EXTENSION COMMUNICATION METHODS AND FARM MANAGEMENT SUPPORT DURING COVID-19 PANDEMIC: THE CASE OF SMALLHOLDER CABBAGE FARMERS IN POLOKWANE AND LEPELLE-NKUMPI LOCAL MUNICIPALITIES, LIMPOPO PROVINCE

BY

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DISSERTATION SUBMITTED IN FULFILMENT OF THE REQUIREMENT FOR THE DEGREE OF MASTER OF AGRICULTURAL MANAGEMENT (AGRICULTURAL EXTENSION) IN THE CENTRE FOR RURAL COMMUNITY EMPOWERMENT, SCHOOL OF AGRICULTURAL AND ENVIRONMENTAL SCIENCES, FACULTY OF SCIENCE AND AGRICUTURE, UNIVERSITY OF LIMPOPO, SOUTH AFRICA.

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DECLARATION

I Madevhele Murendeni Marvellous hereby declare that the full dissertation “extension communication methods and farm management support during covid-19 pandemic: the case of smallholder cabbage farmers in Polokwane and Lepelle-Nkumpi local municipalities, Limpopo province ” hereby submitted to the University of Limpopo for the degree of Master of Agricultural Management (Agricultural Extension) has not previously been submitted by me for a degree at this or any other university; that it is my work in design and in execution, and that all material contained herein has been duly acknowledged.

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_____ 19 April 2023 _____

Supervisor: Prof EM Zwane Date

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No words can match my profound gratitude to my parents for the emotional support and guidance throughout my studies at the University of Limpopo.

DEDICATION

This work is dedicated to my daughter Onalerona Masenya. I want her to grow up knowing that she can achieve anything she set her mind to. All that is needed is to have a dream and work towards it.

LIST OF ACRONYMS

COVID-19	Coronavirus Disease
DVD	Digital video disc
ICT	Information and Communication Technology
ES	Extension Service
SPSS	Statistical Package for The Social Science
TREC	Turfloop Research Ethic Committees
LDA	Limpopo Department of Agriculture

ABSTRACT

The study presents extension communication methods for cabbage farmers with the aims to understand how the COVID-19 pandemic has affected the extension communication methods (ICT tools) through which smallholder cabbage farmers receive farm management information from their local extension practitioners and whether farmers socio-economic situation position them to receive farm management information through the conventional communication media and the current digital communication tools in Polokwane and Lepelle-Nkumpi local municipalities. The restrictions on people movement and contacts between people, including farmers and extension practitioners. Smallholder farmers in developing countries including South Africa, who depend mainly on the public extension service provider for their farm management information needs, are no longer receiving the traditional face-to-face farm management support through individual and group visits. The conceptualization of adoption behaviour analysis utilized in this study was based on the Düvel framework. The study objective were; to identify and describe smallholder cabbage farmers socio-economic characteristics that might influence the communication methods (ICT tools) they use for receiving farm management information from their local extension practitioner, to ascertain and describe the communication methods (ICT tools) through which smallholder cabbage farmers mainly received farm management information from their local extension practitioner before and since the COVID-19 outbreak in South Africa in 2020, and also to describe the challenges associated with the communication methods (ICT tools) through which smallholder cabbage farmers have received farm management information from their local extension practitioner since the COVID-19 outbreak in South Africa in 2020. A cross-sectional survey approach was used for this study to collect data at one point in time to achieve the aim of the study. A sample of 81 farmers from the two municipalities were interviewed using a semi-structured questionnaire. Descriptive and inferential statistics were applied to analyze the data using SPSS software. The questionnaires were coded, and the data was entered on a computer using Statistical Package for Social Sciences (SPSS) version 11.5 software. The software was used for data analysis. Data were analysed using percentages and, frequency and Chi-square test. The study findings showed that there is a significant relationship between socio-economic characteristic and the communication methods through which farmers

received information. Furthermore, the results showed that most respondents utilized ICT tools before COVID-19 as compared to the period of COVID-19. Finally, the results of the distribution of respondents on challenges associated with the communication methods showed that most respondents had no challenges utilizing the communication ICT tools. It is therefore recommended that to accelerate innovation and improve agricultural practices among farmers, policy needs to address both the technical and social-economic barriers to adoption as well as the cultural change. Issues such as reading levels require long term transformation strategies. Shorter term strategies are therefore required, such as deliberately ensuring that dissemination methods adopt accessible technologies, which in this instance include radio and TV. It will be essential for research organisations to match the dissemination methods with the farmers' preferences to attain more effective transfer of knowledge and skills from research to farmers.

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CHAPTER 1: INTRODUCTION

1.1 CHAPTER OUTLINE

This chapter presents the introduction study that enabled the research hypotheses to be tested and the objectives of the study to be realised. The study was carried out at Polokwane and Lepelle-Nkumbi local municipality. This study also expresses the problems farmers face such as no contact with extension and no farm visit to ensure improvement of their production. The study aims to understand how the COVID-19 pandemic has affected the extension communication methods (ICT tools) through which smallholder cabbage farmers receive farm management information from their local extension practitioners and whether farmers" socio-economic situation, position them to receive farm management information through the conventional communication media and the current digital communication tools. This chapter also outline three objective and research question which was utilized in the study. The hypothesis for this study is to check the influence of farmers socioeconomic characteristics has influence on communication methods used by farmers.

1.2 BACKGROUND

Among the challenges facing public extension services in developing countries include inadequate communication capacity, inadequate operating resources and financial sustainability (Chander & Rathod, 2020 citing Swanson and Mathur (2003).

Simpson and Calitz (2014) have indicated that industries and academics now see research in electronic agriculture (e-agriculture) as important for improving the competitiveness of the South African agricultural sector. Sylvester (2011) pp 43-44 defines e-agriculture as ‘’a particular emerging branch of study paying attention to improvement of agriculture and rural development by using enhanced information and communication procedures’’. The agricultural sector in South Africa is moving abreast with the times regarding the current trend towards using and adopting information and communication technology (ICT) in agriculture, especially, in rural development (Patrikakis and Maumbe, 2012). The main goal of this move is to facilitate the exchange of agricultural knowledge and information, processing and marketing in the

sector and improve the productivity on farms (Jones, 2011; Mpofu, 2011). Furthermore, the advantages of e-agriculture include enhancing the methods of communication and service delivery that support the agricultural sector's ability to meet farmers' farm management and information needs such as evidenced-based decision-making by farmers (Namisiko and Aballo, 2013).

Farmers struggled to obtain timely agricultural extension services because of restrictions on their freedom of movement and social distance rules. The food security and well-being of these farmers may be in jeopardy as a result of these control measures restricting agricultural extension agents' face-to-face interactions with rural farmers who may need agricultural extension services (Bisoffi et al., 2021).

1.3 PROBLEM STATEMENT

Communication is essential in the adoption of innovations because innovative ideas or technologies are not automatically accepted and used by potential users (Lee, Kwon & Schumann 2005). The face-to-face extension communication method through which farmers have traditionally received farm management information has changed drastically since the coronavirus disease (COVID-19) pandemic. The restrictions on people movement and contacts between people, including farmers and extension practitioners, put in place by the South African government since the global COVID-19 outbreak in 2020, has severely affected the face-to-face interaction between farmers and extension practitioners. Smallholder farmers in developing countries including South Africa, who depend mainly on the public extension service provider for their farm management information needs, are no longer receiving the traditional face-to-face farm management support through individual and group visits (Mdungela, Batha & Jordan 2017). The limitation on face-to-face communication method poses a serious problem for smallholder farmers, which will be investigated in this study. This invariably, has affected smallholder farmers" exposure to new farming technologies which has the potential to improve their farm productivity (Beuhren et al. 2017), and therefore, their household food security. Smallholder cabbage producers in Polokwane and Lepelle-Nkumpi local municipalities of Limpopo province are one group of farmers who need cutting-edge farm management technologies in view of the fact that producers face serious challenges regarding pest and disease infestation. This

cabbage pest and disease issue is not limited to Polokwane and Lepelle-Nkumpi local municipalities. In Niger for example, it has been reported that cabbage is one crop most treated chemically, after tomato (Zabeirou, 2018). As a result of this pest and disease problem, few farmers engage in cabbage production in the Polokwane local municipality (M. Sechaba, pers. comm., June 1, 2021; P. Maluleke, pers. comm., June 8, 2021), and Lepelle-Nkumpi local municipality (M. Sello, per. comm., August 16, 2021). This study will, therefore, focus on smallholder cabbage producers in Polokwane and Lepelle-Nkumpi local municipalities.

2. Rationale

Agricultural extension services include transferring knowledge to farmers, advising and educating farmers in their decision making. This aim Agricultural Extension is achieved through the flow of information between the public extension and farmers in what is called communication. The notion of communication is thus seen as an activity of sharing meaning among people as they interact with one another (Conrad & Poole, 1998).

In agricultural extension work, the communication methods for relating to clients have been grouped into three categories: individual, group and mass methods (Wilson & Gallup, 1955). Mass methods involve sending a message to reach all clients in an area at a time through the electronic or print media or beating of the kong-kong by the town -crier in the village. Examples are electronic media such as television, radio, internet etc.; the print media which include newspapers, posters, exhibits, circular letters, leaflets, bulletins, newsletters etc. The individual methods involve sending messages to clients by having an interpersonal contact with them on individual basis (one-on-one). Examples are visiting farmers in their homes or farms, calling farmers by telephone, and writing letters to individual farmers. Reaching farmers in groups involves sending a message to clients in small groups by means of interpersonal contacts. Examples include meetings of all kinds such as result and method demonstrations, lectures, training, discussions, workshops, field trips, farmers/field days, etc.

The different extension mass media communication methods are referred to in the Information, Communication and Technology (ICT) field as Communication Tools

(Jabbar, 2017). For this reason, both terms, communication methods and ICT tools will be used together in this study. Examples of ICT tools and products are telephones, DVDs, email or the World Wide Web; photocopiers, fax machines; calculators; electronic textbooks and newspapers, email.
(https://idahoat.org/services/resources/ICT).
Extension service providers globally are adopting new and reinforcing the use of old, conventional communication methods apart from the traditional face-to-face methods to reach farmers with farm management information because of the current COVID-19 pandemic restrictions on people movement and gathering. Karanasios and Slavova (2019) reported that, mobile phones, the Internet, and more traditional media such as radio, video, and television are supplementing and occasionally replacing face-to-face extension services. Innovative ways of reaching farmers by means of recorded videos and materials based on pictures have been reported in India despite restrictions on movement of people, including extension agents (Habtom, 2019). Extension service recipients including farmers, therefore, have to gear themselves to receive farm management information through these communication methods to ensure that their farming businesses continue to be efficient and productive.

Different countries have different economic situations which influence the socioeconomic situation of their citizens, including farmers and, therefore, the farmers" ability to take advantage of innovations to receive farm management information and skills development. The burning question to be answered is, are the smallholder cabbage farmers in Polokwane and Lepelle-Nkumpi local municipalities positioned in terms of their socio-economic characteristics to use these conventional mass media methods (e.g., radio, television, and newspaper) and current electronic/digital communication methods such as mobile phones, DVDs etc. to receive farm management information from their local extension practitioners during this period of the COVID-19 pandemic? The literature search on this issue yielded no information which can advance our knowledge on this subject. This is a gap in knowledge that this study will attempt to fill.

2.1 Aim

The study aims to understand how the COVID-19 pandemic has affected the extension communication methods (ICT tools) through which smallholder cabbage farmers receive farm management information from their local extension practitioners and whether farmers socio-economic situation, position them to receive farm management information through the conventional communication media and the current digital communication tools.

2.2 The objectives of the study are to:

I. Identify and describe smallholder cabbage farmers socio-economic characteristics that might influence the communication methods (ICT tools) they use for receiving farm management information from their local extension practitioner.

II. Ascertain and describe the communication methods (ICT tools) through which smallholder cabbage farmers mainly received farm management information from their local extension practitioner before and since the COVID-19 outbreak in South Africa in 2020.

III. Describe the challenges associated with the communication methods (ICT tools) through which smallholder cabbage farmers have received farm management information from their local extension practitioner since the COVID-19 outbreak in South Africa in 2020.

2.3 Research questions

I. What are the smallholder cabbage farmer's socio-economic characteristics that might influence the communication methods (ICT tools) they use for receiving farm management information from their local extension practitioner?

II. What are the communication methods (ICT tools) through which smallholder cabbage farmers have mainly received farm management information from their local extension practitioner before and since 2020?

III. What are the challenges associated with the communication methods (ICT tools) through which smallholder cabbage farmers have received farm management information from their local extension practitioner since 2020?

2.4 Research hypothesis

Smallholder cabbage farmers‟ socio-economic characteristics have no influence on the communication methods (ICT tools) they use for receiving farm management information from their local extension practitioner.

CHAPTER 2 LITERATURE REVIEW

2.1 Introduction

The purpose of this chapter is to present the literature review. It covers the role of information in development, etc.

2.2 Role of information in development

Information plays a vital role in uplifting these farmers to improve their living standards. Important information, such as how to battle pests and diseases, helps farmers make better decisions (Dlamini & Worth, 2019). Seasonal weather patterns, deterioration in soil conditions, and sporadic climatic occurrences such as droughts, floods, pest and disease outbreaks all affect farmers' decision-making processes and influence their information needs. It can be difficult to provide such knowledge because the information must be adapted to unique situations. The emergence of Information and Communication Technology (ICT) is well timed in light of these issues. As a result, both the public and private sectors have long sought effective solutions to meet both long and short-term difficulties in agriculture, including how to respond to farmers' substantial information needs. One of these options, information and communication technology (ICT), has recently unlocked enormous promise for improving agriculture in underdeveloped countries. ICT has found a place on poor smallholder farms and their activities, due to the rising mobile, wireless, and Internet industries. The most effective tool for farmers is to get knowledge from information and make decisions based on that understanding (Eze & Obikeze, 2017).

2.2 Teaching methods used by extension.

The teaching methods employed by the extension worker directly influence the effectiveness of his efforts. This is true whether the extension teacher is a county extension agent or a state subject-matter specialist or whether the learner is a farmer, farm woman or farm youth. An understanding of the capabilities and limitations of the available teaching tools is essential to their intelligent selection and efficient use. Improvement in the use of methods in extension teaching implies the necessity of making measurements and accountings. It involves the scientific way of collecting and weighing the facts. Things cannot be taken for granted. Valid evidence of a reliable and objective nature must exist (Wilson & Gallup, 1955).

From the green revolution to precision agriculture, adoption of contemporary agricultural technologies has always been crucial to not only rural sociology but practically all social sciences. Small-scale farmers' adoption of ICT in farming ignores the flaws of traditional extension systems and instead puts them on a path to communal well-being (Fosterand & Rosenzweig, 2010). The nature of ICT adoption in agriculture necessitates the absence of a socioeconomic digital gap in society. Extrinsic elements such as socioeconomic status in a society provide all of the nurturing for a developing adaptive behaviour. As a result, farmer's choice of agricultural technology utilization is associated with his socioeconomic status, even at work. This fact necessitates the creation of user-friendly and cost-effective ICT-based agriculture services (Omorogbe, 2012). If a farmer cannot establish a balance between the relative advantages of a technology and his socioeconomic circumstances, both the technology and the farmer may face difficulties. This conflict has a negative impact on the technology adoption process that is necessary to achieve agricultural development goals.

2.3 Socioeconomic characteristics of Farmers.

It has been found that the socio-economic characteristics of farmers can influence the communication method used by farmers to receive information, for example according to Riesenberg & Gor (1989), ideal teaching approaches differ depending on the farmer's age, farm size, and educational background. It was discovered that young farmers, as well as farmers with a college education, prefer to learn using computers. Farmers who have a lot of land profit the most from publications. According to Kim & Frick (2011), age, educational level, and motivation influence each student's learning so that what was once chosen may not be the student's current preferred learning method. This underlines the need of determining who will attend the sessions in order to use the most effective delivery methods to increase adoption.

Young and old persons have varied risk attitudes and preferences depending on their age. According to Morris & Venkatesh, (2000), younger people's ICT usage is more likely to be impacted by their capacity to obtain and utilize the gadgets, whereas older people's use of such devices is more likely to be influenced by distinctive customs and perceived behavioural skill. The perceived worth of ICT devices is also influenced by age, with young individuals placing a larger value on them. Furthermore, young people

are seen as more pragmatic, informed, aware, and open to new technologies than older individuals (Cant & Shen, 2006).

Education is a method of bringing about desired behavioural changes in people. In simplicity, education is an investment in human capital that boosts labour productivity, reduces income inequality, and, most importantly, reduces poverty (Amin & Awung, 2005). According to Alene & Manyong (2007), education has a favourable impact on the adoption of new technologies and innovations.

2.4 Educational level of farmers

The educational levels of farmers can also influence the capacity to adopt and use ICT devices. Farmers with a particular level of formal literacy can adequately utilise agricultural knowledge. Farmers who have received a basic education are more likely to adopt new technology and boost their productivity. Education improves people's ability to receive, decode, and evaluate valuable information for agricultural production. This concurs with the findings of Benard (2014) which indicated that good, educated farmers can easily access information from various sources, and can be able to create knowledge out of those sources.

2.5 Gender and ICT use

In the agricultural sector, women and men play diverse but equally important responsibilities; their contributions complement each other to encourage the industry's growth and development. Gender mainstreaming in agricultural extension relates to taking into account the extension needs of both men and women in the development and implementation of extension programs so that inequity is not perpetuated (Dayanandan, 2011). As a result, extension officers' ICT skills are critical in ensuring that rural men and women have equal access to agricultural information. It is observed that providing extension services in rural areas is not balanced in terms of gender: women turn to receive fewer extension services compared to their male counterparts (Dayanandan, 2011).

Although women's participation in agricultural activities has increased over the years, agricultural extension and information on new technologies are almost exclusively directed to men (Beevi et al., 2018). The decision of farmers to use ICT can be evaluated in terms of gender. Women are more risk conservative, while male farmers are more likely to participate in geographically dispersed social networks, giving them greater opportunity to receive knowledge and embrace ICT (Croson & Gneezy, 2009).

Despite the critical role that women play in agricultural production, women's use of ICT for agricultural purposes continues to lag behind men's (Ragasa, 2014). Women farmers are excluded from technology design and implementation programs in Africa, according to Ashby (2002), resulting in ICT adoption issues. Women tend to have a larger ICT accessibility bias than their male colleagues. Nancy & Helen (2007) discovered that females in rural communities have less access to ICT facilities than their male counterparts. They emphasized that rural information centres' or cyber-cafés are typically located in areas where women may feel uncomfortable. In many countries, particularly in Africa, social and cultural views play a significant influence in limiting women in agricultural activities.

Since the majority of farmers are young, we can encourage them to be more entrepreneurial by offering appealing and useful information via social media. Because the majority of farmer households have a medium level of family education, social media can be used as part of the media mix, as well as a supplement and complement to traditional technology transfer programs. It has the potential to alleviate the strain on insufficient extension personnel (Darshan, Meena & Meena, 2017).

2.6 Group membership

A group can be positive outlets to farmers since it gives them sense of belonging. A group can be pressurizing or provide motivation for farmers who are not really interested in technological communication. Farmers in a group can be able to influence one or two farmers due to sharing the benefits and their results.

2.7 Farm size

The impact of farm size on ICT Adoption can be a positive, negative, or neutral experience. Farmers in rural locations may have a lot of land, but they lack the assets (money) to buy such a device because of the management costs. Some farmers, on

the other hand, may want to use such gadgets for management and productivity tracking via mobile applications. This can be advantageous when it comes to receiving farming management information (Dlamini & worth, 2019).

2.8 Farming experience

Farming experience can influence the attitude of the farmer towards use of ICTs. Farmers with high experience may not feel the need to have such digital for information thinking they are well informed about overall farming. However, at the same hand farmers with high experience can also see the need to use ICTs for issues like emerging problem and record keeping perfecting their production (Wyckhuys et al., 2018).

2.9 Annual income

Another key factor influencing farmers' attitudes regarding the acquisition of new agricultural technology and its implementation for enhanced agricultural production is their income. Educated people, on the other hand, adopt new agricultural techniques and innovations in their farms, resulting in higher net annual returns (Guerin & Guerin, 1994).

2.10 Household size

Most of the rural farmers occupy a family of 4 to 6 persons with few under the privilege of marriage. It is easily a privilege for farmers who lives with one or more individual, due to the fact that one member of the family can occupy ICT device that can assist the farmer with their production information. It can also be beneficial towards the farmers to adopt ICT device due to the assistance they will often receive in operating the device to ensure improvement in their productivity (Leslie, 2019).

2.11 Access to credit

Any rural development policy aimed at reducing poverty should concentrate on agriculture, which is the most significant activity for the poor, who lack access to loans, farm inputs, and technology, and are unable to save production infrastructure. As a result of these efforts, financial organizations such as the NYDA have been established to give financing to rural farmers, particularly smallholder farming households across the country. Despite the progress made by these financial

organizations, farmers, particularly small-scale farmers, complain about difficulties in obtaining financing from financial institutions (Anang & Kabore, 2021).

2.12 Social influence

Social influence refers to the degree to which an individual perceives that other important people believe that he/she should use the new system. People in a community engage on a regular basis across a shared set of issues, interests, or needs. This engagement also occurs among farmers regarding ICT-based farm information. Studies reported that farmers impact each other and that the significant sources of information for farmers were their peers (families, friends and neighbours). As a result, interaction around farm management information accessed through ICT is essential to the use (success) of that information source (ICT) (Lee, Cheung & Chen, 2005).

2.12 Access and able to use radio.

Considering the scarcity of extension field personnel, radio is the most effective way to reach out to farmers. If network and timing are taken into account, the chances of radio communications reaching their intended destination are high. Radio can be used to inform farmers about new crop varieties, disease outbreaks, and the availability of farm input.

Digital technology has revolutionized the media sector to the point where radio is now available on mobile phones and the internet in addition to in-home radio. Getting messages from the radio has become much easier as a result of this. The ICT policy advocates for upgrading critical areas of development, including agriculture, in support of programs to employ ICT in agriculture. The policy's execution, on the other hand, necessitates a supportive regulatory framework to aid implementers in infrastructure construction and equipment acquisition.

Stakeholders in the agriculture sector have a wide range of radio experience. The following are some of the experiences: When compared to other channels, the transmission of messages is more timely. Increased information coverage for farmers. When radio messages are combined with other traditional communication channels and resources, such as extension services, farmer community meetings, posters, folk media, the internet, and MP3 players, they are more successful. This is because some

technical shortcomings in radio programs can be compensated for by appropriate channel programming.

2.13 Theories of communication used in farm radio communication.

Farm radio communication has been designed using three fundamental notions all around the world. Diffusion of innovations, social marketing, and theory of reasoned action are three of them. In summary, Rogers' (1962) theory of diffusion of innovations discusses the process of spreading knowledge and successes from other cultures to those in need. This communication modernisation paradigm identifies stages and actors in the communication process.

Instead, they operate best when used in conjunction with other forms of communication, such as opinion leaders and others. According to the theory of reasoned action, people are rational beings who make reasonable decisions to abandon bad attitudes and behaviours in favour of something more lucrative. As a result, if a beneficial idea is provided, individuals will be more likely to accept it and abandon their earlier negative sentiments (Terry & Hogg, 1999). The notion of reasoned action has a lot in common with the Uses and Gratification hypothesis, which claims that media consumers choose what they want and ignore what they don't (see West and Turner, 2004). The third theory is social marketing, which uses strategies used in commercial marketing, to sell development ideas and innovations to the target public (Waisbord, nd).

2.13. 1 Limited knowledge and skills for running community radio.

Effective farm radio programming requires a combination of technical agricultural knowledge and skills, as well as communication and journalism knowledge and skills. The majority of radio officers do not have such a diverse set of abilities. They are either pure technical agriculture experts, particularly those from the Agricultural Communications Branch, or pure communication experts with some journalistic knowledge and skills. This leads to flaws such as failing to offer accurate information on the radio or having correct technical knowledge but failing to communicate it effectively on the radio.

2.14 Access& ability to use mobile phones & laptop.

In developing countries, mobile phones are so widely used that they have become necessary in all types of business and interactions, both in rural and urban settings. Because future farmers will not necessarily be born into farming households, according to Chatel (2018), mobile phones will be vital in agriculture. They will have more opportunity to study the trade and adjust their knowledge and abilities to meet new difficulties, making them more likely to become farmers. Major telecommunication service providers must, however, be pushed to establish infrastructure in rural communities with effective control to assure network flow consistency (Ezeh, Eze & Eze, 2020).

Due to age differences, farmers and extension agents should be given opportunities to learn about the intricacies of using mobile phones in extension work so that they can understand the nuances of coding agricultural data.

According to Sennuga & Fadiji (2020), using mobile phones in extension services can help marginalized poor farmers integrate into the mainstream by promoting communication that is not limited by time, distance, volume, or medium, thereby overcoming barriers caused by territorial borders and physical distance. The cost of communication and information is greatly reduced while using a mobile phone. Poor communication facilities limit access to information, which might result in loss of income (Adamides & Stylianou, 2013).

According to Aker (2011), the use of mobile phones and laptops provides new opportunities for farmers to obtain agricultural information in various formats such as audio (voice), video (internet), and text, for market prices, weather reports, transportation information, and agricultural techniques. Michailidis et al., (2010) explain why mobile technology has been adopted and deployed in rural areas far more rapidly than other ICTs by categorize the benefits of mobile technology into two categories: (a) socioeconomic, such as reducing the distance between individuals and institutions and making information sharing easier and more effective; (b) rural, such as making local material available and making rural services more efficient in terms of logistics and coordination, as well as cost-effective.

Cell phone-enabled technologies are also being used to track and communicate information regarding crop disease outbreaks (Ndyetabula & Legg, 2011). Similarly, Murthy (2009) claims that SMS services delivered via cell phones help keep farmers informed about weather conditions as well as insects and pests in their farms. WhatsApp has a lot of advantages over some of these mobile agricultural information providers. It's a type of social networking technology that enables one-to-many and many-to-many contact, information sharing, and discussion (Andres & Woodard, 2013). Among farmers who use cell phones, it has become the most popular mode of communication. It's an information-rich platform since it lets users share data in a variety of formats, including text, audio, photos, audio-visuals, and even online connections. Furthermore, information can be shared at any time and from any location without concern for background noise (Thakur, Chander & Sinha, 2017).

2.15 Access and able to use television.

Television is one of the most widely used electronic gadgets because it is simple to use and project visual images and demonstrations. However, unlike voice records, the extension service program does not contemplate reaching farmers through television programs, which might be more of a benefit to farmers by painting images in their minds to make farming easier. Farmers, on the other hand, are less inclined to obtain information from television due to their advanced age and instead rely on radio (Mtega, 2018).

This fact was also proved by study analysis, that mostly farmers with significant farming experience apply the information received from radio and the other half was found doubtful in applying the information in their fields, received through television and radio (Mtega, 2018). Regarding importance of television, information department should make the targeted objectives for the development of agriculture by producing and broadcasting different useful programs for agricultural development and progress on scientific basis (Aldosari et al., 2019).

2.16 Access to extension service

Agricultural extension services and capital inputs can be provided to these farmers as a form of assistance. Many farmers in rural areas can be motivated to expand their produce as a result of this. The availability of extension services can favourably affect

a downward trend in farmers' perceptions of productivity and ICT use, resulting in a shift toward a less expensive mode of communication (Bingen, Serrano & Howard 2003).

2.17 Access to electricity & stability

South Africa, Africa's second largest economy, has a sizable energy sector. Coal provided the great majority of South Africa's electricity in 2017, accounting for 88 % of total generation. South Africa provides power to both urban and rural areas through the distribution of Eskom branches around the country (Edkins, Marquard & Winkler, 2010). This can be valuable towards farmers keeping their digital electronics such as telephones and television operating at all times. However, people are now faced with high cost of electricity and load shedding which prevents them from keeping up with new emerging information in agriculture (Awumbila, Owusu & Teye, 2014).

2.18 Access and able to use Internet.

Internet-based information is an effective information service mode that should be harnessed by rural farmers in order to improve in their agricultural productivity. Timely and relevant information is a necessity in re-engineering agricultural development at any level (Mbagwu, Benson & Onuoha, 2017). It is a well-known fact that rural areas are faced with challenges regarding internet connective due to low coverage. Some of the rural farmers are also faced with low literacy level which prevents them from being able to utilise Google to look for relevant information.

2.19 Access and able to use DVD players.

DVD player could be used as an effective medium for dissemination of information in order to increase farmers' knowledge level. Use of documentary film as teaching extension aid could bring possible changes in knowledge level of the farmers. It helps them to adopt innovations and get better benefits in production and productivity (Shemfe, 2019).

2.20 Challenges associated with the communication methods through which farmer received information.

This process of guaranteeing the effectiveness of information management in Africa is hampered by a number of obstacles, including a lack of mechanisms for capturing,

systematizing, and disseminating accessible knowledge, as well as a lack of agricultural sector analysis. Traditional ICT tools dominate the use of ICT in knowledge and information management, which is not only low but also low (radio and TV) (Dlamini & Worth, 2019). Despite their enormous potential, the use of modern ICT (internet, mobile phones, etc.) in storing and spreading knowledge and information remains quite low. In this age of knowledge and information, it is critical to overcome the barriers that prevent smallholder farmers from using such technologies and to identify the opportunities that should be pursued to help them enhance their productivity and catch up to large-scale producers. Some of these challenges are

2.20.1 ICT Availability and Affordability

Despite the fact that ICT has enormous potential for sharing agricultural knowledge and information, it is thought that developing nations' lack of ICT infrastructure has prevented the sector from fulfilling its full potential. This has hampered the ability of research institutes and extension personnel to create and disseminate agricultural information to rural farmers in order to boost productivity. Extension agents and farmers, for the most part, are not connected to current ICT infrastructure and services. As a result, the links between research, extension, and farmers are weak and costly (Dlamini & Worth, 2019).

The lack of ICT infrastructure in developing nations makes it difficult to meet the information needs of rural farmers with internet-based information systems. It is difficult to link rural farmers and supply them with internet-based information services without ICT infrastructures such as strong internet connectivity, internet service providers, and so on. When the infrastructures are not in place, information services that could have been offered through websites, online forums, and social media will be difficult to supply (Apulu, Latham & Moreton, 2011).

Rural farmers tend to reside in small groups, making infrastructure and public services such as electricity, water, and health care facilities, as well as some modern ICT devices, challenging to implement. The lack of access to ICT infrastructure has hampered the national and regional sharing and exchange of knowledge and information generated by research centres' (Syiem & Raj, 2015). Despite recent efforts to extend the electrical grid to rural regions through the rural electrification initiative,

power infrastructure penetration in developing countries remains low. The lack of access to energy has hampered the spread of ICT services rural farmers.

Rural farmer's incomes are low in comparison to urban farmers, making modern ICTs harder to get. As a result, there is a digital divide between urban and rural farmers, and rural areas will continue to be marginalized indefinitely (Kloeppinger-Todd & Sharma, 2010).

2.20.2 Accessibility and Usability

Levels of literacy

The majority of smallholder farmers are illiterate or semiliterate; they are unable to use current ICT technologies efficiently. The majority of these farmers, for example, are unable to use most mobile phone capabilities (such as reading and sending text messages) or to get agricultural information over the internet. Women and men who used smart phones were primarily educated elites with a high level of formal education (Kenning, 2007). However, just a few members of a group of farmers can write/compose, send, retrieve, and read an SMS using a mobile phone, which is a significant setback to information transmission through phone (Dlamini & Worth, 2019).

Resource availability

By connecting people to essential farm management information, ICTs can assist poor agricultural communities better their lives. Farmers living in extreme poverty still face considerable obstacles in adopting these technologies. For such farmers, there are many competing household budget priorities, the majority of which are fundamental survival needs including food, healthcare for family members, clothes, and education. Spending money on information isn't as tempting as spending money on essential requirements in these circumstances, socio-cultural factors and farmers' attitudes/perceptions affects ICTs utilization (Kloeppinger-Todd & Sharma, 2010).

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2.20.3 Low level of interest in utilizing agricultural information among rural farmers

It has long been recognized that there is a link between the level of interest in something and the extent to which it is used. Most rural farmers believe they don't need information and prefer to continue doing things the way they've always done them. This apparent lack of enthusiasm for using agricultural data has an impact on

the amount to which rural information demands may be met through digital communication (Munyua, Adera & Jensen, 2009).

The introduction of ICTs into a traditional environment is related with the ushering in of new changes in people's daily lives and has an impact on how they have always done business (Nnadi et al., 2012). Change can be directly or indirectly rejected by not accepting it similarly, along with high levels of illiteracy, due to fear of unknown effects amidst entrenched socio-cultural elements. Farmers' unfavourable attitudes and beliefs about the use of ICT technologies for agricultural purposes were initially reinforced by the high rate of illiteracy in the project communities.

2.21 Conclusion

For extension communication to be mostly effective, farmers' socioeconomic characteristic should be taken into consideration. It is important to identify farmer's socio economic factors that seem to be more equivalent in a group of farmers for selection of the correct communication channel that which won't raise challenges among farmers. However, farmers face challenges in operating and adopting such tools due variability in personal characterises such as literacy level and preference.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the research methods used in this study that enabled the research hypotheses to be tested and the objectives of the study to be realised.

3.2 Study area

This study was conducted in selected Service Centres of Polokwane and Lepelle-Nkumpi local municipalities, Limpopo province, South Africa (see Table 3.1).

3.3 Study population

The theoretical (target) population was comprised of all smallholder cabbage producers in the Capricorn district municipality. The study (accessible) population on which data will be collected will be made up of all smallholder cabbage farmers (106) in the selected Service Centres of the Polokwane and Lepelle-Nkunpi local municipalities.

3.3 Research Design

A cross-sectional survey approach was used for this study to collect data at one point in time to achieve the aim of the study.

3.4 Sampling procedure and sample size

To cut down the cost first, purposive sampling technique was used to select Capricorn district because there are farmers in this this district that fit the problem the researcher is trying to study. Second, two local municipalities (Polokwane and Lepelle-Nkumpi) will also be purposively selected out of the five in the district because the farmers fit the problem the researcher is trying to study. Finally, the farmers‟ interviews will be done in the following Service Centres, which have been selected by simple random technique in the two local municipalities (Mankweng, Tshebela, Moletjie, Mashne, and Middlekop as illustrated in Table 3.1). The number of farmers were provided by Extension practitioners and Mangers in their respective Service Centres: Polokwane

local municipality (M. Sechaba, pers. comm., June 1, 2021; P. Maluleke, pers. comm., June 8, 2021), and Lepelle-Nkumpi local municipality (P. Lechelele, pers. Comm., August 16, 2021; M. Sello, per. comm., August 16; K. Shilajoe, pers. Comm., August 17, 2021).

Table 3.1: Total number of cabbage Farmers in Polokwane and Lepelle-Nkumpi Local Municipalities.

Local Municipality	Service centre	Number of farmers
Polokwane	Mankweng	33
	Tshebela	09
	Moletjie	7
	Mashashabane	5
Lepelle-Nkumpi	Magatle	06
	Grootfontein	20
	Middlekop	52
		132

According to Isreal (2012) for a population of 100 at 5 per cent precision, the sample size is 81. The total population in the selected Service Centres is 106; this is the closet to 100 in the table, therefore, the sample size for this study will be 81.

3.5 Choice of farmers' socio-economic characteristics for the study

Various studies have assessed factors influencing farmers" decision to participate in the uptake of agricultural innovations such as the use of ICT tools (Kuehne et al. 2015). The evidence, however, regarding the effect of institutional, demographic, socioeconomic and geographic-related factors on smallholders" participation decision is varied. The evidence in peer-reviewed publications shows that demographic and socio-economic variables are sometimes conceived differently among researchers and sometimes are used interchangeably. For these reasons, the demographic and

socio-economic factors commonly explored in the literature on ICT access or use among farmers which was used in this study to answer the research questions and test the study hypothesis include education, age, gender, income and cost of data, family size, farm size, training in ICT use and access to resources such as electricity and its stability, credit, extension services, internet connectivity, mobile phone and network coverage, access to and/or use of ICT tools.

3.5.1 Conceptual framework for the study

The Düvel conceptual framework (1991) for adoption behaviour analysis, indicates that the incompatibility of an innovation such as extension communication methods (ICT tools) for receiving farm management information, represents how relevant the innovation is, or how the innovation fits the individual's specific situation e.g. personal, social, cultural, economic, communicability, Most of the factors that make a farmer unable of adoption, in this study, the use the extension methods (ICT tools) for receiving farm management information, are what researchers normally call personal/environmental factors; these factors are generally referred to as independent variables. This framework will, therefore, be used to generate the questionnaire to answer the study research questions and test the study hypothesis.

3.6 Data collection

Data was collected by means of a semi-structured questionnaire. The questionnaire was also translated into the Sepedi language and farmers‟ interviews was done through face-to-face approach because the current COVID-19 lockdown restrictions have been moved to adjusted level 1.

3.7 Data Analysis

Data was analysed through the Statistical Package for the Social Sciences (SPSS) programme. Data on respondents‟ socio-economic characteristics, communication methods through which they received farm management information as well as challenges faced in receiving farm management information will be analysed by means of descriptive statistics (frequency and percentage) and inferential statistic (chi-square test), to address research questions (i), (ii) and (iii).

The research hypothesis (i) was subjected to inferential analysis using inferential statistic the influence of several independent variables (socio-economic variables, (X1 to X20) on a categorical dependent variable: communication methods (ICT tools) smallholder cabbage farmers used to receive farm management information (radio, television, telephone, computer or DVD

The predictor variables (X"s) that was used in this study include X1 until X20. They are:

X1 = Education (in years)

X2 = Sex (dummy: 1= male; 0= female)

X3 = Farming experience (in years)

X4 = Age of farmer (in years)

X5= Farming group membership (dummy; 1=Yes; 0= No)

X6= Income (Rand)

X7= Farm size (ha)

X8= Household size (number of people in household)

X9= ICT training received (Yes; No

X10= Social influence (Yes; No)

X11= Access to electricity and its stability (Yes; No)

X12= Access to credit, (Yes; No)

X13= Access to extension services, (Yes; No)

X14= Access to internet connectivity, (Yes; No)

X15= Access to mobile phone network coverage, (Yes; No)

X16= Access to radio, (Yes; No)

X17= Access to, and able to use television, (Yes; No)

X18= Access to, and able to use lap/desktop computer, (Yes; No)

X19= Access to, and able to use mobile phone/smart phone (Yes; No).

X20= Access to, and able to use DVD equipment (Yes; No)

4. SCIENTIFIC CONTRIBUTION

The Science of Agricultural Extension and the use of agricultural innovations will be enriched if the Düvel framework (1991) for adoption behaviour analysis is able to hold its own to predict the influence of smallholder cabbage farmers‟ socio-economic characteristics on their use of the selected communication methods (ICT tools) to receive farm management information from their local extension officers.

Furthermore, the practice of Agricultural Extension will also benefit because Extension practitioners will have evidence-based information to decide on the appropriate communication methods (ICT tools) to use to convey farm management information to farmers, especially, in this era of COVID-19 restrictions that preclude face-to-face interactions between Extension practitioners and farmers.

5. ETHICAL CONSIDERATION

The research requires ethical clearance from TREC since it deals with humans

5.1 Permission

Permission to carry out the study was obtained from the Turfloop Research Ethics Committee (TREC) prior to its commencement.

5.2 Inform consent.

The research informed applicants that participation is voluntary and if they want to pull out from participating when they feel uncomfortable, they were allowed to do so at any time. Applicants were asked to sign a consent form to show that they agreed to participate in the study.

5.3 Confidentiality and anonymity

The study paid attention to confidentiality and anonymity of applicants. The information that applicants provided would only be used for the purpose of this study only, and their names would not be mentioned in the study. The researcher informed the applicants before they agreed to participate in the study.

5.4 The benefits and protection from harm/risk

The researcher would protect the identities of the applicants and their privacy through anonymity. The researcher would protect harm and risk by providing the participants with the right to withdraw from the study whenever they do not feel comfortable in answering questions and by hiding their identities. Participant who experienced unforeseen circumstances, would be allowed to postpone the date for interview.

5.5 Respect, Dignity and standard of care

The researcher would respect all applicants through the same conduct. Also, native practitioners" secrets trait would be respected. The questionnaire has socio-economic characteristic in a rank form to make farmers feel comfortable to give answers as they would not provide direct answers and it would help in maintaining participant's dignity as well as making them feel not offended.

Researcher would ask whether participant were willing to talk about the communication methods through which they think its best suited for them to receive information. All emerging cabbage farmers' rules and secrets would be respected. Participants who do not understand and who cannot write English would be interviewed in their native language which is Sepedi, and the researcher would help them with signing the consent form. Standard of care would be considered in the study; Therefore, participant would be treated with pride, and their rights as well as welfare would be ensured.

CHAPTER 4 RESULTS AND DISCUSSION

4.1 INTRODUCTION

The study aims to understand how the COVID-19 pandemic has affected the extension communication methods (ICT tools) through which smallholder cabbage farmers receive farm management information from their local extension practitioners and whether farmers" socio-economic situation, position them to receive farm management information through the conventional communication media and the current digital communication tools in Polokwane and Lepelle-Nkumpi local municipalities, Limpopo province. The data from farm visit interviews were subjected to descriptive and inferential analyses using SPSS software 11.5 version.

The presentation of the findings begins with present situation in the study areas in which descriptive analysis were used to describe respondents 'socioeconomic characteristics that may influence extension communication methods that may through which they receive information and also the challenges associated with the communication methods. This description provides the researcher with a better insight into, and an understanding of the nature and type of respondents in the study, and therefore, their actions and reactions regarding the issue under study.

This is followed by the use of inferential analyses to test any significant differences in the views of respondents on various issues stated in the hypotheses and also study the relationships to predict respondents' views on whether or not socio-economic characteristics have no influence on the communication methods (ICT tools) they use for receiving farm management information from their local extension practitioner.

The findings are assessed in relation to literature and the chapter ends with a summary to explain what the study has identified.

4.2. Present situation in the study area

In this section, the study findings regarding the present situation, scheme membership-related issues as well as respondents' socio-economic characteristics

and their challenges in the two local municipalities of the Limpopo Province namely, Lepelle-Nkumpi and Polokwane local municipality regarding information communication technology are presented in this section.

4.3 Respondents' socioeconomic characteristics

A summary of continuous and categorial variables and results related to all 81 respondents in the survey is presented in Table 4.1. The table indicates the socio-economic characteristic that are perceived to influence the use of ICT, which includes age, sex, education, farming experience, regular income, farm size, farming experience, farming group, household size, access to electricity and stability, access to credit, access to extension service (ES), access to internet connectivity and access to mobile network. A cross tabulation between socio-economic characteristics and ICT to disseminate information was carried out.

Table 4.1: Respondent socio-economic characteristics influence on communication methods (N=81)

	Radio		Television		Mobile phone		Smartphone		Laptop		DVD	
	Yes %	No %	Yes %	No %	Yes %	No %	Yes %	No %	Yes %	No %	Yes %	No %
AGE (in years)												
18– 35	73.9	26.1	87	13	82.6	17.4	100	0	91.3	8.7	35	65
36-50	50	50	86.7	13.3	96.7	3.3	60	30	56.7	43.3	23	77
51 – 75	82.1	17.9	60.7	39.3	96.4	3.6	21.4	78.6	17.9	82.1	14	86

Significance	P<0.05*		P<0.05*		P>0.05		P<0.05		P<0.05		P>0.05	
SEX												
Male	68.6	31.4	78.4	21.6	90.2	9.8	58.2	41.2	54.9	45.1	21.6	78.4
Female	66.7	33.3	76.7	23.3	96.7	3.3	56.7	43.3	50	50	26.7	73.3
Significance	P>0.05		P>0.05		P>0.05		P>0.05		P>0.05		P>0.05	
FARMING EXPERIENCE (in years)												
1-10	59.6	40.4	89.4	10.6	89.4	10.6	76.6	23.4	80.9	19.1	31.9	68.1
11-20	80	20	68	32	96	4	36	64	32	68	16	84
21-30	100	0	28.6	71.4	100	0	28.6	71.4	0	100	0	100
31-40	0	100	100	0	100	0	0	100	0	100	0	100
Significance	P<0.05*		P<0.05		P>0.05		P<0.05		P<0.05		P>0.05	
EDUCATION (in years)												
1-10	75.8	24.2	63.6	36.4	96.7	3.3	18.2	81.8	9.1	90.9	15.2	84.8

11-20	62.5	37.5	87.5	12.5	89.6	10.4	85.4	14.6	83.3	16.7	29.2	70.8
Significance	P>0.05		P<0.05*		P>0.05		P<0.05		P<0.05		P>0.05	
FARMING GROUP MEMBERSHIP												
Yes	78.6	21.4	64.3	35.7	95.2	4.8	33.3	66.7	26.2	73.8	16.7	83.3
No	56.4	43.6	92.3	7.7	64.1	35.9	84.6	15.4	82.1	17.9	12	69.2
Significance	P<0.03*		P<0.05		P>0.05		P<0.05		P<0.05		P>0.05	
REGULAR INCOME												
Yes	56.7	43.3	90	10	86.7	13.3	96.7	3.3	96.7	3.3	23.3	76.7
No	74.5	25.5	70.6	29.4	96.1	3.9	35.3	64.7	27.5	72.5	23.5	76.5
Significance	P>0.05		P<0.05*		P>0.05		P<0.05		P<0.05		P>0.05	
FARM SIZE (in hectares)												

1-10	62.1	37.9	82.7	17.3	86.2	13.8	75.9	24.1	69	31	31	69
11-20	55.6	44.4	92.6	7.4	96.3	3.7	63	37	63	37	29.6	70.4
21-30	80	20	60	40	90	10	30	70	40	60	10	90
31-40	87.5	12.5	50	50	100	0	37.5	62.5	12.5	87.5	0	100
41-50	100	0	0	100	100	0	0	100	0	100	0	100
51-60	100	0	80	20	100	0	40	60	20	80	20	80
Significance	P>0.05		P<0.05*		P>0.05		P<0.05*		P<0.05*		P>0.05	
HOUSEHOLD SIZE												
1-5	66.1	33.9	79	21	90.3	9.7	66.1	33.9	61.3	38.7	24.2	75.8
6-10	73.7	26.3	26.3	73.7	100	0	31.6	68.4	26.3	73.7	21.1	78.9
Significance	P>0.05		P>0.05		P>0.05		P<0.05*		P<0.05*		P>0.05	
ACCESS TO ELECTRICITY & STABILITY												

Yes	66.7	33.3	80.8	19.2	92.3	7.7	60.3	39.7	55.1	44.9	24.4	75.6
No	100	0	0	100	100	0	0	100	0	100	0	100
Significance	P>0.05		P<0.05*		P>0.05		P<0.05		P>0.05		P>0.05	
ACCESS TO CREDIT												
Yes	60.3	39.7	84.5	15.5	91.4	8.6	69	31	62.1	37.9	22.4	77.6
No	87	13	60.9	39.1	95.7	4.3	30.4	69.4	30.4	69.4	26.1	73.9
Significance	P<0.05*		P<0.05*		P>0.05		P<0.05		P<0.05		P>0.05	
ACCESS TO ES												
Yes	68.8	31.2	61.3	38.7	92.5	7.5	57.5	42.5	52.5	47.5	23.8	76.2
No	0	100	60.9	39.1	100	0	100	0	100	0	0	100
Significance	P>0.05		P>0.05		P>0.05		P>0.05		P>0.05		P>0.05	
ACCESS TO INTERNET												

CONNECTIVITY												
Yes	63.6	36.4	88.6	11.4	90.9	9.1	90.9	9.1	85.4	14.6	31.8	68.2
No	72	28	64.9	35.1	94.6	5.4	18.9	81.1	13.5	86.5	13.5	86.5
Significance	P>0.05		P<0.05*		P>0.05		P<0.05		P<0.05		P<0.05*	
ACCESS TO MOBILE NETWORK												
Yes	65.2	34.8	82.6	17.4	27.5	72.5	63.8	36.2	59.4	40.6	27.5	72.5
No	83.3	16.7	50	50	0	100	25	75	16.7	83.3	0	100
Significance	P>0.05		P<0.05*		P>0.05		P<0.05*		P<0.05		P<0.05*	

4.3.1 Age of farmers in years

There are indications that the farming population in South Africa is ageing. According to Skebe (2020), AgriSA estimates that the average age of a farmer in South Africa is 62 while countries that lead in food production, such as the United States of America, which have an average farmer age of 55. The median age of 60 years found amongst cabbage farmers in this study is thus a good reflection of national trend.

There were differences in the use of communication channels during the COVID-19 pandemic by age in the case of radio, television, mobile phone, smartphone, laptop

and DVD. The use of communication channels varied by age. For example, the use of television (87%), smartphones (100%), laptop (91.3%), and DVD (35%) occupied a leading position among farmers over the age between 18 to 35 years. Respondents of the middle age up to 50 years predominantly used mobile phone (96.7%), together with the old age generation (96.4%). However old age group seem to be more dominant in the section of radio (82.1%). Regarding the influence of age categories into three in the type of communication methods used, the interviewed carried out resulted to 73.9% of youth farmers, 50% of middle-aged farmer and 82.1% of old age farmers with the significance difference of $P<0.05$. this is a clear indication that old age group farmers still prefer the use of old methods of communication which hinders the use of current methods of communication. Age also has a significance influence on the use of radio to transfer extension information to cabbage farmers to better their production.

The use of television in relation to age resulted to 87% youth farmers, 86.7% of middle-aged farmers and 60.7% who utilize these device old-aged farmers who utilize this device with a significance of $P<0.05$. The use of mobile phone resulted to 82.6% of young farmers, 96.7% of middle-aged farmers and 96.4% of old-aged farmers with a significance difference of $P>0.05$. this clearly indicate that that age has no influence of the use of mobile phone to receive information. 100% of young farmers, 60% of middle-aged and 21.4% of old-aged farmers tend to use smartphones to receive information regarding their cabbage production with the significance difference of $P<0.05$. On the other hand, 91.3% of young farmers, 56.7% of middle-aged farmers and 17.9% of old-aged farmers utilize laptop as their source of information with the significance difference of $P<0.05$. Lastly 35% of young farmers, 23% of middle-aged farmers and 14% of old-age farmers have access to DVD as one of the communication methods with a significance difference of $P>0.05$.

Age is an important as an influential factor in the use of mentioned communication methods to receive agricultural information. Differences in the proportion of mentions by respondents of different age groups for radio and television are almost nil, as for smartphone and laptop.

These data indicate that young and middle-aged farmers are more favourable disposed towards adoption of current communication tools than are older ones. Perhaps young and middle-aged farmers do not have as many inhibitions, status positions to maintain as compared to their elders. They may be generally more easily motivated to utilize different communication methods to receive effective information than are their elders due to traditional values, therefore, should seek the active cooperation and participation of young and middle-aged farmers in agricultural activity. Young farmers may be more willing than their elders to provide land and other materials for demonstrations.

4.3.2 Sex of farmers

The table above shows male as the main participants in the farming of cabbage in Limpopo, which is one of the factors hindering women empowerment in agriculture. However, the gender of farmers resulted to no significance difference on the influence of the communication methods with all dependent categories resulting to a significance value of $P>0.05$. this correlate with the statement by Croson & Gneezy, (2009), you can assess the use of ICT by farmers based on their gender. Male farmers are more likely to participate in geographically dispersed social networks than female farmers, giving them a higher chance to learn new information and adopt ICT. However, it also opposes the following findings by Beevi et al, (2018), Despite an increase in women's involvement in agricultural activities throughout time, agricultural extension and information on new technology remain nearly entirely targeted at men.

Asfaw & Admassie (2004) found that males are more likely to adopt new technologies whereas Nhemachena & Hassan, (2007) have been inconsistent with the findings that women are more inclined than men to adopt agricultural advancements. These various findings seem to be influenced by how men and women are positioned in various cultural agricultural systems. In South Africa, men typically prefer to raise cattle, goats, and sheep than getting involved in the cultivation of crops, particularly vegetables. According to the Agricultural Household Statistics, 53.3% of men in the province of Limpopo work as livestock producers (Stats SA, 2013). Our study's findings have ramifications for the province's agriculture program planning.

4.3.3 Farming experience

According to the study farmers were categorized into 4 categories which includes 1 to 10 years, 11 to 20 years, 21 to 30 years and 31to 40 years. The interview resulted to more farmers between the of 1 to 10 and 11 to 20 years of experience being dominant. The above research findings are somewhat in line with those of Edeoghon, Ajayi & Ugboya (2008) who discovered that 32% of the respondents had farming experience ranging from 10 to 20 years. Regarding the significance difference, radio, television, smartphone, and laptop resulted to a significance difference of $P<0.05$, while mobile phone and DVD resulted to a significance value of $P>0.05$. these results oppose Rehman et al (2013) finding that there was no statistically significant correlation between respondents' access to agricultural knowledge and their experience as farmers. The lack of a meaningful association demonstrates that the respondent's farming experience had no bearing on their ability to retrieve information.

4.3.4 Education of farmers in years

Education was categorized into two which includes 1 to 10 years and 11 to 20 years whereby 1 to 10 years represent below and equal to matric and 11 to 20 representing undergraduate to PHD. The study indicates that 75.8% of farmers are categorized to 1 to 1o years and 62.5% the farmers belong to a category of 11 to 20 for farmers that utilize radio as form of communication with the significance difference of $P>0.05$. this simply indicates that farmers do not require professional education to utilize radio since it’s not the current technology of communication. People utilized radio from the period of apartheid.

Farmers who had access to television were 63.6 and 87.5 in percentage respectively to the categories of education. Farmers who had access to mobile phone were 96.7% and 87.5 respectively. In correlation to access to smartphones, the were 18.2% and 85.4% of farmers, 9.1% and 83.3% of farmers had access to laptop and lastly 15.2% and 70.8% of farmers had access to DVD respectively. All this communication methods resulted to a significance difference of less than 0.05. The results further oppose Musa, Githeko & El-Siddig (2013) farmers' views on conventional planting techniques have a negative impact on how they use ICT. 37 percent of the

researchers said that political and institutional leadership made it difficult to use ICT to spread information about agriculture.

4.3.5 Farming group membership

In this category, most of the farmers seemed to participate in farm group. Which lead to radio, television, mobile phone, smartphone, and laptop with a significance value of $P<0.05$. this simply mean that farm groups also influence the type of communication method through which farmers receive information. This can be basically because one or few members have access to certain technologies of communication that might influence other members of the group to adopt such technologies. However, DVD resulted to a significance value of more than 0.05($P>0.05$).

4.3.6 Regular income

The data revealed that a very high number of the respondents from both municipalities do not receive regular income either from farming or job. However, a high proportion of farmers who received regular income was observed, particularly those with smartphones and laptop as the main affordable source of information. 96.7% of farmers owned smartphones and also 96.7% of farmers owned laptops respectively. A chi-square test shows that there were no statistically significant differences between the two ($P<0.05$). Television and mobile resulted to no statistically significant differences ($P<0.05$) with more farmers being not receiving regular income.

4.3.7 Farm size

Farm sizes were categorized into 5 categories which are 1 to 10 hectares, 11 to 20 hectares, 21 to 30 hectares, 31 to 40 hectares, 41 to 50 hectares and 51 to 60 hectares. Most farmers who had access to communication methods such as radio, television, mobile phone, smartphone, laptop, and DVD seem to occupy 1 to 10 and 11 to 20 hectares. Radio, mobile phone, and DVD showed independence from farm size resulting a $P>0.05$. however, television, smartphones and laptop seem to be dependent on the size of the farm resulting to a significance of $P<0.05$. most farmers utilize modern technologies like smartphones and laptop to install application for their farm management. The results of the present study are in line with those of Saadi,

Mahdei & Movahedi (2018) who discovered a highly substantial link between respondents' land ownership and information access.

4.3.8 Household size

Household sizes were categorized into two categories which are 1 to 5 family members and 6 to 10 family members depending on how many a farmer is supporting. The data revealed that a very high number of the respondents from both municipalities had 1 to 5 family members in support. However, a high proportion of farmers who had access to such technologies were on 1 to 5 categories, particularly those with radio, television, mobile phone, smartphones and laptop as the main affordable source of information and least farmers had access to DVD. Out of 62 farmers under category 1-5 family members, 66.1% of farmers had access to radio, 79% owned televisions, 90.3% had access to mobile phone, 66.1% had access to smartphones, 61.3% had access to laptop and 24.2% had access to DVD respectively. A chi-square test shows that there's no statistically significant differences ($P>0.05$) for access to radio, television, mobile phones, and DVD. Access to smartphone and laptop resulted to statistically significant differences ($P<0.05$). these two devices depend on household size mainly since they are the most common mode of communication whereby older generation have little to no knowledge about their operation. This knowledge can be instilled by one the household members.

4.3.9 Access to electricity and its stability

The result from the figure 4.1 show a large proportion of farmers with access to electricity and its stability. A percentage of 66.7 out of 63 number of farmers owned television and 60.3% of 47 farmers owned smartphones respectively. A chi-square test shows that there were no statistically significant differences between the two. This is clearly because television requires electricity to run through out and smartphone is a mode of various communication which utilize a lot of application to communicate with other this can be through several social media and phone calls. A larger proportion of farmers who had access to radio, mobile phone, laptop, and DVD also had access to electricity. However, these devices resulted to a no significance difference of $P>0.05$. Greater access to electricity may be affected by the cost of

electricity though, which may be high especially in the context of Sub-Sahara Africa where poverty rates are high amongst several developmental challenges device such as radio do not necessarily depend on electricity since most use batteries. However, the accessibility of electricity hinders the finding of Byamukama, Kalibwani & Mbabazi (2022) that, in rural areas, there's no supply of electricity to power ICT devices which prevent adoption of communication tools.

4.3.10 Access to credit

From the above result obtained it shows that there's a larger number of farmers with access to credit as compared those who have no access to those who do not have access to credit in respect to access to such communication methods. 60.3% of 55 farmers with access to credit had access to radio, television (84.5%), smartphone (69%), and laptop (62.1%).an overall significance difference of the farmers who had access and no access to credit for all these four dependent categories result to a statically significance difference ($P<0.05$). Rural development policy aimed at reducing poverty should concentrate on agriculture, which is the most significant activity for the poor, who lack access to loans to influence adoption of technologies. Mobile phone and DVD resulted to a no significance difference of $P>0.05$. However, farmers from these two municipalities raise complain regarding the type of credit whereby they only receive farmer support as a voucher which only can purchase agricultural goods only which makes adoption of expensive technologies difficult.

4.3.11 Access to extension service (ES)

From the result obtained from the conducted survey, it indicates that a lot of farmers had access to extension service as compared to those with no access to extension service irrespectively of the communication methods they use. Access to ES resulted to a no significance difference of $P>0.05$. This clearly state that access to communication methods above is not influence by access to extension service. This finding opposes Bingen, Serrano & Howard (2003) results that, a decline in farmers' perceptions of productivity and ICT use can be positively impacted by the availability of extension services, leading to a switch to a less expensive form of communication.

4.3.12 Access of internet connectivity

Internet is considering the most important source of communication for phones and laptops. The finding shows that there is a lot of farmers who has access to internet as compared to those with no access. From the above table, television, smartphone, and laptop result to a statistically significance difference (P<0.05). This are the only device which can access internet due to the system incorporated in them, their adoption is influence by desire to access information from the internet. This is supported by Mbagwu, Benson & Onuoha (2017) describing how using Internet-based information is a useful information service modality that rural farmers could take advantage of to increase their agricultural output. Any level of re-engineering agricultural development requires timely and pertinent information.

4.3.13 Access to mobile network

Mobile network is the centre republic of all phone and internet device such as wifi for both internet and phone calls. For this section there's a higher number of farmers who has access to mobile network with television, smartphone and laptop showing significance difference of P<0.05.

4.4 Communication methods (ICT tools) through which smallholder cabbage farmers mainly received farm management information from their local extension practitioner before and since the COVID-19 outbreak in South Africa in 2020**.**

Table 4.2: Information from their local extension practitioner before the COVID-19 outbreak in 2020 (N=81)

Communication Methods	**FREQUENCY**		**PERCENTAGE**	
	YES	**NO**	**YES**	**NO**
Radio	26	55	32.1%	67.9%
Television	0	81	0%	100%
Mobile phone	72	9	88.9%	11.1%
Smartphone	51	30	63%	37%
Landline	64	17	79%	21%
Computer	45	36	55.6%	44.4%
DVD	1	80	1.2%	98.8%

A summary of some continuous variables related to all 81 respondents in the survey is presented in Table 4.2. The use of mobile phone, smartphone, landline, and laptop distribution among the respondents shows a high percentage; this means a few respondents were not receiving farm management information with such communication tools. The distribution of the use of radio, television, and DVD on the other hand shows lower percentages indicating that a few farmers had access to such ICT tools. The description of the variables in this table is expanded on in the next paragraphs.

Before the period of COVID-19, 26 farmers had access and were utilizing radio to acquire information as requested by their extension agents. This resulted to a percentage of 32.1% of farmers who use radio as their form of information source. Farmer who utilized tv as form of Information were found to be zero resulting to a percentage of 0%. This is mainly there's no farming programmes airing on television. Mobile phones seem to be the most utilized source whereby farmers received phone calls and text messages regarding their farming activities. 72 farmers were found to utilize mobile phone resulting to 88.9% of farmers utilizing mobile phones. 51 one farmers out of 81 had access to smartphones which enabled them to receive demonstrative information through WhatsApp and E-mail and allowed them to received phone calls. This resulted to a percentage of 63%. 64 farmers from both municipalities received information through landline calls from their respective departments equating to a total of 79% of farmers who received extension service. Lastly, only one person received information through DVD which resulted to percentage of 1.2%

Table 4.3: Information from their local extension practitioner during the COVID-19 outbreak in 2020 (N=81)

Communication Methods	**FREQUENCY**		**PERCENTAGE**	
	YES	**NO**	**YES**	**NO**
Radio	28	53	34.6%	65.4%
Television	0	81	0	100%
Mobile phone	61	20	75.3%	24.7%
Smartphone	53	28	65.4%	34.6%
Landline	47	34	58%	42%
Computer	40	41	49.4%	50.6%

DVD	0	81	0	100%

A summary of variables related to all 81 respondents in the survey during COVID-19 is presented in Table 4.3. During the period of the pandemic there was an increase in number of farmers (28) who used radio as their source of information from their extension agent. This elevated the percentage to 34.6%. The use of television before and during COVID remained constant with a percentage of 0% farmers utilizing television of farm information. The use of mobile phones decreased drastically from 72 farmers utilizing mobile phones for information to 61 farmers resulting to a percentage of 75.3%. The use of smartphone as source of information seems to have increased by 1.4%. This clearly indicates the influence of extension agents to promote use of current digital technologies. The use of landline as form of communication decreased from 79% to 58%. This is mainly because there was reduction in number of extension agents in office to avoid widespread of COVID-19. The use of laptop as source of information also decreased drastically from 55.6% to 49.4%. This might be affected by the cost of data since a lot of people were under lockdown not generating enough income. The use of DVD also decreased from little use (1.2%) to no use (0%).

4.5 Challenges associated with the communication methods (ICT tools) through which smallholder cabbage farmers have received farm management information from their local extension practitioner since the COVID-19 outbreak in South Africa in 2020

Table 4.4: Challenges associated with the communication methods (N=81)

	FREQUENCY	PERCENTAGE
DEMONSTRATIVE INFORMATION		
No response	37	45.7%
Yes	17	21%
No	27	33.3%
CLARITY OF INFORMATION		
No response	14	17.3%
Yes	43	53.1%
No	24	29.6%

INTERNET CONNECTIVITY		
No response	40	60.5%
Yes	12	14.8%
No	20	24.7%
CLARITY OF TEXT MESSAGES		
No response	41	50.6%
Yes	17	21%
No	23	28.4%
LANGUAGE BARRIER		
No response	39	48.1%
Yes	17	21%
No	25	30.9%
MOBILE NETWORK		
No response	34	42%
Yes	25	30.9%
No	22	27.2%
LACK OF DIGITAL SKILLS		
No response	54	66.7%
Yes	0	0
No	27	33.3%

In terms of Table 4.4, the respondents the discussion is summarized in the next section from 4.5.1 up to 4.5. 7. The discussion commences with the results of demonstrative information.

4.5.1 No demonstrative information

Respondents were asked to indicate their challenges with regard to demonstrative information. The response is presented in Table 4.4. From the conducted survey, 45.7% farmers didn't raise concern regarding information that is demonstrative like photos and videos. 21% of the farmers did agree that they didn't receive demonstrative information, where else 33.3% of farmers showed no difficulty in not receiving demonstrative information. Most farmers did indicate that they are familiar with farming which do not require them to receive photos and videos but clear information due to them being experienced in farming. This opposes the past study by Karubanga et al (2016), which revealed that watching videos usually increases retention power of the participants to an extent of remembering most things learnt.

Earlier findings by Bentley et al (2014) also indicated that many farmers were able to recall videos and remember topics learnt after video watching.

4.4.2 Clarity of text messages

As far as clarity of text messages is concerned, the responses is indicated in the above table. 17.3% farmers didn't raise concern regarding clarity of information. 53.1% of the farmers did agree that they didn't receive clear information, where else 29.6% of farmers showed no concern regarding the clarity of information they received. Most of the farmers complained about the complexity of information and how hard it is for them to put the information into practice. Some farmers did complain that radio information is summarised that it becomes hard for them to understand to the point of solving their problem and also that information is sometimes not important or relevant to their problems.

The other researchers additionally perceived radio and TV programmes as challenges because in most cases these programmes tend to focus on political and other government-related messages and lack sufficient focus on technology transfer in agriculture (Dhaka & Chaval, 2016).

4.5.3 Internet connectivity

Internet is the most important feature in the use of ICT such as smartphones and laptops. It enables the farmers to acquire different information from multiple sources either demonstrative or theory. Most researchers believe that underdeveloped communities do not have access to internet connection. However, the government has mobilized reliable Internet infrastructure to more than half of those living in rural areas, but not enough of those people who are using it because accessing it is too expensive (Hove, Ngwerume & Muchemwa, 2013). Hove et al believes that there's inadequate focus on rural infrastructure development such as internet connectivity which led to the continuous growth of the African urban population. The internet connectivity position of respondent is indicated in Table 4.4. This study reveals that 14.8% of the cabbage farmers had no internet connectivity where else 24.7% percentage of the farmers had access to internet. This opposes the study conducted

by Dhaka & Chaval (2016), which state that more than half of respondents expressed irregular internet connectivity as one of the major constraints.

4.5.4 Clarity of text messages

From the survey conducted on 81 cabbage farmers, it indicates that 50.6% of the farmers did not respond to clarity of text messages. 21% of the farmers did raise issues regarding using text messages to receive information. 28.4% used text message to communicate with their extension officers for advisory. These findings are supported by Razaque & Sallah (2013) who claimed that the use of mobile phone for farmers to get advice by text message over mobile phones resulted to positive result to the farmers, and they enhanced their production. technology-driven extension techniques, particularly those involving text messages, were viewed as an enhancement rather than a replacement of conventional face-to-face extension techniques. Text messaging is a new technology that has lately been made available to farmers, but it will take some time for it to catch on (Razaque & Sallah, 2013).

4.5.5 Language barrier

As far as the language barrier is concerned the respondents' findings are presented in Table 4.4. The findings show that 48.1% of the 81 cabbage farmers did not reply to the issue of language barrier. 21% of the farmers had problems in understanding information due to language difference. With 30.9% of the farmers who had no concern with language. Few members of a group of farmers can write/compose, send, retrieve, and read an SMS using a mobile phone, which is a significant setback to information transmission through phone (Dlamini & Worth, 2019). It is important for extension officer to use a language mostly understood by the farmer while sending messages to farmers or communicating with them. However, both Polokwane and Lepelle-Nkumpi farmers indicated that almost all their extension officers are multilingual.

4.5.6 Mobile network

Availability of network connection around the rural areas which are predominately occupied by smallholder farmers is affected by the altitudes such as hills and also

rivers which tempers with the wireless waves (Dillehay, 2011). The Respondents findings are presented in Table 4.4. The study shows that a lot of farmers who did answer about the mobile network seem to experience problems regarding network service (30.9%). Ogunniyi & Ojebuyi (2011) also reported that poor network connectivity is the second most hampering constraint that is preventing farmers from using mobile phone as source of information.

4.5.7 Lack of digital skills

The respondents were checked with regards to digital skills and their findings are presented in Table 4.4. The study indicates that many farmers (66.7%) did not give their response regarding digital skill and a group of farmers did not have issues with utilizing digital technology. However, this does not give us a clear indication that all the farmers have digital skills. When it comes to socio-demographic factors, residents of rural areas who are elderly and have low levels of education are most at risk for digital exclusion. These farmers typically lack the knowledge and abilities necessary to effectively use current technologies.

CHAPTER 5

SUMMARY OF RESULTS, RECOMMENDATIONS AND CONCLUSION

5.1. Introduction

The objective of this chapter is to provide summary and recommendations about the study. ICT has found a place on poor smallholder farms and their activities, due to the rising mobile, wireless, and Internet industries. The most effective tool for farmers is to get knowledge from information and make decisions based on that understanding (Eze & Obikeze, 2017).

COVID-19 has drastically affected communication and farmers from getting information fate-to-face from their extension agent therefore, it became critical for effective communication methods to be evaluated. The evaluation in this study focused on extension communication methods and farm management support during covid-19 pandemic in Limpopo province. Purposeful research requires that its conclusions be based on tested hypotheses which should answer the research questions. A summary of the main study findings together with conclusions reached from the study and recommendations are outlined next.

5.2. Summary of the findings

The problem investigated in this study relates to the little research attention to evaluate extension communication methods through which farmers used to receive information since COVID-19, using a conceptual framework from behaviour adoption literature, to assess farmers' socioeconomic characteristics that may influence communication tools and challenges related to the communication tools. The assessment led to the generation of objectives hypotheses. These objectives are as follow:

- Identify and describe smallholder cabbage farmers‟ socio-economic characteristics that might influence the communication methods (ICT tools) they use for receiving farm management information from their local extension practitioner.

- Ascertain and describe the communication methods (ICT tools) through which smallholder cabbage farmers mainly received farm management information from their local extension practitioner before and since the COVID-19 outbreak in South Africa in 2020.
- Describe the challenges associated with the communication methods (ICT tools) through which smallholder cabbage farmers have received farm management information from their local extension practitioner since the COVID-19 outbreak in South Africa in 2020.

The main findings are as follows:

- The significant difference in the results of respondents' socio-economic characteristics that may influence communication methods indicates that socio-economic characteristics has neither positive nor negative influence on the use of ICT. Thus, the null hypothesis was not supported.

- The results of the distribution of respondents on the communication methods used before and during COVID-19 showed that most respondents utilized ICT tools before COVID-19 as compared to the period of COVID-19.
- Similarly, the results of the distribution of respondents on challenges associated with the communication methods showed that most respondents had no challenges utilizing the communication ICT tools.
- The hypothesis that farmers' characteristics such as respondent's age, respondents' sex, farming experience, years of schooling, farm size, income and etc of participant do not significantly influence the use of communication methods was tested. The results show that all factors do have significant influence.
  - Age of farmers seem to have influence on the use of radio, smartphone, laptop, and television but it does not influence the use of mobile phone and DVD. Sex of the farmers does not have influence in either of this communication methods. Farming experience seem to have influence on the use of television, smartphone, and laptop. However, it does not influence the use of radio, mobile phone and DVD. Education level of farmers have influence on the use of television, smartphone, laptop and mobile phone but has no influence on radio and DVD.

- Farming group membership has influence on radio, television, smartphone, and laptop but not on mobile phone and DVD. Regular income showed to be significant towards television, mobile phone, smartphone, and laptop instead of radio and DVD. Farm size in hectares showed to have influence on television, smartphone, and laptop instead of radio, mobile phone, and DVD. Household size showed significance towards the use of smartphone and laptop and no significance towards the use of radio, television, mobile phone, and DVD. Access to electricity and its stability had significance towards television, smartphone, and laptop but had no significance towards radio, mobile phone, and DVD. Access to credit influenced the use of radio, television, smartphone, and laptop as source of information for the farmers but did not influence the use of mobile phone and DVD. Access to extension service show no significance in the use of communication methods. Access to mobile network & access to internet connectivity showed significance towards television, smartphone, and Laptop.

5.3. Conclusions

It is concluded from the foregoing findings that current hypotheses about farmers socio-economic characteristics influence on the communication methods (ICT tools) that cabbage farmers used to receive information have been tested. In particular, hypotheses about the farmers socio-economic characteristics influence on the communication methods (ICT tools) were supported by the findings of this study. ICT tools were used by relatively large percentages of farmers. Education, regular income, and farming experience are some of the important factors affecting the use of modern way of communication by farmers in this study. Most farmers do not know how to read and write especially the old age group. Their capacity to perceive and digest information given by mass media is constrained by this limitation.

5.4 Recommendations

To accelerate innovation and improve agricultural practices among farmers, policy needs to address both the technical and social-economic barriers to adoption as well as the cultural inertia. Issues such as reading levels require long term transformation strategies. Shorter term strategies are therefore required, such as deliberately ensuring that dissemination methods adopt accessible technologies, which in this

instance include radio and TV. It will be essential for research organisations to match the dissemination methods with the farmers' preferences to attain more effective transfer of knowledge and skills from research to farmers.

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APPENDICES

APPENDIX A: INFORMED CONSENT FORM

University of Limpopo

CONSENT TO PARTICIPATE IN RESEARCH

TITLE OF RESEARCH PROJECT: Extension communication methods and farm management support during covid-19 pandemic: the case of smallholder cabbage farmers in Polokwane and Lepelle-nkumpi local municipalities, Limpopo province

Dear Participant,
You are requested to participate in above mentioned research study conducted by ……. (Centre for Rural Community Empowerment, University of Limpopo). You were selected as a participant in this study because you are one of the cabbage farmers in the province

1. PURPOSE OF THE STUDY

this research project aims to understand how the COVID-19 pandemic has affected the extension communication methods (ICT tools) through which smallholder cabbage farmers receive farm management information from their local extension practitioners and whether farmers‟ socio-economic situation, position them to receive farm management information through the conventional communication media and the current digital communication tools.

2. PROCEDURES

As the investigator I would like you volunteer to participate in this study where I would request you to Agree to be interviewed in person by me. Request you to respond to questions on the communication methods (ICT tools) through which smallholder cabbage farmers mainly received farm management information from their local extension practitioner before and since the COVID-19 outbreak in South Africa in 2020.

3. POTENTIAL BENEFITS TO SUBJECTS AND/OR TO SOCIETY

This research the practice of Agricultural Extension because Extension practitioners will have evidence-based information to decide on the appropriate communication methods (ICT tools) to use to convey farm management information to farmers, especially, in this era of COVID-19 restrictions that preclude face-to-face interactions between Extension practitioners and farmers.

4 CONFIDENTIALITY

Information obtained from the participants during the study will remain confidential and will be disclosed only with your permission. Confidentiality of all the research data will be maintained by the investigator and identity of the respondents will not be revealed in the research report.

5 PARTICIPATION AND WITHDRAWAL

You can choose whether to participate in this study or not. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. You may also refuse to answer any questions you don't want to answer and still remain in the study. The investigators may withdraw you from this research if circumstances arise which warrant doing so.

6. IDENTIFICATION OF INVESTIGATORS

In situation where you have any questions or concerns about the research, please feel free to contact the project leader:

Project leader: Prof E.M Zwane
E-mail: elliot.zwane@ul.ac.za
Contacts: 0828087173

7. RIGHTS OF RESEARCH SUBJECTS

You may withdraw your consent at any time and discontinue participation without penalty. You are not waiving any legal claims, rights or remedies because of your participation in this research study. If you have questions regarding your rights as a research subject, contact: Mr Abdul Maluleke [Abdul.Maluleke@ul.ac.za]; 015 268 2306 at the University of Limpopo Research office.

SIGNATURE OF RESEARCH SUBJECT OR LEGAL REPRESENTATIVE

The information above was described to me by …… (Enumerator) I was given the opportunity to ask questions and these questions were answered to my satisfaction. I hereby consent voluntarily to participate in this study. I have been given a copy of this form.

_____

Name of Subject/Participant

_____ _____

Signature of Subject/Participant **Date:**

SIGNATURE OF INVESTIGATOR

I declare that I explained the information given in this document to _____ [*name of the subject/participant.* He/she was encouraged and given ample time to ask me any questions.

Signature of Investigator :_____Date:_____

APPENDIX B: FARMERS QUESTIONNAIRE

Title of research: Extension communication methods and farm management support during COVID-19 pandemic: the case of smallholder cabbage farmers Polokwane Local municipality, Limpopo province

Section A: Farmers' Socio-economic characteristics	
Variables	Response
1. Age (in years)	**Write inside the box** ☐☐
2. Sex	**Tick inside one box** Male ☐ Female ☐
3. Farming experience (in years)	**Write inside the box** ☐☐
4. Education (years of schooling) (in years)	**Write inside the box** ☐☐
5. Farming group membership	**Tick inside one box** Yes ☐ No ☐
6. Regular income	**Tick inside one box** Yes ☐ No ☐

7. Farm size (in hectares)	**Write inside the box** ☐☐
8. Household size (number of people living in the household who depend on you)	**Write inside the box** ☐☐
11. Access to electricity and its stability	**Tick inside one box** Yes ☐ No ☐
12. Access to credit	**Tick inside one box** Yes ☐ No ☐
13. Access to extension services	**Tick inside one box** Yes ☐ No ☐
14. Access to internet connectivity	**Tick inside one box** Yes ☐ No ☐
15. Access to mobile phone network coverage	**Tick inside one box** Yes ☐ No ☐
16. Access to radio	**Tick inside one box** Yes ☐ No ☐
17. Access to,and able to use television	**Tick inside one box** Yes ☐ No ☐
18. Access to, and able to use lap/desktop computer	**Tick inside one box** Yes ☐ No ☐
19. Access to, and able to use mobile phone	**Tick inside one box** Yes ☐ No ☐

20. Access to, and able to use smart phone	**Tick inside one box** Yes ☐ No ☐
21. Access to, and able to use DVD equipment	**Tick inside one box** Yes ☐ No ☐

Section B: From the communication methods (ICT tools) listed below, mention those through which you have mainly received farm management information from their local extension practitioner before and since the COVID-19 outbreak in 2020.

A		**B**
Before the COVID-19 outbreak in 2020 **(write yes or no below**	**Communication method used**	Since the COVID-19 outbreak in 2020 till now **(write yes or no below**
	1. Radio	
	2. Television	
	3. Telephone 3.1 Mobile phone: (**Not smart phone**)	
	3.2 Mobile phone (Smart phone)	
	3.3 Telephone (landline)	
	4. Computer (desktop or laptop	
	5. DVD	

Section C: Challenges associated with the communication methods (ICT tools) through which farmers have received farm management information from their local extension practitioner since 2020 during the COVID-19 pandemic

Mention three challenges associated with the communication methods (ICT tools) **(those mentioned in Section B under B)** through which you have received farm management information from their local extension practitioner since 2020 during the COVID-19 pandemic till now.

1. First, most important challenge:
2. Second,
3. Third,

THANK YOU FOR YOUR COOPERATION!!!

-END-

SEPEDI TRANSLATION OF THE QUESTIONNAIRE

Sehloo sa go dira dinyakisiso: Mekgwa ya katoloso le tsheyetso ya taolo ya bolemi Nakong ya seowa sa COVID-19: setsopolwa sa balemi b aba nyennyane ba di khabetshe masepaleng wa legae la Polokwane, profinsing ya Limpopo.

Karolo A: Balemi ba' Ditšobotsi tsa maruo a setshaba	
Mehuta-huta	Karabo
1.Mengwaga (ka mengwaga)	**Ngwala ka gare ga lepokisi**
2.Bong	**Swaya ka gare ga lepokisi le tee** Monna Mosadi
3. Boiphihlelo ka tsa temo (ka mengwaga)	**Ngwala ka gare ga lepokisi**
4. Thuto (megwaga ya go tsena sekolo) (ka megwaga)	**Ngwala ka gare ga lepokisi**
5. Go ba karolo ya sehlopha sa tsa temo	**Swaya ka gare ga lepokisi le tee** Ee Aowa
6. Tshelete ya ka mehla	**Swaya ka gare ga lepokisi le tee** Ee Aowa
7. Bogolo bja polasa (ka dihekhethere)	**Ngwala ka gare ga lepokisi**
8. Bogolo bja ntlo (palo ya batho ba dulang ka ntlong ba itshepetseng go wena)	**Ngwala ka gare ga lepokisi**
9. Kamogelo ya thuto ka ICT	**Swaya kagare ga lepokisi le tee** Ee Aowa

10. Tshutshumetso ya setshaba[1]	**Swaya kagare ga lepokisi le tee** Ee ☐ Aowa ☐
11. Khumano ya motlagase le botsitso bja yona (**ka bobedi di swanetsi go humanega)**	**Swaya kagare ga lepokisi le tee** Ee ☐ Aowa ☐
12. Go fihlelela sekoloto	**Swaya kagare ga lepokisi le tee** Ee ☐ Aowa ☐
13. Go fihlelela ditshebeletso tsa katoloso	**Swaya kagare ga lepokisi le tee** Ee ☐ Aowa ☐
14. Go fihlelela kgokagano ya inthanete	**Swaya kagare ga lepokisi le tee** Ee ☐ Aowa ☐
15. Go fihlelela kgokaganyi ya sellathekeng	**Swaya kagare ga lepokisi le tee** Ee ☐ Aowa ☐
16. Go fihlelela seyalemoya	**Swaya kagare ga lepokisi le tee** Ee ☐ Aowa ☐
17. Go fihlelela thelebisheni	**Swaya kagare ga lepokisi le tee** Ee ☐ Ee ☐
18.Go fihlelela, le go kgona go berekisa khomphutare ya seropeng goba ya tafoleng (**ka bobedi dia hlokagala go araba ee)**	**Swaya kagare ga lepokisi le tee** Ee ☐ Aowa ☐
19. Go fihlelela, le go kgona go berekisa sellathekeng (e sego selathekeng se bohlale)	**Swaya kagare ga lepokisi le tee** Ee ☐ Aowa ☐

1

20. Go fihlelela , le go kgona go berekisa sellathekeng se bohlale	**Swaya kagare ga lepokisi le tee** Ee ☐ Aowa ☐
21. Go fihlelela , le go kgona go berekisa diberekiswa tsa DVD	**Swaya kagare ga lepokisi le tee** Ee ☐ Aowa ☐

Karolo B: Go tloga le ka mekgwa le poledisano ye (Marangrang disebeliswa) go tseo di ngwadilego ka tlase mo, re botse ka tseo go tsona o ilego wa humana hlagisolseding ya taolo ya polasa go tswa go ba boikgethelo katoloso pele le morago ga ge COVID-19 e thoma ka 2020

A		**B**
Pele go thoma COVID-19 ka 2020 **(ngwala ee goba aowa ka mo fase)**	**Mekgwa ya poledisano yeo o e berekisistseng**	Go tloga COVID-19 e thoma gp fihla gane bjalo ka 2020 **(ngwala ee goba aowa ka mo fase)**
	1. Seyalemoya	
	2. Thelebisheni	
	3. Thelefounu ya mogala 3.1 Sellathekeng: (**Ga se founu ya bohlale**)	
	3.2 Sellathekeng (Mogala wa bohlale)	
	3.3 Mogala (mogala wa mahala)	
	4. Khomphuthara (desktop goba laptop	
	5. DVD	

Karolo C: Mathata a go amana le mekgwa ya poledisano (Marangrang disebedisswa) yeo ka yona ga jwale balimi ba amogetsego taolo ya ba polasa ya hlagisoleseding go tswa go ba boikgethelo katoloso go tloga ka 2020 nakong ya COVID-19

Bolela mathata a ma **raro a go amana le mokgwa ya poledisano** (dithulusi tsa ICT) **(tseo di boletswego Karolong ya B ka tlase ga B) y**eo ka yona o hweditsego tlhagiso-leseding ya taolo ya polasa go tswa go setsebi sa bona sa katoloso ya legae go tloga ka 2020 nakong ya segoa sa COVID-19 go fihlela ga bjale.
1. Ya pele, phephetso ya bohlokwahlokwa:
2. Ya bobedi,
3. La boraro,

KE LEBOGA TSHOMOSANO!!!

-MAFELELO-

APPENDIX C: ETHICAL CLEARANCE CERTIFICATE

University of Limpopo
Department of Research Administration and Development
Private Bag X1106, Sovenga, 0727, South Africa
Tel: (015) 268 3935, Fax: (015) 268 2306, Email: anastasia.ngobe@ul.ac.za

TURFLOOP RESEARCH ETHICS COMMITTEE

ETHICS CLEARANCE CERTIFICATE

MEETING: **27 June 2022**

PROJECT NUMBER: **TREC/150/2022: PG**

PROJECT:

Title:	Extension Communication Methods and Farm Management Support During Covid-19 Pandemic: The Case of Smallholder Cabbage Farmers in Polokwane and Lepelle-Nkumpi Local Municipalities, Limpopo Province.
Researcher:	MM Madevhele
Supervisor:	Prof EF Zwane
Co-Supervisor/s:	N/A
School:	Agricultural and Environmental Sciences
Degree:	Master of Agricultural Management (Agricultural Extension)

PROF D MAPOSA
CHAIRPERSON: TURFLOOP RESEARCH ETHICS COMMITTEE

The Turfloop Research Ethics Committee (TREC) is registered with the National Health Research Ethics Council, Registration Number: **REC-0310111-031**

Note:

i) **This Ethics Clearance Certificate will be valid for one (1) year, as from the abovementioned date. Application for annual renewal (or annual review) need to be received by TREC one month before lapse of this period.**

ii) **Should any departure be contemplated from the research procedure as approved, the researcher(s) must re-submit the protocol to the committee, together with the Application for Amendment form.**

iii) **PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES.**

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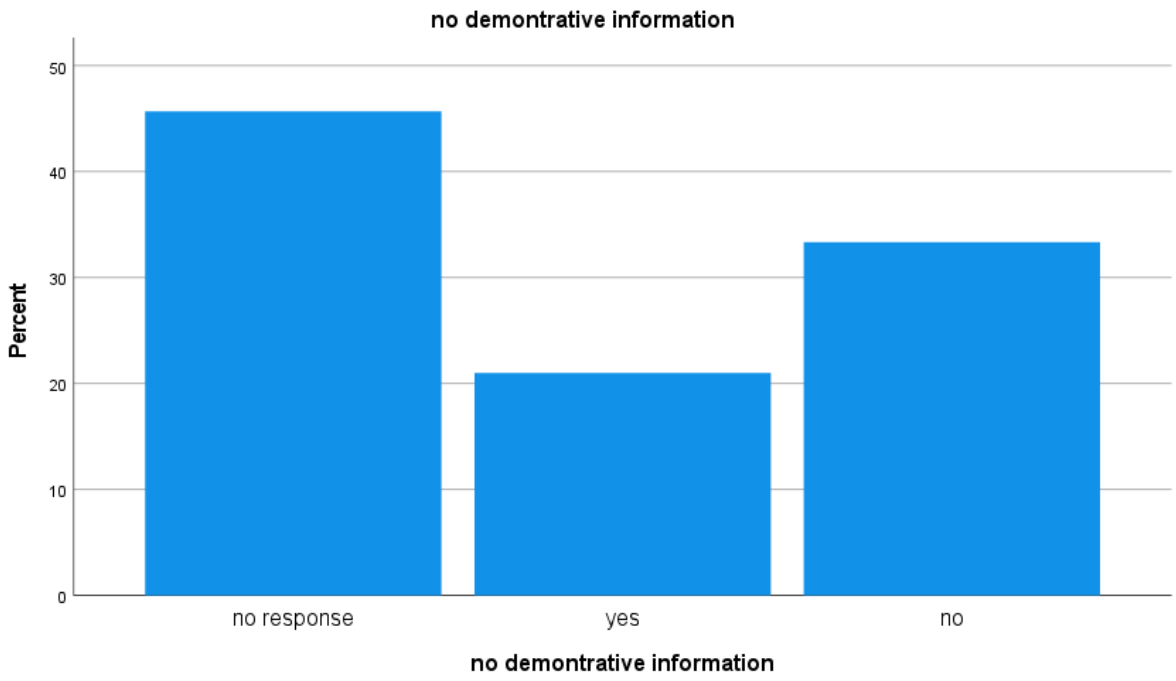
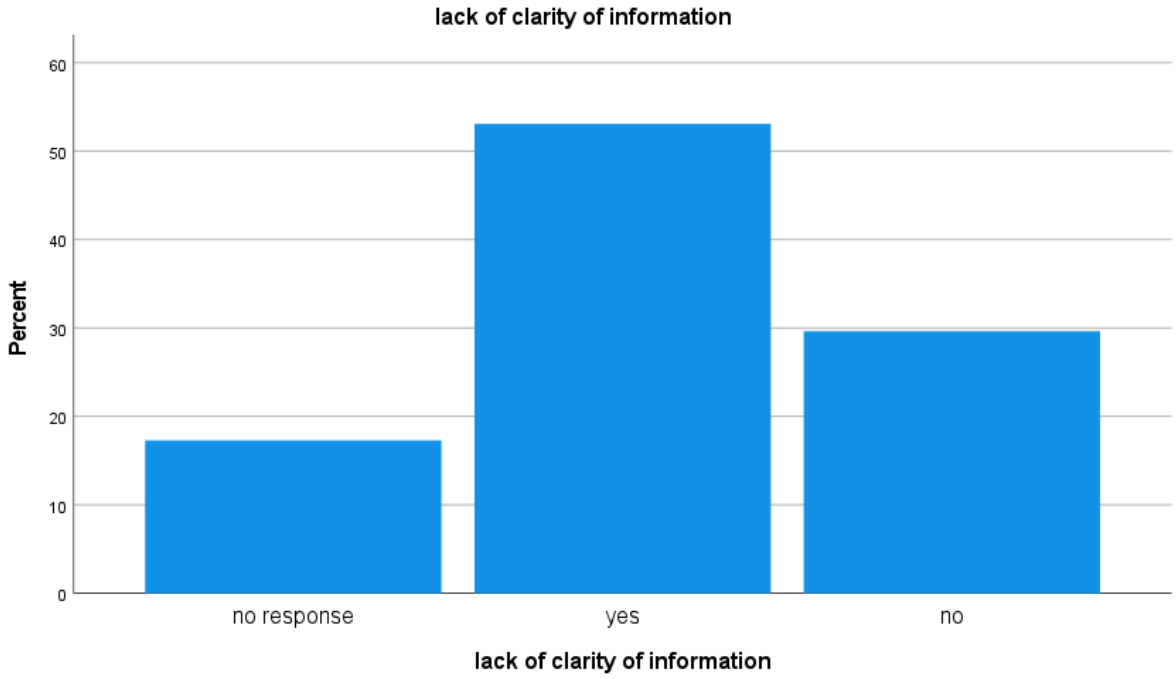
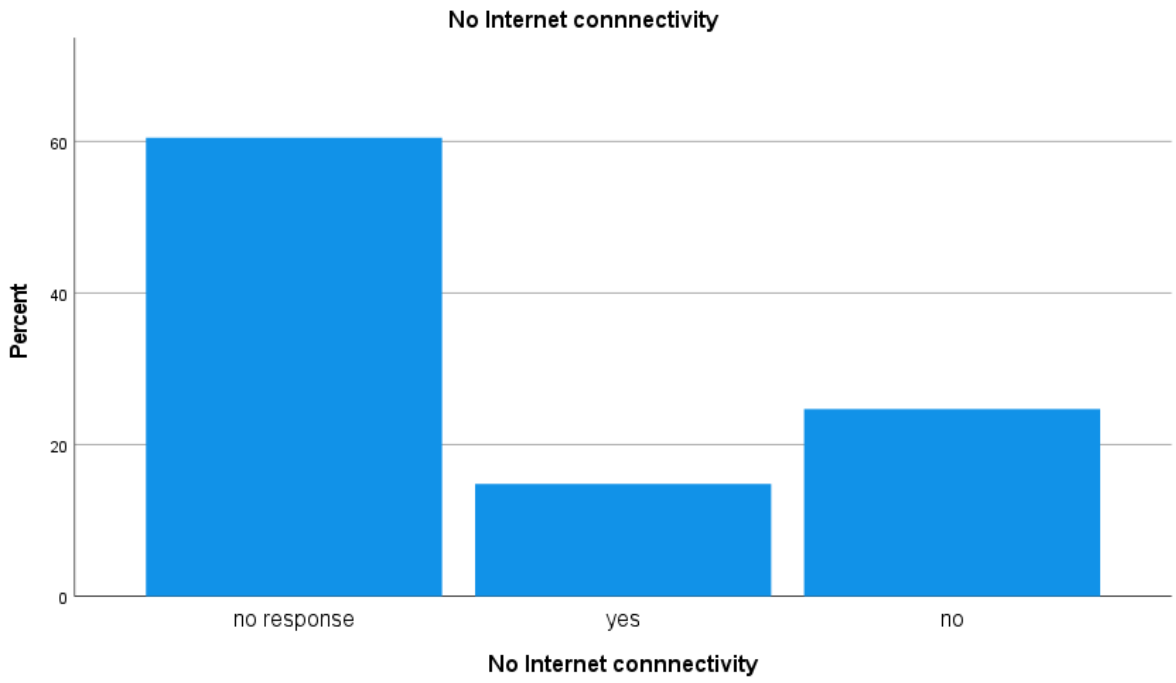
APPENDIX D: NO DEMONSTRATIVE INFORMATION



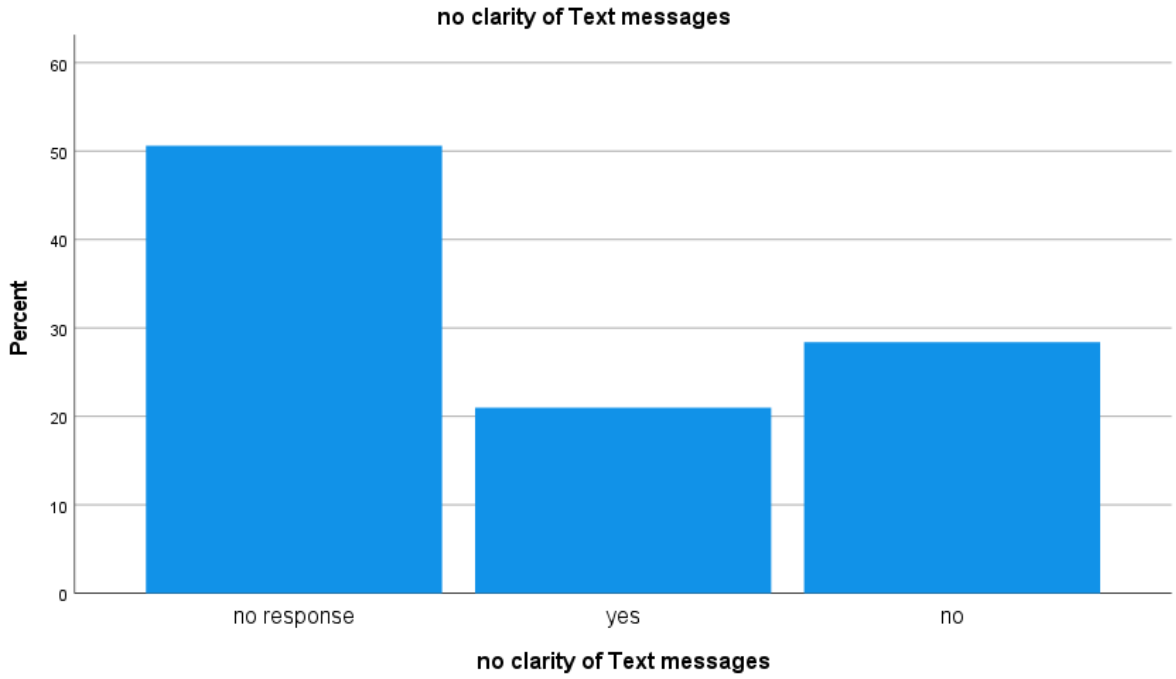
APPENDIX E: CLARITY OF INFORMATION



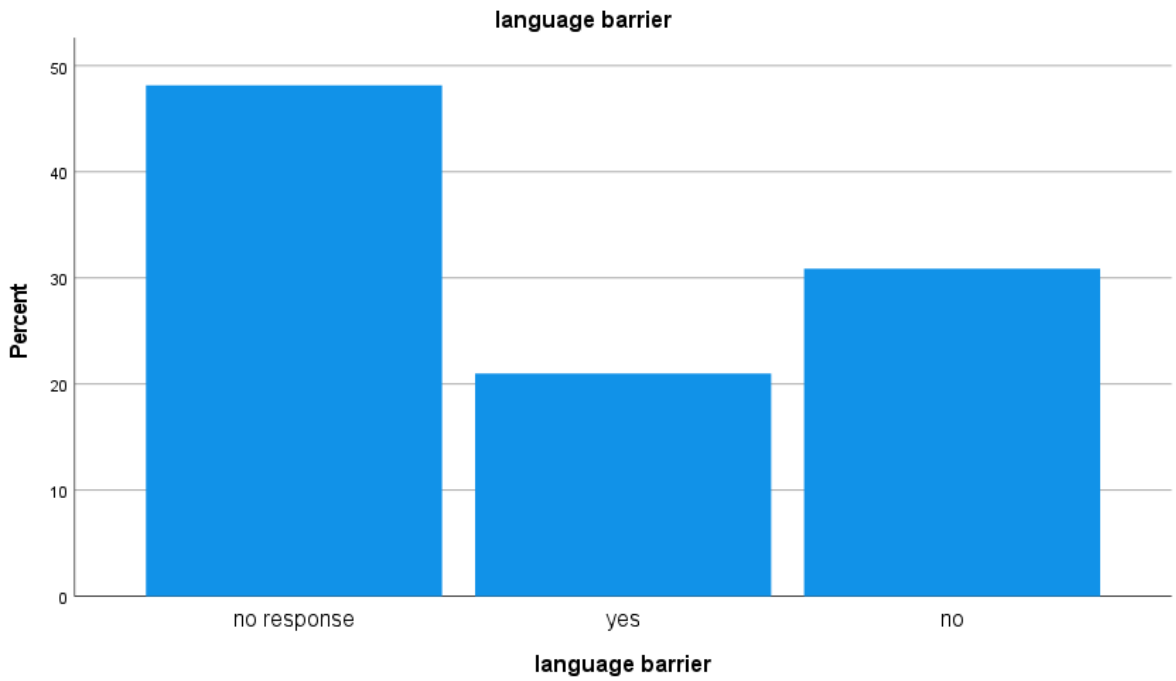
APPENDIX F: INTERNET CONNECTIVITY



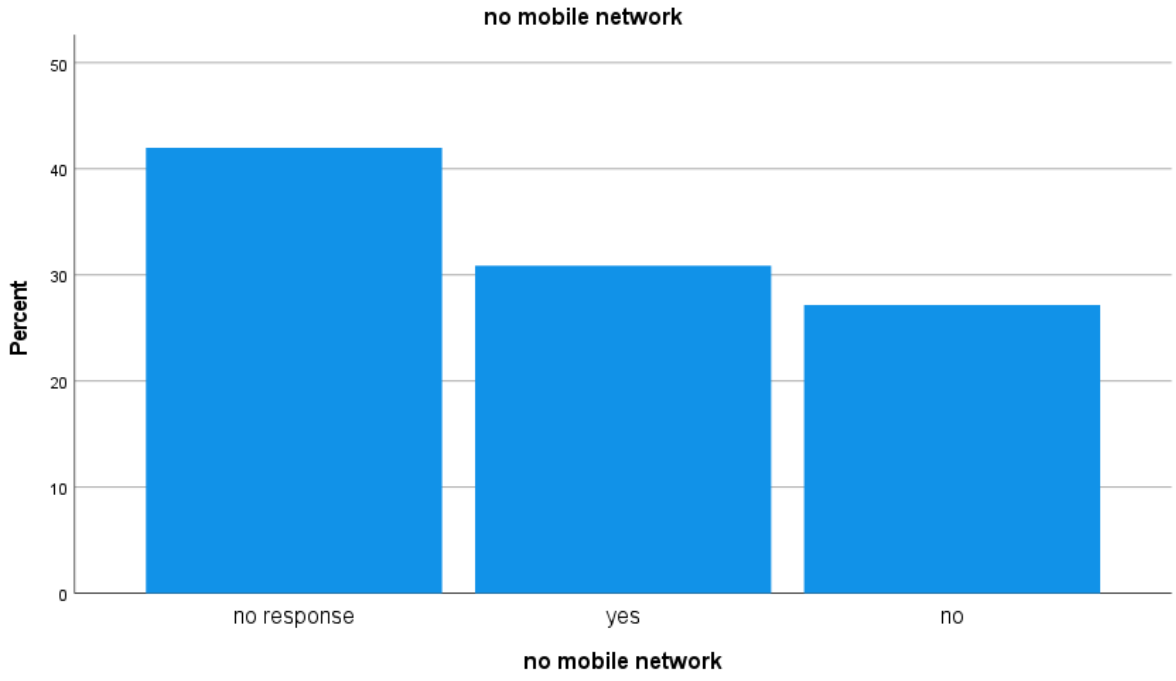
APPENDIX G: CLARITY OF TEXT MESSAGE



APPENDIX H: LANGUAGE BARRIER



APPENDIX I: MOBILE NETWORK



APPENDIX J: LACK OF DIGITAL SKILLS