 Agricultural information sources of respondents

The result indicates that the majority of respondents (36%) in the study area indicated fellow farmers as the most prominent source of agricultural information, while another 35% indicated extension agents as their main source of agricultural information. Only (29%) of the sample population indicated the radio as their source of agricultural information. In addition, the respondents' selection of agricultural information was based on multiple choices. This

implies that respondents had the choice of selecting more than one agricultural information source.

Table 10: Agricultural information sources of respondents

Information sources	***Frequency***	***Percentage (%)***
Extension agent	*111*	*35*
Fellow farmers	*114*	*36*
Radio	*92*	*29*
Total	***317***	***100***

4.1.11 Awareness on the use of ICT for extension services of respondents

The results indicate that the majority of respondents (92%) are aware of the use of ICT for extension service delivery and only (8%) of the respondents indicated that they were unaware of the use of ICT for extension service delivery. According to Shiro (2008), people in rural communities are aware of the importance of ICT, possess positive attitude towards ICT, and accept any ICT project to be built in their communities. However, ICT usage amongst this group of people (farmers) is at minimal due to lack of ICT knowledge.

Table 11: Awareness of the use of ICT for extension services of respondents

Awareness	***Frequency***	***Percentage (%)***
Yes	*111*	*92*
No	*10*	*8*
Total	***121***	***100***

4.1.12 Use of ICT in accessing extension services of respondents

In the study area, the results show that majority of the respondents (86%) use ICT to access extension services and agricultural information, while (14%) of the respondents do not use ICT for accessing extension services. According to Taragola and Van Lierde (2010) the use of ICT has played very significant and efficient role in the development of agriculture and in the decision making of farmer communities in different countries. Moreover, Sideridis et al. (2010) stated that farmers who use ICT for agricultural practices have successfully increased their production, information and knowledge.

Table 12: Use of ICT in accessing extension services of respondents

Use	***Frequency***	***Percentage (%)***
Yes	*104*	*86*
No	*17*	*14*
Total	***121***	***100***

4.1.13 ICT tools available and accessible of respondents

In this study, respondents' selection of various ICT tools used for farm management was based on multiple choices. The result therefore, indicates that the majority of the respondents use television (30.87%), radio (27.7%) and mobile phones (27.18%) devices as their major ICT tools for accessing agricultural information for farm management. Only a few of the respondents' used internet (8.97%), personal computers (3.96%), DVD and CDS (0.53%), digital camera (0.53%), video conferencing (0.26%) while none of the respondents used the telecentres. This is supported by the study by Ovwigho et al. (2009), which indicated that television was the major ICT used for information dissemination in extension service delivery to farmers in Nigeria, while radio was the most important ICT followed by television and video in Kenya. Similarly, studies by Farooq et al. (2007) show that in Pakistan the majority of respondents reported radio (75%) and television (80%) as most commonly used ICT tools for sourcing for information.

Table 13: ICT tools available and accessible of respondents

ICT Tools	*Frequency*	*Percentage*
Radio	*105*	*27.7*
Television	*117*	*30.87*
Mobile phones	*103*	*27.18*
Internet	*34*	*8.97*
Video Conferencing	*1*	*0.26*
Personal Computer	*15*	*3.96*
DVD and CDS	*2*	*0.53*
Digital Camera	*2*	*0.53*
Telecentres	*0*	*0*
Total	***379***	***100***

4.2 Perception on the use of ICT for farm management of respondents

In the study respondents' perception was measured on a 5point Likert scale of strongly agreed (SA), agreed (A), Undecided (U), strongly disagree (SD) and disagree (D) which consisted of 12 statements. Assigned values of 5, 4, 3, 2 and 1 were used to analyse objective 3 which is mathematically represented as:

$\frac{5+4+3+2+1}{} = \frac{15}{} = 3$

5 5

Therefore, a mean of 3 and above was adjudged okay and accepted while any value below 3 were not accepted.

The results from the study showed that the majority of respondents strongly agreed (65%) and agreed (29%) that ICT is a valuable tool to implement change in farming. This is contrary to the study by Rajoria et al. (2017) which examined the attitude of Livestock Farmers towards the ICT based Livestock Extension Services in Jaipur District of Rajasthan, India, in which ICT was indicated as a valuable tool but not having any impact on farmers' decision making (49.17%). Furthermore, the majority (62.8%) of respondents agreed that ICT increases farmers' access to agricultural information. Although, (36%) of the respondents agreed that ICT is easily accessible, (25%) of the respondents disagreed while (14%) were undecided. However, (63.6%) of respondents agreed that ICT increased farmers' productivity while (73.6%) agreed that ICT enhances the agricultural productivity of farmers. More so, the majority of respondents (61.1%) agreed that ICT reduces travel time and expenses, that ICT increases farmers' profitability through access of good market and prices of products (66%) and that it also leads to broader network (70.2%). Although, (30.6%) of the respondents were undecided that ICT helps farmers' make good decision during transactions, (56.2%) agreed that ICT indeed helps them make good decisions during transaction, this is also contrary to Rajoria et al. (2017) where farmers (49.17%) indicated that ICT had no impact on farmers' decision making. Furthermore, in the study area 36% of the respondents agreed that ICT was easy for them to use, while 17% of the respondents were undecided and (28%) disagreed that ICT was easy to use. However, majority of the respondents (53%) agreed that ICT improves the quality of services rendered to farmers. From the results, it can be concluded that generally majority of the Respondents' have a high perception on the use of ICT for farm management as none of the mean was below 3.

Table 14: Perception on the use of ICT for farm management of respondents

STATEMENTS	**Strongly agree Frq (%)**	**Agree Frq (%)**	**Undecided Frq (%)**	**Strongly Disagree Frq (%)**	**Disagree Frq (%)**	**Mean**	**SD**

ICT is a valuable tool to implement change in farming	79(65)	35(29)	5(4)	1(1)	1(1)	4.57	0.69
ICT increases farmers access to agricultural information	37(30.6)	76(62.8)	7(5.8)	1(0.8)	0(0)	4.23	0.58
ICT is easily accessible by farmers	22(18)	43(36)	17(14)	9(7)	30(25)	3.15	1.46
ICT enables farmers to reach new market	21(17)	77(64)	17(14)	1(1)	5(4)	3.91	0.83
ICT enhance agricultural productivity of farmers	20(16.5)	89(73.6)	9(7.4)	1(0.8)	2(1.7)	4.02	0.65
ICT reduces travel time and expense	23(19)	74(61.1)	19(15.7)	2(1.7)	3(2.5)	3.93	0.79
ICT increases farmers profitability through access of good market and prices of products	22(18)	80(66)	16(13)	0(0)	3(3)	3.98	0.73
ICT leads to broader network	15(12.4)	85(70.2)	17(14)	0(0)	4(3.3)	3.88	0.55
ICT helps farmers to make good decisions during transactions	15(12)	68(56)	37(31)	0(0)	1(1)	3.79	0.68
ICT are easy for farmers to use	14(12)	44(36)	20(17)	9(7)	34(28)	2.96	1.42
ICT improves the quality of services rendered to farmers	16(13)	64(53)	26(22)	4(3)	11(9)	3.58	1.06

4.3 Knowledge of the use of ICT for farm management of respondents

In the study, respondents' knowledge was measured with a dummy variable of Knowledgeable or Not Knowledgeable and it consisted of 12 statements.

Most respondents were knowledgeable that Television provides multimedia agricultural information (97%), that radio provides agricultural information (98%), but (75%) were not knowledgeable that Agricultural information can be recorded in DVD/CD and passed to farmers, neither was (64.5%) of the respondents knowledgeable that internet provides agricultural information. Although (87%) of respondents in the study were knowledgeable that mobile phone provides agricultural information, (74%) of the respondents were not knowledgeable that DVD's/CD's / documentaries provide detailed information with audio and video. Also, (90%) of the respondents were not knowledgeable that Video conference provides agricultural information. Majority of respondents (88%) were knowledgeable that ICT provides weather information while (92%) were not knowledgeable that video conference provides a two-way communication. Furthermore, (62%) of the respondents were knowledgeable that ICT provides information that is retrievable, while (93%) were also knowledgeable that ICT tools provide information on crop production, protection and post-harvest technologies. Moreover, (89%) of respondents were knowledgeable that ICT tools provide marketing and storage information on agriculture. As indicated by the result, the majority of respondents seem to be knowledgeable about conventional ICT tools as compared to the contemporary ICT tools. This observation is supported by a survey in India conducted by National Sample Survey Organisation (NSSO) which indicated that nearly (60%) of farmers did not have access any information with the use of modern technology from any source (Aggarwal, 2003).

Table 15: Knowledge of the use of ICT for farm management of respondents

STATEMENTS	**Knowledgeable Frq (%)**	**Not Knowledgeable Frq (%)**	**Mean**	**SD**
Television provides multimedia	117(97)	4(3)	1.97	0.18

agricultural information				
Radio provides agricultural information	119(98)	2(2)	1.98	1.36
Internet provides agricultural information	43(35.5)	78(64.5)	1.36	0.48
Agricultural information can be recorded in DVD/CD and pass to farmers	30(25)	91(75)	1.25	0.43
Mobile phones provides agricultural information	105(87)	16(13)	1.87	1.26
DVD's/CD's / documentaries provide detailed information with audio and video	32(26)	89(74)	1.26	0.44
Video conference provides agricultural information	12(10)	109(90)	1.10	0.30
ICT provides weather information	107(88)	14(12)	1.88	0.32
Video conference provides a two way communication	10(8)	111(92)	1.08	0.27
ICT provides information that are retrievable	75(62)	46(38)	1.62	0.48
ICT tools provide information on crop production, protection and post-harvest technologies etc.	113(93)	8(7)	1.93	1.89
ICT tools provide marketing and storage information on agriculture	108(89)	13(11)	1.89	0.31

4.4 Constraints to the use of ICT for management of respondents

In the study, constraints were measured on a 3-point scale as major constraints, minor constraints and not constraints. In the study, major constraints to the use of ICT were poor infrastructure in rural areas (85%), lack of ICT related facilities such as telecentres (79%), data bundles are expensive to purchase (73%), lack of internet connectivity (71%), ICT tools are expensive to purchase (71%), poor network coverage (55.4%) and lack of technical

know-how (55%). In a study by Muricho (2013) that assessed banana farmers' use of ICT found that ICT services in the study area had Technological challenges especially the internet (100%). In addition, Singh et al. (2015) in their study found that high cost for services provided was a major constraint to small-scale farmers' use of ICT. According to Morrow (2002) small-scale farmers do not have access to computers, adequate telecommunication infrastructure and lack computer literacy to interpret electronic text. Other constraints indicated by respondents were language barrier (50%) and educational/literacy level (50%). Ajani (2012) stated that illiteracy has been cited as a major barrier to the use of ICT among small-scale farmers. Muricho (2013) also found that language barrier was a constraint to the use of ICT as most electronic information was presented in English. This implies that the majority of the farmers including the educated ones may prefer the local language which is Setswana.

Table 16: Constraints to the use of ICT for farm management of respondents

CONSTRAINTS	**Major constraints Frq (%)**	**Minor constraints Frq (%)**	**Not a constraint Frq (%)**	**Mean**	**SD**
ICT tools are expensive to purchase	86(71)	27(22)	8(7)	2.64	0.60
Language is a barrier to use of ICT	61(50)	37(31)	23(19)	2.31	0.77
Educational level/literacy	61(50)	37(31)	23(19)	2.31	0.77
Lack of internet connectivity	86(71)	19(16)	16(13)	2.58	0.71
Poor network coverage	67(55.4)	44(36.4)	10(8.2)	2.47	0.64
Lack of technical know-how	66(55)	28(23)	27(22)	2.32	0.81
Data bundles are expensive to purchase	88(73)	22(18)	11(9)	2.64	0.65
Poor infrastructures in rural areas	103(85)	14(12)	4(3)	2.82	0.46
Lack of ICT related facilities e.g. telecentres	96(79)	20(17)	5(4)	2.75	0.52

4.5 Logit regression of respondents' socio-economic/personal characteristics and their perception on the use of ICT for farm management.

The result as presented in table 18 showed that educational level had a coefficient of (1.190649) and was positively significant at (P≤0.01), this implies that the higher the educational level of respondents, the more probability to use ICT, this means that respondents' educational level influences the way respondents perceive the use of ICT for accessing information relevant to farm activities. This also implies that respondents that are more educated have the likelihood to adopt and operate ICT tools more effectively to harness relevant information that could promote agricultural activities as well as influence their decisions during transactions. This is affirmed by Siulembe and Moodley (2014) that small-scale farmers that have formal education are likely to adopt and use new technologies for agricultural practices.

In the study area, Gender was coefficient at (-1.081679) and negatively significant at (P≤0.10) this implies that the more female farmers are involved in farming, the lesser the likelihood to use of ICT, this is probably because majority of women in the study area are less educated than the men and have more domestic responsibilities such as taking care of children and the aged. Cultural bias could also play a role as women are seen as weak and do not have the mental capacity to interpret, operate or access advanced technologies. This result is supported by the FAO (2018) that in Africa the proportion of women as compared to men using the internet is 25 per cent lower.

The information sources of the respondents' were coefficient at (-.4438458) and was negatively significant at (P≤0.10) this implies that the more information sources of respondents, the lesser the likelihood to use ICT which could be attributed to the fact that the majority of the respondents' do not rely on just one information source which probably is due to reliability and accountability of their information needs.

The awareness of the respondents on the use of ICT for extension service delivery was coefficient at (4.261418) and was a positively significant at (P≤0.05) this implies that the majority of the respondents are aware of the use of ICT for extension service delivery and are likely to use one of the ICT tools within their capacity to access information relating to farm activities and management. According to Shiro (2008), people in rural community are aware of the importance of ICT and possess positive attitude towards ICT and accept any ICT project to be built in their communities.

In the study, ICT is easy for farmers to use was coefficient at (0.36816) and was positively significant at (P≤0.05) this is likely because most respondents are knowledgeable about conventional ICT tools. However, fewer respondents had formal education and are mostly the aged. This implies that those who had formal education would be able to operate ICT given the access although their educational level is likely to determine the type of ICT tools they would be able to operate.

Table 17: Multicollinearity Test of Variables

Variables	VIF	Tolerance	Eigenvalue
Educational level	1.69	0.5929	0.3226
Gender	1.15	0.8682	0.2426
Age	1.34	0.7441	0.1543
Farm Experience	1.33	0.7528	0.1123
Annual Income	1.31	0.7620	0.0937
Information sources	1.81	0.5515	0.0700
Awareness of ICT use in extension service delivery	2.15	0.4652	0.0593
Valuable tool to implement change	1.38	0.7247	0.0322
Broader Network	1.56	0.6416	0.0239
Good decision	1.77	0.5647	0.0160
Easy to use	1.57	0.6361	0.0142
Extension quality	1.83	0.5453	0.0056
Mean VIF	1.58		

Source: Authors Compilation from the Computer Printout of Multicollinearity Test

Table 18: Logit regression analysis of respondents' socio-economic/personal characteristics of respondents and their perception on the use of ICT for farm management

Variables	Coefficient	Std. Error	Z	P>|z	Marginal Effects	Tolerance
Educational level	1.190649	0.3477275	3.42	0.001*	0.2717101	0.5929
Gender	-1.081679	0.5867735	-1.84	0.065***	-0.2468429	0.8682
Age	-.2656404	0.4052505	-0.66	0.512	-0.0606201	0.7441
Farm Experience	.0690387	0.3045996	0.23	0.821	0.0157549	0.7528
Annual Income	-0.329596	0.2670267	1.23	0.217	0.075215	0.7620
Information sources	-.4438458	0.2641827	-1.68	0.093**	-0.1012872	0.5515
Awareness of ICT use in extension	4.261418	2.073414	2.06	0.040***	0.4254344	0.4652

service delivery						
Valuable tool to implement change	.1058911	0.4893154	0.22	0.829	0.0241647	0.7247
Broader Network	.4901168	0.4782659	1.02	0.305	0.1118464	0.6416
Good decision	.0823112	0.5042659	0.16	0.870	0.0187837	0.5647
Easy to use	0.36816	0.2114253	1.74	0.082***	0.0840154	0.6361
Extension quality	-.0710006	0.2977931	-0.24	0.812	-0.0162026	0.5453
Constant	-7.084194	3.715509	-1.91	0.057		
Number of observation	121					

LR chi ^{2} (12) =	60.76
Prob > chi ^{2} =	0.0000
Pseudo R^2 =	0.3720
Log likelihood =	-51.290358
Marginal effects after logit=	0.35236353

Note: *, ** and * means1%, 5% and 10% levels of significant respectively**

4.6 Probit regression analysis of respondents' socio-economic/personal characteristics and their constraints in the use of ICT for farm management.

The results as presented in table 20 show that farm size was coefficient at (.9062135) and had a positive significance at (P≤0.10), this shows that an increase in farm sizes will probably lead to an increase in the use of ICT, this implies that the farm size of respondents' probably constrain them from the use of ICT as those with smaller farms are likely to have lower production output which has the probability to reduce their income and as a result they are likely to find it difficult to purchase ICT tools. This finding is contrary to that of Kalema (2017) where farm size had a negative significance on ICT adoption as Farmers with large farms were perceived to have their target market already and hence do not need ICT to connect them with buyers as compared to farmers with small farm sizes.

In the study, ICT tools are expensive to purchase was coefficient at (-.1325804) and was negatively significant at (P≤0.10). This implies that the higher the cost of ICT tools, the lesser the likelihood of respondents' use of ICT as they are considered expensive to purchase. This finding is supported by the study by Rimi and Chudi (2017) which found that the high cost of ICT devices was a major constraint to farmers' ICT adoption and use.

Lack of internet connectivity was coefficient at (-2.972073) negatively significant at (P≤0.1) this implies that the lesser the lack of internet connectivity the higher the probability of respondents' inability to use ICT, as respondents who do not have access to internet are likely

to be unable to connect with new markets nor acquire information through the internet. This may be attributed to the fact that there is unavailability of 2G, 3G and 4G networks in rural areas.

In the study, data bundles are expensive to purchase was coefficient at (1.316974) and was positively significant at (P≤0.5) this implies that the higher the cost of data bundles, the lesser the probability of respondents' use of ICT, this is because the high cost of data bundles is likely to affect their purchasing power thereby constraining respondents' use of ICT.

In addition, lack of ICT related facilities was coefficient at (2.123933) and was positively significant at (P≤0.5) this implies that the higher the lack of ICT related facilities in the study the more the likelihood that farmers will be unable to use ICT as respondents do not have access to ICT related facilities such as cyber cafes and telecentres.

Table 19: Multicollinearity Test of Variables

Variables	VIF	Tolerance	Eigenvalue
Educational level	1.71	0.5085	1.6247
Household size	1.13	0.5857	0.3227
Farm experience	1.20	0.8855	0.2796
Farm size	1.43	0.6992	0.1702
Types of entrepreneur	1.31	0.7622	0.1280
ICT tools are expensive to purchase	1.60	0.6237	0.1044
Lack of internet connectivity	2.55	0.3915	0.0826
Data bundles are expensive to purchase	1.16	0.4635	0.0724
Poor infrastructures in rural areas	1.81	0.5520	0.0457
Lack of ICT related facilities	2.41	0.4154	0.0351
ICT provide marketing and storage information	4.54	0.2202	0.0261
ICT provide information on crop production, protection and post-harvest technologies	3.11	0.3212	0.0186
Language is a barrier to use of ICT	2.70	0.3701	0.0180
Lack of technical know-how	3.16	0.3164	0.0110
Mean VIF	2.19		

Source: Authors Compilation from the Computer Printout of Multicollinearity Test

Table 20: Probit regression analysis of respondents' socio-economic/personal characteristics and their constraints in the use of ICT for farm management

Variables	Coefficient	Std. Error	Z	P>|z	Marginal Effects	Tolerance
Educational level	-.3374258	0.2829973	-1.19	0.233	-.0177774	0.5085
House hold size	.4241322	0.4425219	0.96	0.338	.0223456	0.5857
Farm experience	.2936651	0.3464677	0.85	0.397	.0154719	0.8855
Farm size	.9062135	0.4906695	1.85	0.065***	.0477443	0.6992
Types of entrepreneur	-.2775878	0.37682	-0.74	0.461	-.0146248	0.7622
ICT tools are expensive to purchase	-.1325804	0.71667	-1.85	0.064***	-.0698506	0.6237
Lack of internet connectivity	-2.972073	1.0706	-2.78	0.006*	-.156585	0.3915
Data bundles are expensive to purchase	1.316974	0.5119009	2.57	0.010**	.0693854	0.4635
Poor infrastructures in rural areas	0.9385972	0.7333215	1.28	0.201	.0494504	0.5520
Lack of ICT related facilities	2.123933	0.8608678	2.47	0.014 **	.1119003	0.4154
ICT provide marketing and storage information	-16.99907	595.504	-0.03	0.977	-.9999381	0.2202
ICT provide information on crop production, protection and post-harvest technologies	13.39215	595.5003	0.02	0.982	.1299198	0.3212
Language is a barrier to use of ICT	0.3668651	0.5572695	0.66	0.510	.0193285	0.3701
Lack of technical know-how	0.0333747	0.5916735	0.06	0.955	.0017584	0.3164
Constant	-.2202614	2.103695	-0.10	0.917		
Number of observation	121					
LR chi ^{2} (14) =	64.51					
Prob > chi ^{2} =	0.0000					
Pseudo R^2 =	0.6568					
Log likelihood =	-16.852644					
Marginal effects after probit=	0.97790065					

Note: *, ** and * means1%, 5% and 10% levels of significant respectively**

CHAPTER FIVE

SUMMARY, CONCLUSION, AND RECOMMENDATIONS

5.1 Summary

This study focused on the evaluation of small-scale farmers' use of Information Communication Technology (ICT) for farm management in Mahikeng Local Municipality in Ngaka Modiri Molema District, North-West Province of South-Africa. Simple random sampling technique was used to select 302 respondents, out of the 302 selected respondents only 121 participated voluntarily. The simple random technique gave respondents' in the area equal chances of being selected. In this study, data was collected with a structured questionnaire. The results indicate that the majority of respondents were male (63%) and the highest educational level of the majority of the respondents was primary education (33%), most respondents were married (51%), the age distribution of respondents were mostly ≥50 years (49%) and 41 to 50 years (40%), majority of respondents' (59.5%) had a household size of 4 to 6 members, respondents' farming experience was mostly 11 to 20 years (39.67%) and 2-10 years (33.06%). The farm sizes of the majority of respondents 0-2 hectares (47%) and 3-6 hectares (39%). In the study, the annual gross income of respondents was majorly R10,000 to R30,000 (46.3%) and R31,000 to R50,000 (32.2%). The majority of respondents were into both crop and animal production (72%) and their major information sources were fellow farmers (35%) and extension agent (36%). The majority of respondents (92%) were aware of the use of ICT for extension service delivery and 86% of the respondents used ICT in accessing extension services, however the most available and accessible ICT tools used by respondents were majorly conventional ICT tools such as television (30.87%), (radio 27.7%) and mobile phone (27.18%). Most respondents in the study had a high perception on the use of ICT for farm management this is because none of the mean value was lesser than 3. The majority of respondents was knowledgeable about the conventional ICT tools such as television (97%), radio (98%) and mobile phone (87%) but was not knowledgeable on contemporary ICT tools such as the internet (64.5%) and video conferencing (90%). The major constraints identified by respondents were poor infrastructures in rural areas (85%), lack of ICT related facilities such as telecentres (79%), expensive data bundles (73%), lack of internet connectivity (71%), expensive ICT tools (71.1%), poor network coverage (55.4%) and lack of technical know-how (55%). Other constraints indicated by respondents were language barrier (50%) and educational/literacy level (50%). The results further showed that educational level was positively significant at ($P \leq 0.01$), awareness on the use of ICT for extension and ease of use were both positively significant at ($P \leq 0.10$). Gender had a negative significance at ($P \leq 0.10$) this implies that the more increase of female farmers in the study area the lesser the use of ICT as most women have little access to ICT devices as compared to

men. Information sources also had a negative significance of (P≤0.05). Furthermore, farm size had positive significant (P≤0.10) which implies that the increase in farm sizes results to increase annual gross income, which makes ICT devices purchasable for respondents with large farm sizes. ICT tools were expensive had a negative effect at (P≤0.10) on respondents use of ICT. This implies that increase in the cost of ICT tools will result in small-scale famers' inability to purchase or use ICT. Lack of internet connectivity had a negative significance at (P≤0.10), data bundles are expensive to purchase and lack of ICT related facilities both had a positive significance at (P≤0.05).

5.2 Conclusion

From the research findings, it can be concluded that Information Communication Technology (ICT) is perceived by respondents as useful for farm management although the ease of use depends on their educational level. The results further showed both positive and negative level of significance in the study area. The major reasons why small-scale farmers use ICT was because it increased their access to agricultural information, it provided a broader network and also helped them make good decisions during transactions. The result also showed that the majority of famers who use ICT were more familiar with the conventional ICT i.e. the television, radio and mobile phone as compared to the contemporary ICT i.e. Internet and video conferencing. Furthermore, certain factors affect their ability to use contemporary ICT efficiently and effectively, factors such as high cost of ICT tools, lack of ICT related infrastructure in rural areas, poor network coverage, lack of internet connectivity and high cost of data bundles, lack of technical know-how, educational level/literacy and language barrier. Thus, it can be concluded that ICT plays an important role in the farm management of small-scale farmers and is seen to have both positive and negative levels of significance, which also has an effect on the decisions small-scale farmers make during transactions which could help them to secure better market and prices which could result in increased annual income and improved rural livelihood.

5.3 Recommendations

Based on the findings, it is therefore recommended that:

1. The consistent use of Television and Radio in dissemination of adequate and timely information to small-scale farmer's needs to be exercised as they are easily accessible, affordable and user friendly to the rural settlers.
2. Adult literacy programmes should be organised for those with informal and primary education as their educational level enhances their ability to use contemporary ICT such as Internet and video conference.
3. Rural farmers need to be trained on the intricacies associated with computers and internet to equip them to operate effectively.
4. There is need for mobile and internet service providers to improve connectivity in rural areas as poor network coverage constrained farmers' use of ICT.
5. Small-scale farmers that own mobile phones should be educated on the use of social media such as WhatsApp and Facebook as a forum that can serve as farmers group.
6. In addition, the use of Short Message Services (SMS) in disseminating information in the native language should be encouraged as it costs less compared to voice calls and most small scale farmers have mobile phones.
7. Relevant government agencies should collaborate with mobile phone and internet service providers such as (Vodacom, MTN, Cell C and Telkom) to set up ICT projects in rural areas to enhance ICT accessibility and usage.
8. The cost of airtime vouchers, call tariffs and data bundles needs to be reduced, as the high cost was a major constraint to farmers' use of ICT.

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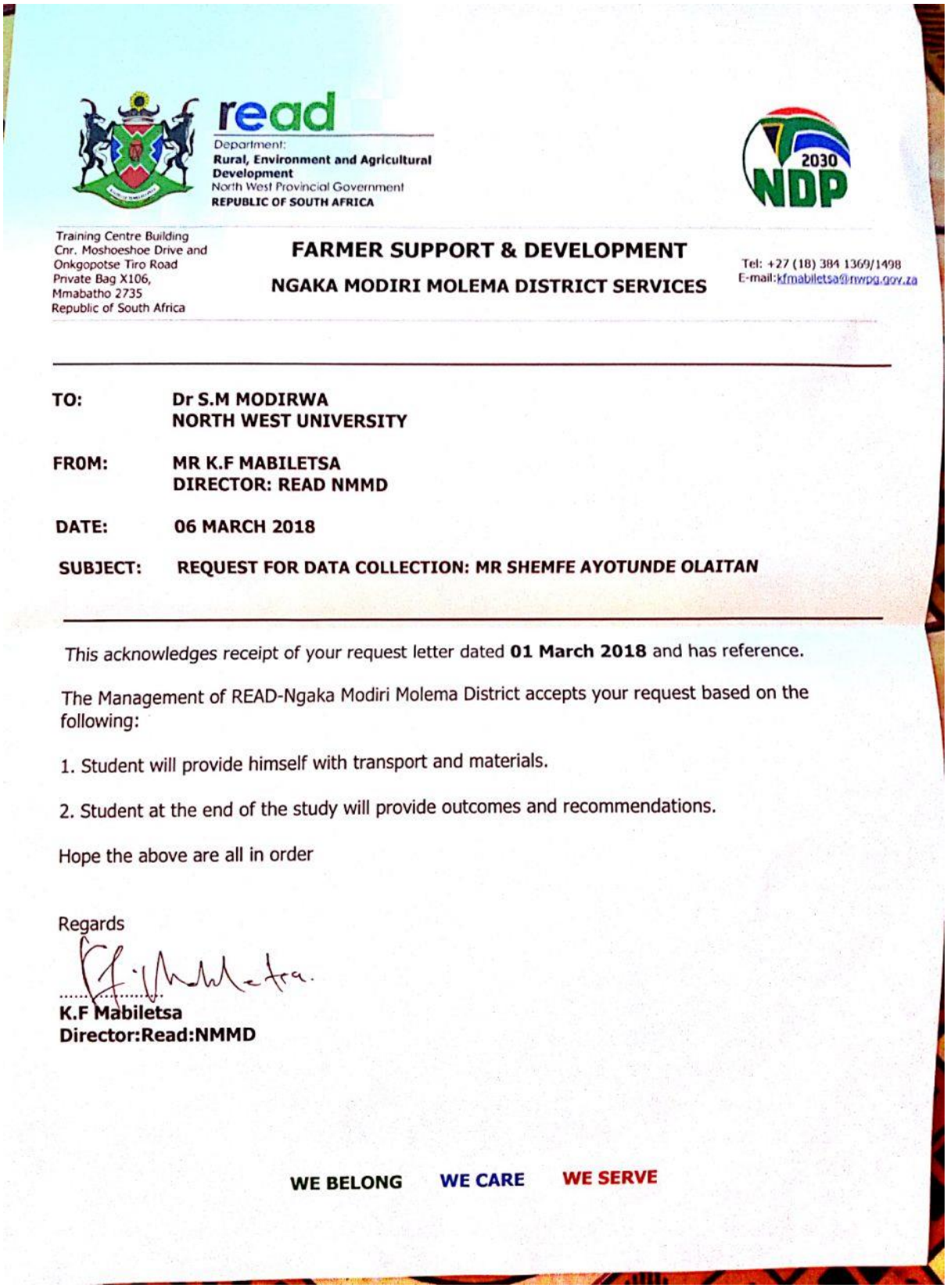
APPENDIX



read

Department:
Rural, Environment and Agricultural Development
North West Provincial Government
REPUBLIC OF SOUTH AFRICA

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FARMER SUPPORT & DEVELOPMENT

NGAKA MODIRI MOLEMA DISTRICT SERVICES

Tel: +27 (18) 384 1369/1498
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TO: **Dr S.M MODIRWA**
NORTH WEST UNIVERSITY

FROM: **MR K.F MABILETSA**
DIRECTOR: READ NMMD

DATE: **06 MARCH 2018**

SUBJECT: **REQUEST FOR DATA COLLECTION: MR SHEMFE AYOTUNDE OLAITAN**

This acknowledges receipt of your request letter dated **01 March 2018** and has reference.

The Management of READ-Ngaka Modiri Molema District accepts your request based on the following:

1. Student will provide himself with transport and materials.

2. Student at the end of the study will provide outcomes and recommendations.

Hope the above are all in order

Regards

.....
K.F Mabiletsa
Director:Read:NMMD

WE BELONG **WE CARE** **WE SERVE**

-

Consent Form

Investigator:

"My name is **Olaitan Ayotunde Shemfe** and I am a post graduate student of Agricultural extension **25245708** at Northwest University Department of Agricultural Economics and Extension Faculty of Natural and Agricultural Sciences. I am inviting you to participate in a research study. Involvement in the study is voluntary, so you may choose to participate or not. I am now going to explain the study to you. Please feel free to ask any questions that you may have about the research; I will be happy to explain anything in greater detail.

"I am interested in learning more about Small-scale farmers' use of Information Communication Technology for farm management. You will be asked to identify your socio-economic characteristics, prominent ICT tools, your perception, knowledge as well as constraints in the use of ICT. This will take approximately (5-10minutes) of your time. All information will be kept (confidential, in the case where subjects' identities need to be retained or can be associated with their responses, or anonymous and confidential, in the case where data collection does not allow responses to be connected with a particular subject). If anonymous, this means that your name will not appear anywhere and no one except me will know about your specific answers. If confidential, I will assign a number to your responses, and only I will have the key to indicate which number belongs to which participant. In any articles I write or any presentations that I make, I will use a made-up name for you, and I will not reveal details or I will change details about where you work, where you live, any personal information about you, and so forth.

"The benefit of this research is that you will be helping us to understand (small-scale farmers'' use of Information Communication Technology for Farm Management). This information should help us to (know the prominent ICT tools used by small-scale farmers, their perception on the use of ICT, their knowledge and constraints in the use of ICT. If you do not wish to continue, you have the right to withdraw from the study, without penalty, at any time."

Participant - "All of my questions and concerns about this study have been addressed. I choose, voluntarily, to participate in this research project. I certify that I am at least 18 years of age [or have a signed parental consent form on file with the department].

_____

Name of participant

_____ _____

Signature of participant date

_____

Name of investigator

_____ _____

Signature of investigator date

NORTH-WEST UNIVERSITY
YUNIBESITI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT

Evaluation of small scale famers' participation in the use of Information Communication Technology (ICT) for farm management in Mahikeng Local Municipality

QUESTIONNAIRE NUMBER	

SECTION A: DEMOGRAPHIC INFORMATION

1. **Gender**

C1 Male	0
C2 Female	1

2. **Educational level**

C3 Informal education	0
C4 Primary education	1
C5 Secondary education	2
C6 College education	3
C7 University education	4

3. **Marital status**

C8 single	0
C9 married	1
C10 divorced	2

4. **Age**

C11 20-30 years	0
C12 31-40 years	1
C13 41 to 50 years	2
C14 > 50 years	3

5. **Household size**

C16 0-3 members	0
C17 4-6 members	1
C18 7-10 members	2
C19 11-13 members	3
C20 > 14 members	4

6. **Farming experience**

C21 2-10 years	0
C22 11 to 20 years	1
C23 21 to 30 years	2
C24 31 to 40 years	3
C25 41 to 50 years	4
C26 >50 years	5

7. **Farm size**

C27 1-2 hectares	0
C28 3-6 hectares	1
C29 7-10 hectares	2
C30 11-15 hectares	3
C31 >16hectares	4

8. **Annual income**

C32 10 000-30 000	0
C33 31 000-50 000	1
C34 51 000-70 000	2
C35 71 000-90-000	3
C36 >91 000	4

9. Type of farm enterprise

C37 Crop production	0
C38 Animal production	1
C39 Both	2

9. **What are your sources of agricultural information?**

C40 Extension agent	0
C41 Fellow farmers	1
C42 Radio	2

SECTION 2

1. **Are you aware of the use of ICT in extension service delivery?**

C43 YES	0
C44 NO	1

2. **Do you use ICT in accessing extension services?**

C45 YES	0
C46 NO	1

3. **Which of this Information Communication Technology tools do you use? Tick as many as applicable**

C47 Radio	0
C48 Television	1
C49 Mobile Phones	2
C50 Internet	3
C51 Video Conferencing	4
C52 Computer	5
C53 DVD and CDs	6
C54 Digital camera	7
C55 Telecentres	8

SECTION 3

What are you perceptions on this Information Communication Technologies in farm management?

STATEMENTS	**Strongly agree**	**Agree**	**Undecided**	**Strongly disagree**	**Disagree**
C56 ICT is a valuable tool for implementing change in farming	4	3	2	1	0
C57 ICT increases farmers' access to agricultural information	4	3	2	1	0
C58 ICT is easily accessible to farmers'	4	3	2	1	0
C59 ICT enables farmers' to reach new markets	4	3	2	1	0
C60 ICT enhances agricultural productivity of farmers'	4	3	2	1	0

C61 ICT reduces travel time and expenses	4	3	2	1	0
C62 ICT increases farmers' profitability	4	3	2	1	0
C63 ICT leads to broader network	4	3	2	1	0
C64 ICT helps farmers to make good decisions during transactions	4	3	2	1	0
C65 ICT are easy for farmers' to use	4	3	2	1	0
C66 ICT improves quality of service render to farmers	4	3	2	1	0

SECTION 4

What is your knowledge level on the services this ICT tools provides?

STATEMENTS	Knowledgeable	Not knowledgeable
C67 Television provides multimedia agricultural information	1	0
C68 Radio provides agricultural information	1	0
C69 Internet provides agricultural information	1	0
C70 DVDs/CDs provides agricultural information	1	0
C71 Mobile phones provides agricultural information	1	0
C72 DVDs and CDs documentaries provides detailed information with audio and video	1	0
C73 Video conference provides agricultural information	1	0
C74 ICT provides weather information	1	0
C75 Video Conference provides a two way communication	1	0
C76 ICT provides information that are retrievable	1	0
C77 ICT tools provide information on crop production, protection, post-harvest technologies etc.	1	0
C78 ICT tools provide marketing and storage information on agriculture	1	0

SECTION 5

What are the constraints to your use of ICT?

CONSTRAINTS	**Major Constraint**	**Minor Constraint**	**Not a Constraint**
C79 ICT tools are expensive to purchase	2	1	0
C80 Language is a barrier to use of ICT	2	1	0
C81 Educational level/literacy	2	1	0
C82 Lack of internet connectivity	2	1	0
C83 Poor network coverage	2	1	0
C84 Lack of technical know-how	2	1	0
C85 Data bundles are expensive to purchase	2	1	0
C86 Poor infrastructures in rural areas	2	1	0
C87 Lack of ICT related facilities e.g. Telecentres	2	1	0