ADOPTION OF INFORMATION AND COMMUNICATION TECHNOLOGY FOR THE DEVELOPMENT OF THE INCUBATED RURAL FARMING COOPERATIVES IN LIMPOPO PROVINCE, SOUTH AFRICA

by

MICHAEL PHAANE SEROKA

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DEDICATION

This study is dedicated to:

- My grandparents, Mphela, Mosebjadi, Monare and Hunadi, for keeping healthy ties with the Almighty God for the life and opportunity to pursue the PhD.
- My parents, Nekwana ‘a Mphela (Late) and Nogana ‘a Monare, for being one of your children. You might have decided otherwise.
- My beloved wife, Ngwamasokesoke Mary-Helen and our five children, Mphela, Molebogeng, Nepo, Mologadi and Lehlogonolo, for the unwavering support throughout the academic journey.
- My special grandchild, Phaane Kabelo, for believing in me. Your message: “**I hope you will make it**”, will remain in my mind forever.
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  - Ms Cebile Khanye: LDoE
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DECLARATION

Name : Mr Michael Phaane Seroka

Student number : 8023603

Degree : PhD in Development Studies

I declare that the above thesis is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references. I further declare that I submitted the thesis to originality checking software and that it falls within the accepted requirements for originality. I further declare that I have not previously submitted this work, or part of it, for examination at Unisa for another qualification or at any other higher education institution.

22 May 2023

Michael Phaane Seroka Date

ABSTRACT

Information and communication technology (ICT) is ubiquitous and has penetrated various economies and farming included. The advent of ICT has expanded the farming sector evidenced by a whole range of value chains that can be tapped to ameliorate the South African triple challenges of poverty, unemployment and inequality particularly in rural areas.

Through the adoption of the South African anthology of "***Walala wasala***" translated as "You snooze, you loose", this study aims to explore the extent of ICT adoption for development of the incubated rural farming cooperatives in Limpopo Province.

Although there are available studies around ICT adoption in farming and cooperatives around the globe, thus far, no commissioned study of this magnitude is available in Limpopo Province on this topic. The contributions of this work will undoubtedly serve as the baseline for subsequent studies.

The study is premised on two theories namely, the Roger's diffusion of innovation theory and Kurt Lewis's Change theory. These theories were found relevant and suitable for the study as the former serves as the input and the latter as output.

The study employed mixed research methods. However, given the nature of the study of obtaining an in-depth information from the participants, the qualitative method dominated the counterpart. The study population was obtained from the 2018 list of the 56 incubated farming cooperatives from the Limpopo Economic Development Agency (LEDA). A stratified sampling method comprised of mixed genders from youth and adult farmers was conducted. Due to the Covid 19 protocols, an online semi-structured interviews were conducted. Data was analysed through the five steps of the Atlas. Ti management system. It was through this application that themes were established.

The main findings of the study revealed that technology devices, data internet, airtime are unaffordable; youth are the highest ICT adopters; most adult farmers use experience and indigenous knowledge systems; illiteracy as an obstacle

In conclusion, besides the government programmes of developing cooperatives through incubation in Limpopo Province, not much has been achieved to realise the usefulness of ICT adoption in farming.

KEY TERMS: Information and communication technology (ICT); farming; cooperatives; rural; incubation; Limpopo Province.

KAKARETŠO

Theknolotši ya Tshedimošo le Kgokagano (ICT) e gona mafelong ka moka ebile e tsene ka gare ga makala a go fapafapana a ekonomi go akaretšwa la bolemi. Go fihla ga ICT go katološitše lekala la bolemi leo le bonagalago ka go ba le mehuta ya go fapafapana ya tshedimošo ya malebana le ditšweletšwa tšeo di ka šomišwago go kaonafatša ditlhohlo tše tharo tša Afrika Borwa tša bodiidi, tlhokego ya mešomo mmogo le go se lekalekane kudu ka dinagamagaeng.

Ka go šomiša polelo ya Afrika Borwa ya "***Walala wasala***" yeo e fetolelwago bjalo ka "*Wa robala o a šala*", nyakišišo ye e ikemišeditše go hlahloba bogolo bja go šomišwa ga ICT malebana le tlhabollo ya dikgwebo tša thušo le tlhahlo ya balemi ba dinagamagaeng ka Profenseng ya Limpopo.

Le ge go na le dinyakišišo tše di lego gona tše di akaretšago go šomišwa ga ICT ka go bolemi le ka go dikgwebo tša thušo le tlhahlo ya bolemi lefaseng ka bophara, go fihla gabjale, ga gona nyakišišo yeo e hwetšagalago mabapi le hlogotaba ye ebile ka bogolo bjo ye e dirilwego ka Profenseng ya Limpopo. Diphihlelo tša mošomo wo ntle le pelaelo di tla šoma bjalo ka motheo wa dinyakišišo tše di latelago.

Thuto ye e theilwe godimo ga diteori tše pedi tšeo ka maina e lego teori ya phatlalatšo ya boitlhamelo ya Roger le teori ya phetogo ya Kurt Lewis. Diteori tše di hweditšwe di le maleba ebile di loketše nyakišišo ye ka ge ya pele e šoma bjalo ka maele ao a ka dirišwago gomme ya mafelelo bjalo ka ditšweletšwa tša maele ao.

Nyakišišo ye e šomišitše mekgwa ya nyakišišo ye e kopantšwego. Le ge go le bjalo, ge go lebelelwa mohuta wa nyakišišo ya go hwetša tshedimošo ye e tseneletšego go tšwa go bakgathatema, mokgwa wa go nyaka boleng bja diteng o šomišitšwe kudu go feta wo o mongwe. Palo ya bakgathatema e hweditšwe go tšwa lenaneong la 2018 la dikgwebo tša thušo le tlhahlo ya balemi tše 56 go tšwa go Mokgatlo wa Tlhabollo ya Ekonomi ya Limpopo (LEDA). Mokgwa wa go kgaoganya bakgathatema ka dihlophana tše nnyane wo o akareditšego batho ba bong bja go fapana go tšwa go balemi ba bafsa le ba bagolo o šomišitšwe. Ka lebaka la mananeotshepedišo a Covid-19, go dirilwe dipoledišano tša dipotšišo tšeo di rulaganywago ebile di fanago ka monyetla wa go ka botšišeletša letlakaleng la inthanete. Datha e ile ya sekasekwa ka go šomišwa ga magato a mahlano a lenaneotshepedišo la taolo ya ATLAS.ti. Ke ka tšhomišo ye moo dihlogotaba di ilego tša hlongwa.

Diphetho tše dikgolo tša nyakišišo ye di utolotše gore didirišwa tša theknolotši, datha, phihlelelo ya inthanete le nako ya moyeng ga di fihlelelege ka theko. Bafsa ba palo ye kgolo ke bona ba amogelago ICT gomme bontši bja balemi ba bagolo ba šomiša maitemogelo le ditshepedišo tša tsebo ya setlogo mola go se tsebe go bala le go ngwala go sa dutše e le lepheko.

Ka kakaretšo, ntle le mananeo a mmušo a go hlabolla dikgwebo ka go šomiša mekgatlo ya kabo ya thušo, tlhahlo le didirišwa tša bolemi ka Profenseng ya Limpopo, ga se gwa fihlelelwa mo gontši go lemoga mohola wa go šomišwa ga ICT ka go bolemi. Ditlhohlo tše dintši tšeo di utolotšwego nyakišišong le tšona e be e sa le mapheko malebana le kgonagalo ya gore go ka amogelwa tšhomišo ya theknolotši.

ABSTRAK

Inligting- en kommunikasietegnologie (IKT) is oral om ons en het verskeie sektore van die ekonomie, insluitende boerdery, binnegedring. Die koms van IKT het die boerderysektor uitgebrei, soos wat blyk uit ’n rits waardekettings wat benut kan word om die drieledige Suid-Afrikaanse uitdagings van armoede, werkloosheid en ongelykheid, veral in landelike gebiede, hok te slaan.

Deur die ingebruikneming van die Suid-Afrikaanse antologie van “***Walala wasala***”, losweg vertaal as “Gou spring, anders is die geleentheid verby”, het hierdie studie ten doel om te ondersoek wat die omvang van IKT-ingebruikneming vir die ontwikkeling van die ontluikende landboukoöperasies in die Limpopo-provinsie is.

Hoewel daar studies oor IKT-ingebruikneming in boerdery en koöperasies wêreldwyd beskikbaar is, is daar sover geen opdragstudie van hierdie omvang oor hierdie onderwerp beskikbaar in die Limpopoprovinsie nie. Die bydraes van hierdie werk sal ongetwyfeld as die basislyn vir verdere studies dien.

Die studie berus op twee teorieë, naamlik Roger se teorie oor diffusie van innovering, en Kurt Lewis se veranderingsteorie. Daar is bevind dat hierdie teorieë relevant en geskik vir die studie is – eersgenoemde studie dien as die inset en laasgenoemde studie as uitset.

Gemengde navorsingsmetodes is in die studie gebruik. Vanweë die aard van die studie – dat omvattende inligting van die deelnemers bekom word – het die kwalitatiewe metode egter die teenstuk gedomineer. Die studiepopulasie is bekom van die 2018-lys van die 56 ontwikkelde landboukoöperasies van die Limpopo- Ekonomiese Ontwikkelingsagentskap (LEDA). ’n Gestratifiseerde steekproefmetode wat bestaan uit jeugdige en volwasse boere (gemengde geslagte), is gevolg. In ooreenstemming met Covid-19-protokol is halfgestruktureerde onderhoude aanlyn gedoen. Data is ontleed deur die vyf stappe van die ATLAS.ti-bestuurstelsel te volg. Deur hierdie toepassing is temas daargestel.

Die vernaamste bevindings van die studie het onthul dat tegnologiese toestelle, data, internettoegang, en lugtyd onbekostigbaar is. Die jeug is dié IKT-ingebruiknemer met die hoogste telling, en die meeste volwasse boere gebruik ervaring en inheemse kennisstelsels, terwyl ongeletterdheid ’n uitdaging bly.

Ten slotte: afgesien van die regering se programme om koöperasies te ontwikkel deur ontluikende inisiatiewe in die Limpopo-provinsie, is daar nie veel vordering gemaak om die bruikbaarheid van IKT-ingebruikneming in boerdery te laat realiseer nie. Die talle uitdagings wat in hierdie studie uitgewys is, was steeds struikelblokke vir moontlike implementering van tegnologie.

TABLE OF CONTENT

FIGURES

TABLES

LIST OF ABBREVIATIONS

4IR	Fourth industrial revolution
AfDB	African Development Bank
AIETA	Awareness stage, Interest stage, Evaluation stage, Trial stage and Adoption stage
ALRC	Australian Law Reform Commission
ANC	African National Congress
APP	Application
ARCI	Agricultural Research Commercialization Incubators
ATM	Automatic Teller Machine
AUR	Annual University Reports
AVC/SD	Agribusiness Value Chain / Sector Development
BBT	Born Before Technology
BEE	Black Economic Empowerment
BIC	Batavia Industrial Centre
BYOD	Bring your own device
CA	Cooperative Act
CC	Closed Corporations
CDM	Capricorn District Municipality
CFA	Contract farming arrangements
CIPC	Company and intellectual property commission
CPA	Communal Property Associations
CRCE	Centre for Rural Community Empowerment
CSFs	Critical success factors
DAFF	Department Agriculture, Forestry and Fisheries
DARD	Department of agriculture and rural development
DCPS	Department of Communications and Postal Services
DOI	Diffusion of innovation
DRC	Democratic Republic of the Congo
DTI	Department of Trade and Industry
EC	Eastern Cape
FAO	Food and Agriculture Organisation

FS	Free State
FSSAI	Food Safety Standards Authority of India
GDP	Growth domestic product
GHS	General Household Survey
GP	Gauteng Province
GTC	Green Technology Centre
HDIs	Historically Disadvantaged Individuals
ICA	International Cooperative Alliance
ICT	Information and Communication Technology
IKS	Indigenous Knowledge Systems
ILO	International Labour Organization
IT	Information Technology
IWS	Internet World Statistics
Ksu	King Saudi University
KZN	KwaZulu-Natal
LATS	Limpopo Agricultural Technology Station
LEDA	Limpopo Economic Development Agency
LEDET	Limpopo Department of Economic Development, Environment and Tourism
LLL	Lifelong Learning
LP	Limpopo Province
M&E	Monitoring and Evaluation
MDM	Mopani District Municipality
MENA	Middle East and North Africa
MNT	Mobile Telecommunication Network
MP	Mpumalanga Province
NARS	National Agricultural Research System
NC	Northern Cape
NCBA	National Cooperative Business Association
NDP	National Development Plan
NGOs	Non-Governmental Organisations
NW	North-West
OJT	On-the-job Training
PA	Precision Agriculture

PAT	Precision Agricultural Technology
PEU	Perceived Ease of Use
PMDS	Performance Management and Development Systems
PU	Perceived Usefulness
RDIH	Rural Development Innovation Hub
RSA	Republic of South Africa
SABC	South African Broadcasting Corporation
SAIPA	South African Institute of Professional Accountants
SANDP	South African National Development Plan
SASSA	South African Social Security Services
SDG	Sustainable Development Goal
SDM	Sekhukhune District Municipality
SLAG	Settlement Land Acquisition Grant
SMMEs	Small, Medium and Micro-Enterprises
SoNAs	State of the Nation Addresses
SSA	Sub-Saharan Africa
Stats SA	Statistics South Africa
TAM	Technology acceptance model
TTI	Technology Transfer Incubation
UFS	University of the Free State
UJ	University of Johannesburg
UKZN	University of KwaZulu-Natal
UL	University of Limpopo
UN	United Nations
UNIVEN	University of Venda
UNMDG	United Nation’s Millennium Development Goals
USAID	United Sates Agency for International Development
VDM	Vhembe District Municipality
V-SATs	Very Small Aperture Terminals
WC	Western Cape
WDM	Waterberg District Municipality

CHAPTER 1:
ORIENTATION OF THE STUDY

1.1 INTRODUCTION

The adoption of information and communication technology (ICT), especially in the 21st century, is ubiquitous and has occupied the centre stage of development. ICT may not be panacea for the challenges the world faces, but it has been considered very instrumental in the alleviation of many problems. ICT promotes and distributes "new and existing farming information and knowledge, which is communicated within the agricultural sector since information is essential for facilitating" rural development and bring about social change (Swanson & Rajalahti, 2010).

However, the penetration of ICT in agriculture, especially for rural emerging farming cooperatives, is happening slowly, with the spin-offs unnoticed. According to Oladele (2015),

> agriculture is the mainstay of most African countries and it occupies a pivotal role in the development of the continent. It remains an important sector in the South African economy due to its central role in building a strong economy, reducing inequalities by increasing incomes and employment opportunities for the poor.

This study aims to explore the role that ICT adoption can play in the development of the rural emerging farming cooperatives in Limpopo Province. This province is among the poorest of the nine provinces in South Africa. Limpopo province is predominantly rural with available land that can be used for agriculture. Agriculture can be instrumental in reducing the high unemployment rate particularly among the youth. However, most of them believe that agriculture is primitive and associated with the illiterates (Myeni, 2022).

The adoption of ICT, although not the silver bullet to the many challenges the country faces, may alleviate the negative perceptions and attitudes among the rural youths in the area. On many occasions, the sector has been pronounced having the potential to absorb and create many employment opportunities for cooperatives and small businesses.

Cooperatives and small businesses contribute to the economic lives of many people. Rena (2017) asserts that "cooperatives have provided a certain set of exclusive tool that have enabled

the members to attain more economic goals", especially in such an increasingly competitive economic world.

1.2 BACKGROUND

The arrival of (ICT) has led to tremendous strides in development across the globe. ICT might have been associated by some with negative connotations; however, the benefits are huge. Those against ICT are afraid of it, regarding it as a tool to replace them in terms of employment.

ICT has gained popularity in various spaces like education, health, business, communication, etc. The world is connected through technology, which can be seen as an advantage for sectors like farming in rural areas.

By means of ICT, e.g. the internet or other software, rural farming cooperatives have an opportunity to obtain information on climate change, requisite skills like production, financial, human resource management, marketing skills, etc.

Furthermore, ICT can lower farming costs by using robotics and coding applications. This is a benefit for farmers, for instance, pertaining to irrigation, livestock tracking, diseases management, etc. The integration of ICT into farming practices can also be applied in rural areas such as in Limpopo Province.

According to Thaba and Mbohwa (2015), 22 030 cooperatives were registered in South Africa from 2009 to 2015, 15 times the number registered between 1922 and 1994. However, only 2 644 (12%) are still in operation, which brings one to the question: Why such a collapse? The number alluded to includes those in Limpopo Province.

The researcher is of the view that lack of information can be apportioned to the collapse of most cooperatives; hence, he sees the need for such institutions to adopt ICT. He further asserts that ICT has extended the knowledge horizon, which many successful cooperatives have taken advantage of, especially to access the markets better. It is most likely that some of the rural cooperatives, including those in farming, might have not explored this, which is evidenced by their snail's pace growth and development.

The Limpopo Province is one of the nine provinces in South Africa and the fifth-largest province, with five district municipalities, the most rural, as shown in the map below.

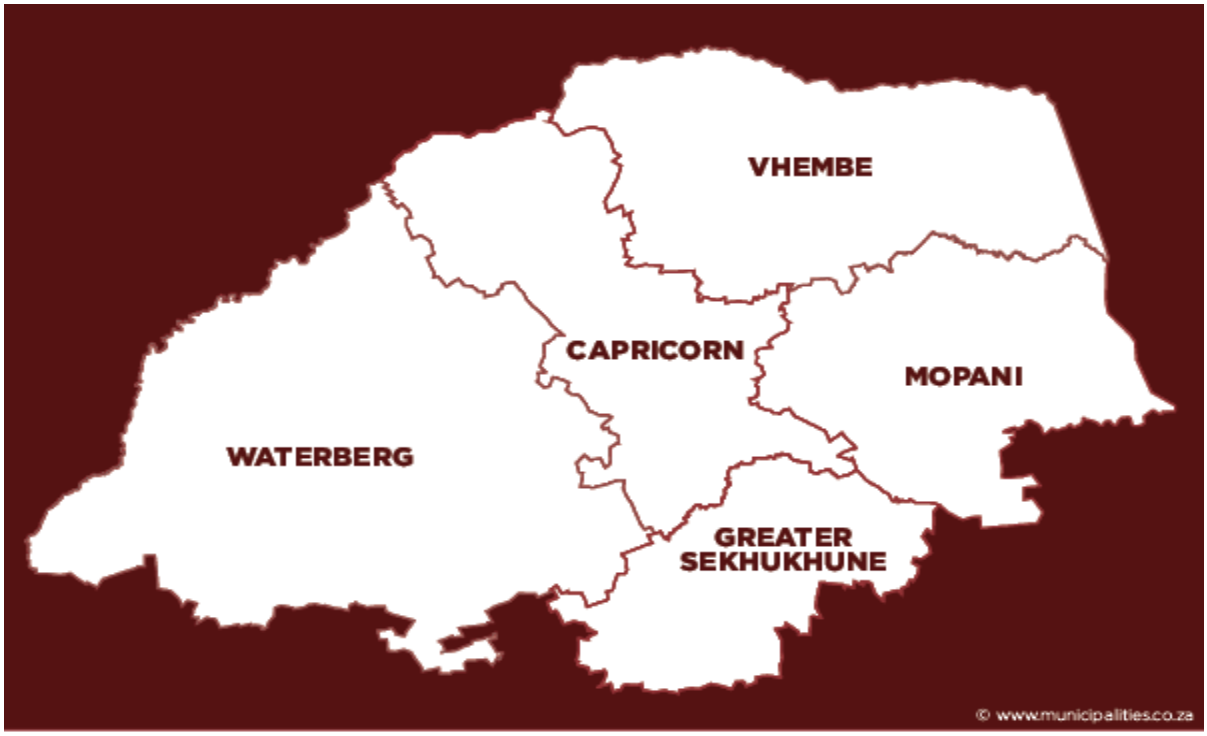


Figure 1: The map of the five districts of Limpopo Province
Source: Stats SA (2019)

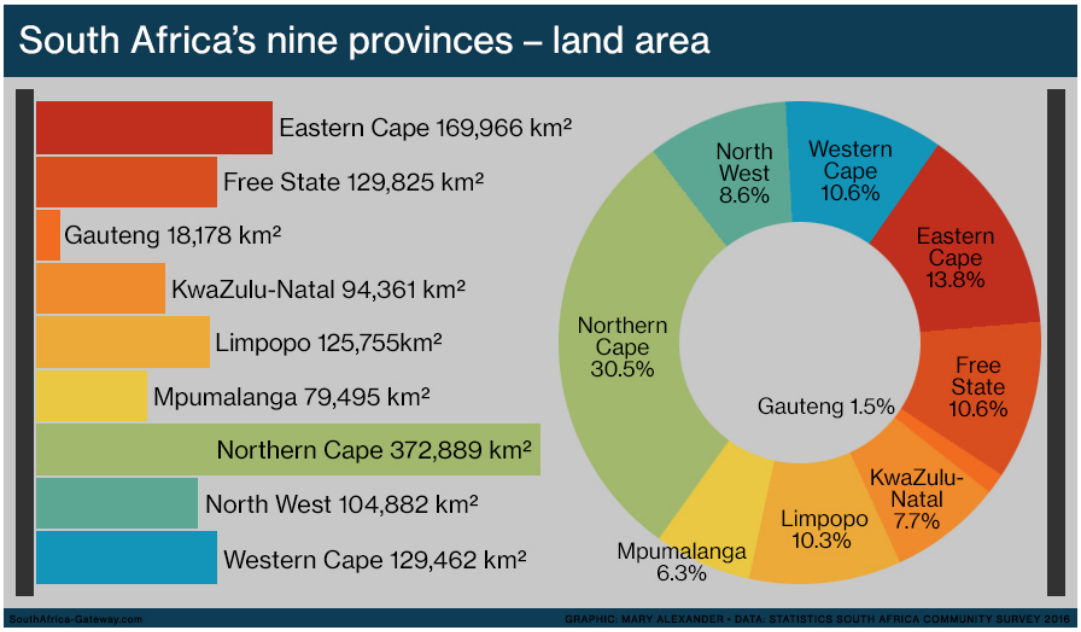


Figure 2: South Africa's nine provinces – Land area
Source: Stats SA (2022)

Figure 2 above shows that the Limpopo Province, which is the focus area of the study, has a land area of 125 755 km^2, which is 10,3% of the total 1 220 813 km^2 of South Africa and with

a total population of 5 941 439. For interest's sake, the Gauteng Province has the smallest land area of 18 178 km^2, a meagre 1,5% of the total land area of the country, South Africa. It is amazing to see Gauteng, the province with the least land area having the largest population of 16 098 571 (Stats SA, 2022). Something to note again is the province with the least population of 1 308 734, the Northern Cape, but which has a vast land area of 372 889 km^2, 30,5% of the entire country's land area.

In the second quarter of 2019, agriculture in Limpopo Province declined by 4,2% in its contribution to the gross domestic product (GDP). The decrease is apportioned mainly to the lower production of field crops and horticultural production (Stats SA, 2019), as depicted in the following figure:

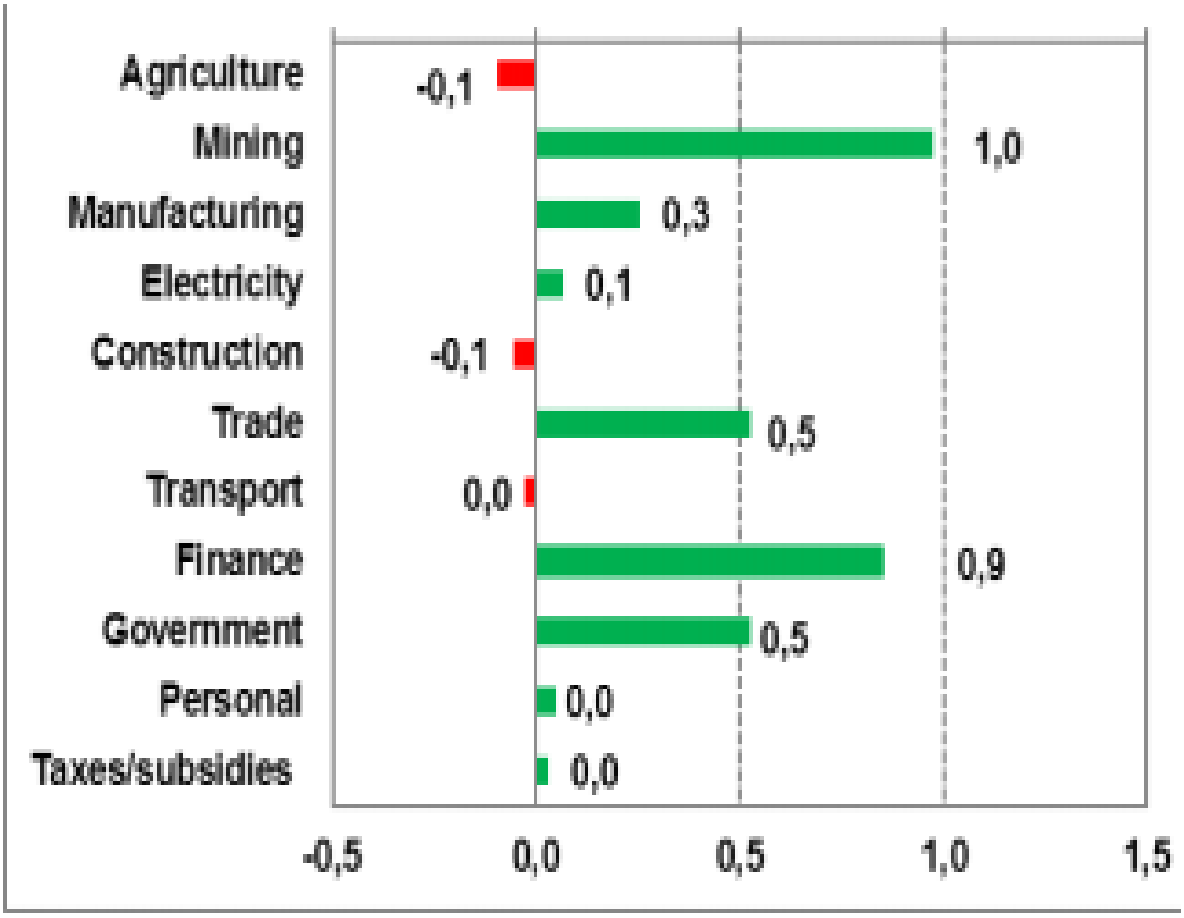


Figure 3: Contribution to growth in GDP, Quarter 2 of 2019 (% points)
Source: Stats SA (2019)

1.3 STATEMENT OF THE PROBLEM

Ayim, Kassahunb, Tekinerdoganc, and Addisond (2020) purport that the agriculture sector particularly in Africa is less developed. The advent of ICT has created an information society which has connected the world and consequently made valuable information available. The researcher stands to believe that the interface of both rural faming cooperatives and technology can bring about business growth. Most businesses across the globe have tapped into the benefits of ICT platforms like the internet to seek information related to their businesses. The internet provides information on aspects such as climate change, markets, value chains, and strategies for business success. Besides the benefits of technology alluded to above, little is known about its adoption particularly in rural farming cooperatives of Limpopo Province. This study is therefore focusing on filling the vacuum in question. Although ICT is no panacea for business growth and development, the researcher is of the view that the infusion of technology in farming will add value to the sector.

It should be noted that the cooperative destination is to reach a stage of commercialisation. Thaba and Mbohwa (2015) state that while a cooperative has to address the social ills of poverty and unemployment, a cooperative is actually an enterprise. Cooperatives should therefore be established to make profit and further participate in the economic mainstream, although it is also there to benefit the members.

The objectives of the *Cooperative Act (CA) 14 of 2005* (RSA, 2005) clearly state "that a viable, autonomous, self-reliant and self-sustaining cooperative movement can play a major role in the economic and social development of the Republic of South Africa by creating employment" and generate income. It further states "that the South African economy will benefit from increasing the number and variety of viable and sustainable economic enterprises". The available emerging rural farming cooperatives, especially in Limpopo Province, have paid little, if no attention to the enterprise element of the cooperative objectives. The National Development Plan [NDP] 2030 (RSA, 2011) stipulates "that cooperatives have several benefits like helping the small producers to achieve economies of scale and establish linkages to markets and value chains".

1.4 RESEARCH OBJECTIVES AND QUESTIONS

1.4.1 Research objectives

1.4.1.1 Primary objective

To explore the extent of ICT adoption for development of the incubated rural farming cooperatives in Limpopo Province.

1.4.1.2 Secondary objectives

- To determine the extent of ICT adoption by the incubated rural farming cooperatives in Limpopo Province.
- To assess the perceptions of the incubated rural farming cooperatives towards ICT adoption in Limpopo Province.
- To investigate the challenges of ICT adoption for development of the incubated rural farming cooperatives in Limpopo Province.
- To determine the critical success factors towards the adoption of ICT for the development of the incubated rural farming cooperatives in Limpopo Province.

1.4.2 Research questions

From the objectives of this study, four critical questions can be asked and they are:

- To what extent do the incubated rural farming cooperatives in Limpopo Province adopt ICT for development?
- What are the perceptions of the incubated rural farming cooperatives towards ICT adoption in Limpopo Province?
- What are the challenges of ICT adoption faced by the rural farming cooperatives in Limpopo Province?
- To what extent is ICT adoption a critical success factors for rural farming cooperatives in Limpopo Province?

1.5 SCOPE OF THE STUDY

The scope of the study is defined by Mafukata and Cornell (2019) as the parameters of the research study in terms of sampling, research participants, approach, objectives, timeframe, etc., that guide the selection of data and what the focus of the researcher will be.

The scope of the study was in Limpopo Province, with the exclusion of the other eight provinces. It is one of the poorest provinces and the most rural. In fact, it has the highest proportion of people on social grants of all South Africa's provinces (76,4%); it has the lowest people to doctor rate (3 511 people per registered medical doctor) and it has the lowest percentage of households using electricity for cooking (62,1%) of all South Africa's provinces (Ndebele & Ansara, 2019). Farming can be one of the key drivers of development if more attention is paid to it. The province has adequate land for farming for food security and commercialisation.

The province has about 93 registered incubated cooperatives, including manufacturing, services, agriculture, tourism and retail. In this study, the focus will mainly be on the incubated rural farming cooperatives, which comprise 60,2% of the total incubated cooperatives. The cooperatives alluded to are found in the five districts (Capricorn, Mopani, Sekhukhune, Vhembe and Waterberg) of the province.

The rationale behind the choice of the incubated cooperatives is that these businesses are nurtured and fully mentored by the Limpopo Economic Development Agency [LEDA]. The assumption is that these cooperatives receive programmes, including ICT and mentorship for growth and development.

The study focused mainly on the rural areas of the province, with the exclusion of the urban incubated cooperatives. Most rural businesses reflect low levels of ICT adoption, which is precisely the problem the researcher intends to explore.

The acquisition and access of information from the various ICT platforms for farming development are the apex of this study. The scope comprises a mixture of basic technological infrastructure like radio, television, tape recorders, computers, routers and mobile phones. The researcher takes cognisance of the poverty levels in rural areas, but affirms that the above technological devices are ubiquitous.

However, the researcher had no intention to infuse any advanced technology like drones and smart cameras in the scope of this research, because ICT adoption in rural farming cooperatives of the province is a new concept and he might have been over-ambitious to assume any success. Adoption of ICT requires a change of the adopter's mind-set as per the Kurt Lewis theory employed in this study. It should be borne in mind that rural people also have their own traditional and cultural practices, which may have a negative impact on the ICT adoption. For example, some pockets of rural people believe that ICT is associated with witchcraft, like in the case of an airplane.

1.6 LIMITATIONS OF THE STUDY

Any study undertaking cannot be without flaws. A study is like a journey that will always be affected by various factors along the way and these hindrances are termed limitations of the study. Theofanidis and Fountouki (2018) refer to limitations of the study as the weaknesses that the researcher has no control over and have serious direct repercussions on the study. The limitations affect the results and should therefore be acknowledged to assist subsequent studies on a similar topic.

In this study, numerous factors directly affected the results, namely:

- **The outbreak of the coronavirus**: The global outbreak of the coronavirus commonly known as Covid-19 had a negative impact on the study. The plan of the study was to have both face-to-face and telephonic interviews, but the need to observe the safety protocols like movement, number of people in a gathering affected the research design. Telephonic interviews were conducted to remedy the situation.
- **Inadequate information about the cooperatives**: The list received from LEDA comprised names of cooperatives, districts and contact numbers. There were no physical addresses of these businesses and it was thus difficult to locate them in case they were not available per telephone, also taking into account the vastness of the province where these five districts are situated. Telephone was the sole means to contact the participants and if they were telephonically not available, there was no alternative way to find them. Most of these respondents were unavailable due to technical reasons as shown in the table below.

Table 1: Register of telephonic calls

Answered calls	Calls on voicemail	Number did not exist	Dropped/rejected calls
44	9	5	3

Source: Own

- **Unavailability of English equivalents when translating the interview guide from English to Sepedi**: The interview guide was developed in English and translated into Sepedi. Some of the English words or equivalent do not exist in Sepedi and this was a bit of challenge to explain to the participants.

- **Language barrier**: The participants came from different regions of Limpopo Province where different languages are spoken. For instance, the province is dominated by three African languages, namely Sepedi, Xitsonga and Tshivenda. Unfortunately, the researcher is only fluent in the former language and weak in the other two languages. This created a barrier between the researcher and the participants, especially those who could not speak English. This might also have caused a serious loss of valuable data presented in the two languages the researcher was unable to understand.

- **Low response rate:** Many cooperatives collapsed immediately after the incubation programme. Some of the participants interviewed indicated that they thought the incubation was about funding their projects. From the sampled 56 cooperatives, the researcher managed to collect data from 44 participants of the 31 cooperatives. However, the low response rate did not have a serious impact, as the study is mainly qualitative and not quantitative, which rests on the assumption of representative sampling to foster valid generalisation. A qualitative study primarily seeks to obtain rich and in-depth data. Furthermore, saturation was reached, as evidenced by the frequent repetition of similar themes and subthemes. Again, the response rate reflected a similar trend, as shown in Figures 54 and 57, respectively, wherein the first three districts with the highest proportion of incubated cooperative participation still maintained the same response rate, with the exception of the last two with an equal response rate.

- **Poverty**: Most rural farmers do not have technological devices like mobile phones. Some participants had to borrow phones from others to participate in the interviews.

- **Poor network connectivity**: Most rural areas do not have adequate network connectivity and this impacted tremendously during the logistical processes and interviews. A lot of data were lost during interview as some respondents were not audible and more time was consumed repeating.

1.6.2 Delimitation of the study

While the researcher has no control over the limitations of the study, delimitation is the opposite. Here the researcher has full control of what to include and exclude in the study. Theofanidis and Fountouki (2018) refer to delimitations of the study as the conscious limitations the researchers set for themselves. These are the boundaries a researcher decides on for a study. Bluntly put, the researcher 'cut the fat' for the study and remained with the main focal areas. There is always a reason or justification for not including and excluding certain parts of the study. Research cannot be about everything and so is the delimitation of the study. Delimitation is the researcher's subjective decision to manage the scope of the study.

- **Limpopo Province as the area of focus**: The study on the adoption of ICT for development of the rural farming cooperatives chose Limpopo Province as the main study area.
- **Rural areas**: There are farming cooperatives in semi-urban and urban areas of Limpopo Province, but the study's main focus is on the rural settings.
- **Farming cooperatives**: The Department of Trade and Industry (DTI) has several cooperatives like manufacturing, but the farming was the option.
- **Incubated farming cooperatives (2018-2020**): LEDA is the DTI's implementing agent. There have been several incubated programmes in the past, but the study decided to focus on the farming cooperatives that were incubated between 2018 and 2020.

1.7 LITERATURE REVIEW

A literature review comprises what has already been said about a particular subject by those who have an interest in the same subject. It is defined "as an account of what has been published on a topic by accredited scholars and researchers" (Taylor, 2018). She asserts that a literature review is characterised by the following:

- It provides a comprehensive discussion of the scholarly research that has already been done on a topic.
- Includes some summary of important articles on a topic.
- Includes comparison: between how different authors discuss the same topic and how it has been handled over time.
- Synthesizes previous ideas on a topic, but looks for gaps in the literature: what needs to be investigated further?

1.7.1 Conceptual framework

The study will be guided by the depicted conceptual framework. It will serve as a roadmap to accomplish the objectives of the study.

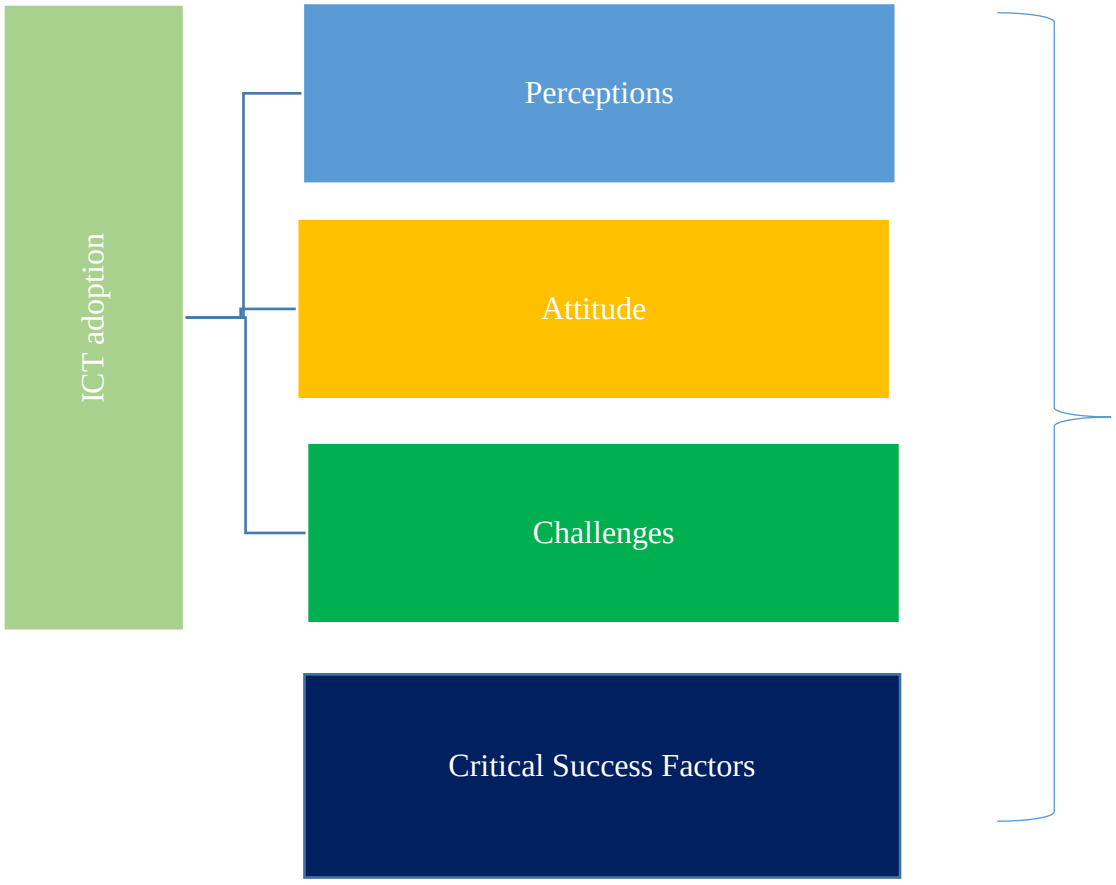


Figure 4: Conceptual framework
Source: Researcher conceptual framework

Figure 4 above illustrates the four layers of the conceptual framework that will be used as the roadmap of the study. ICT adoption in farming will depend on four critical elements, namely extrinsic and intrinsic factors, theories, and models. The four elements therefore become the independent variables and ICT adoption becomes the dependent variable. The objectives of the study are premised on the relationship between these two sets of variables.

1.7.2 Definition of cooperative

The International Cooperative Alliance [ICA], as enshrined in the National Cooperative Business Association (NCBA, 2019), defines a cooperative as the voluntary coming together of people with a common agenda or mutual interest in achieving economic, social and cultural needs. The above definition of a cooperative is in full agreement with the of *Cooperative Act 14 of 2005* (RSA, 2005). What becomes central in a cooperative is that these people are independent, autonomous, and implement democratic principles.

1.7.3 Types of cooperatives

According to the NCBA (2019), agriculture; insurance; financial services; buying; groceries; education; healthcare; housing; and utilities are common types of cooperatives:

1.7.4 CRITICAL SUCCESS FACTORS OF COOPERATIVES

1.7.4.1 Cooperative governance

The success of the cooperative depends on many factors. Scholl and Sherwood (2014) identify the following four cooperative governance pillars, which can schematically be represented as follows:

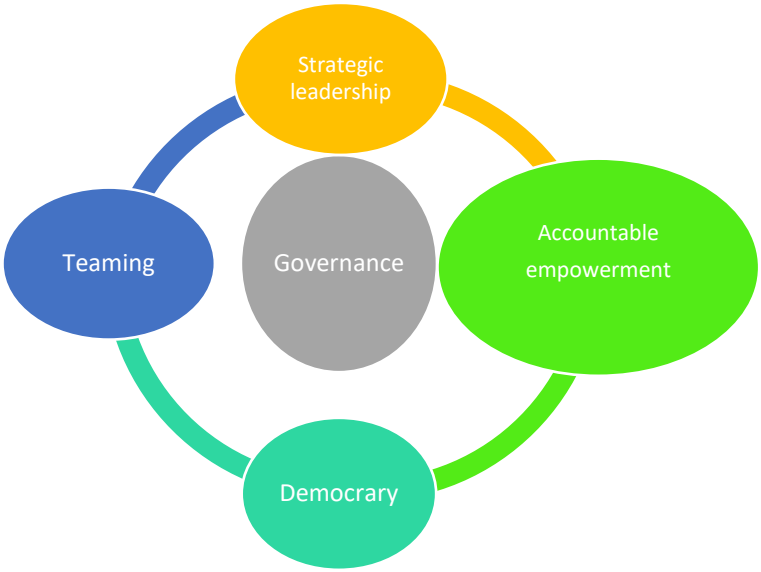


Figure 5: Four pillars of cooperative governance
Source: Scholl and Sherwood (2014)

Figure 5 above states that good cooperative governance comprises four pillars, namely strategic leadership; accountable empowerment; democracy; and teaming. The above pillars are the attributes of a success of a business (Scholl & Sherwood, 2014). The first pillar on strategic leadership states that a successful business is the one characterised by a good leader who has the capacity to direct that institution to greater heights. The second pillar on accountable empowerment states that a thriving business is the one that empowers its people but making them to account for their actions. The third pillar on democracy states that business is about the people. Affording all members of the business to have a voice, brings success. The last pillar on teaming focuses mainly on working as a collective. This is one indicator of business success.

1.7.4.2 Agricultural role

According to the Food and Agriculture Organisation of the United Nations (FAO, 2017), the world population is expected to surpass the 9-billion mark by 2050, and agriculture has to increase the production of nutritious food to meet the growing demand as well as to ensure food security for all, which is congruent with the Sustainable Development Goal [SDG] 2 of the United Nations (UN, 2015).

In the past, farming was driven by supply, but currently it is driven by demand. The time has arrived for farming to embrace information, as this will assist end users to benefit greatly from the potential opportunities that come with the internet and other forms of information and communication technologies (Milovanovic, 2014). This is important in order to make markets more accessible for small producers.

1.7.4.3 Effective implementation of the National Development Plan (NDP) 2030

The South African government has set a target for farming to create approximately a million jobs in 2030, in which case commercial agriculture is anticipated to create about 250 000 direct jobs and 130 000 indirect jobs (NDP 2030, RSA, 2011).

The revitalisation of agriculture has been well covered by the former Presidents of South Africa in their State of the Nation Addresses (SoNAs). The former South African President, Thabo Mbeki, repealed the *1981 Cooperative Act* and replaced it with the *Cooperative Act 14 of 2005* (RSA, 2005). The former Act was seen to exclude the historically disadvantaged individuals (HDIs) in favour of the minority.

1.7.4 Factors that limit farmers to enter the commercial markets

Khapayi and Celliers (2016) have identified "poor roads, lack of transportation to the markets from farms, lack of marketing skills, and information" as the barriers towards the penetration of the markets by emerging farmers. Hagos and Geta (2016) also confirm the need for ICT adoption to improve farming.

1.7.4.1 Youth unemployment

Young people constitute a significant asset to the economy of every nation (Brown, 2012). Unemployment, on the other hand, is a major nightmare hovering in both developed and developing countries. Statistics South Africa (Stats SA, 2018) records that youth unemployment stood at 26,7% of the total population of 57 596 022 during the first quarter of 2018 and the number of the working age population increased by 153 000. South Africa's youth also comprise a substantial proportion of the South African population, as included in the South African population graph below:

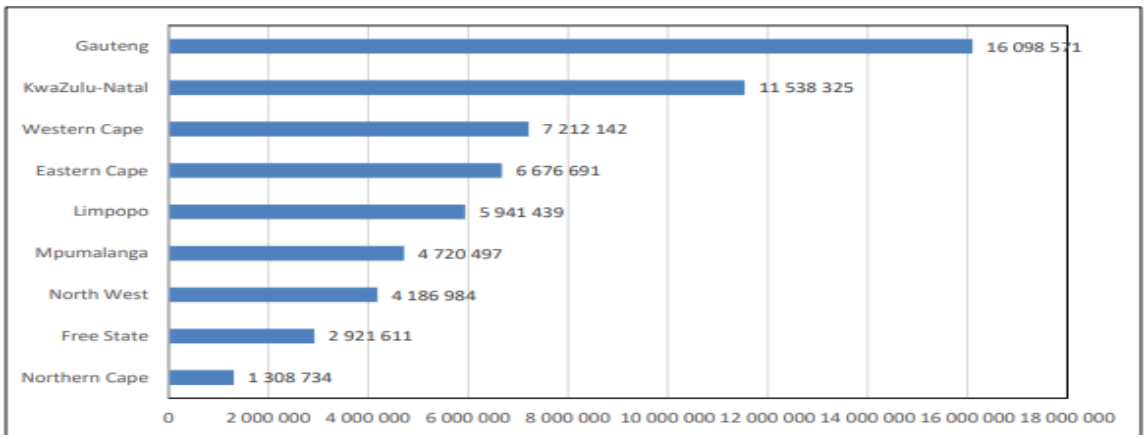


Figure 6: Mid-year population estimates for South Africa by province
Source: Stats SA (2022)

The population is expected to grow as depicted in the population growth graph below and it requires urgent attention, especially in sectors such as agriculture, which has the potential to provide more jobs for the unemployed.

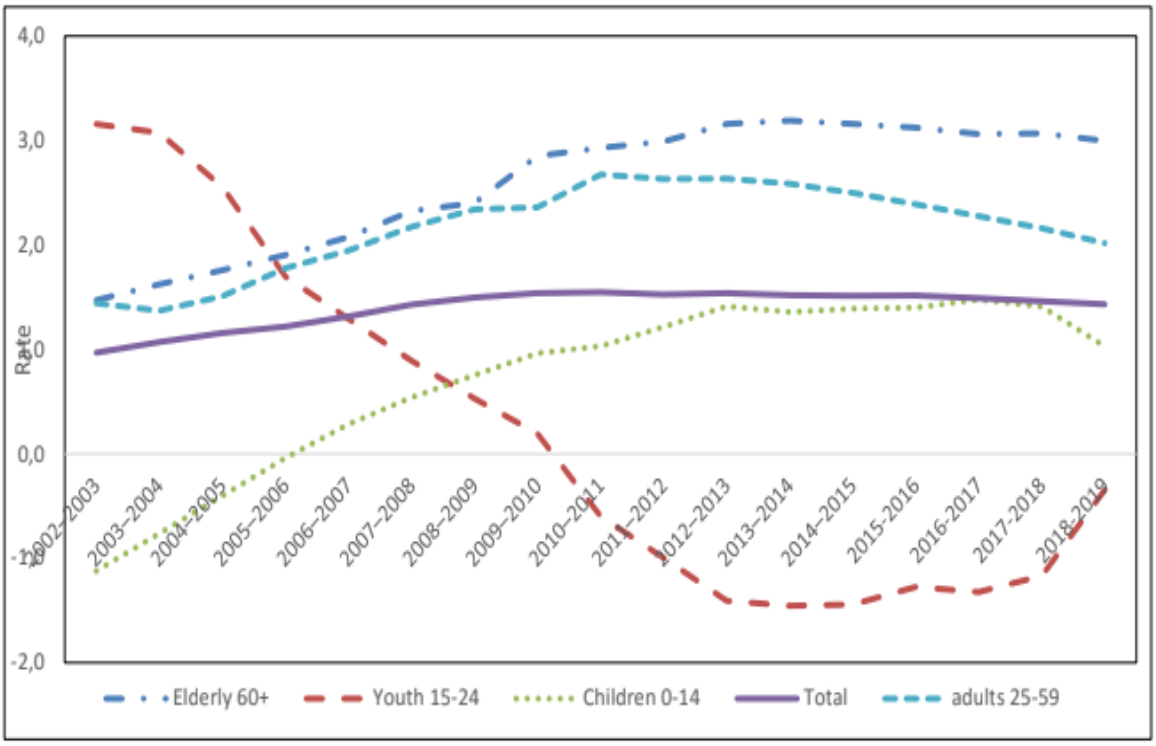


Figure 7: Expected population growth rate
Source: Stats SA (2019)

The expanded unemployment rate for Limpopo during the second quarter of 2019 was a staggering 41,4% (Ndebele & Ansara, 2019).

1.7.6 Importance of ICT

"Information and Communication Technology (ICT) plays a major role in all aspects of national life: in politics, economic life, social and cultural development." (Kelles-Viitanen, 2003) She further emphasises that ICT fuels the global economy. The importance of ICT in farming is supported by Singh, Kumar and Singh (2015). They assert that ICT is an emerging field focusing on the enhancement of farming and rural development, also indicating that 60% of the farmers in the country have not as yet started to integrate ICT. Irungu, Mbugua and Muia (2015) state that the youth generally cherish technology and their inclusion in both cooperatives and SMMEs can make a positive contribution towards the development of farming. ICT is not the silver bullet for all farming challenges, but it provides accurate and timely information, also further considered to have an impact on the growth trajectories of many African economies (Mahant et al. 2012).

According to Chavula (2013), the share of agriculture in the growth domestic product [GDP] in many African countries is relatively smaller, often at 30% or less, with a 2,5% contribution from South Africa, since it is an industrialised nation (Greyling, 2015). This is besides agriculture being the key driver of Africa's economic growth. Some of the reasons that can be apportioned to this low growth may be the traditional nature of the sector associated with illiteracy and untidiness. However, the agricultural sector is traditionally more labour intensive and performs well as a sector for employment creation.

According to Malan (2019), the advent of the fourth industrial revolution [4IR] may be a useful intervention, especially in developing countries like South Africa, as it will boost small farmers through the provision of new ideas and consequently bringing sustainable positive economic spinoffs. Zambon et al. (2019) confirm that speed that comes with the 4IR has the potential to respond to the global markets and in so doing affords the small farmers the opportunity to participate in the worldwide competition. Kimeyi and Moyo (in Chavula, 2013), further confirm that the economic sectors like agriculture, health and education can benefit tremendously from the adoption of new technology through the creation of innovative ideas.

There is strong evidence that countries that adopt and consider investing in technology have a greater chance of sustainable growth and competitiveness. ICT, if applied strategically, can be a major boosting agent in agriculture, which is the largest economic sector in African countries.

ICT can be a catalyst for poverty alleviation and the creation of economic growth for the African continent (World Bank, AfDB & AUC, 2012).

1.7.6.1 ICT adoption challenges

The adoption of ICT is not immune to challenges. The success of ICT adoption requires skills like literacy for interpretation of technological content and language. Unfortunately, most parts of the globe especially in Africa suffer from literacy skills. Although South Africa is mostly an urbanised country, there are still large rural areas with people deriving a livelihood from the land. Many of these rural communities still have high levels of illiteracy (Mahant et al., 2012). Low education level has been confirmed by Iorliam, Imbur and Iortima (2012) as a barrier towards ICT adoption, something confirmed by Oladele (2015) and Singh, Ahlawat and Sanwal (2017).

Kante, Oboko and Chepken (2019) have summarised the ICT adoption factors as follows:

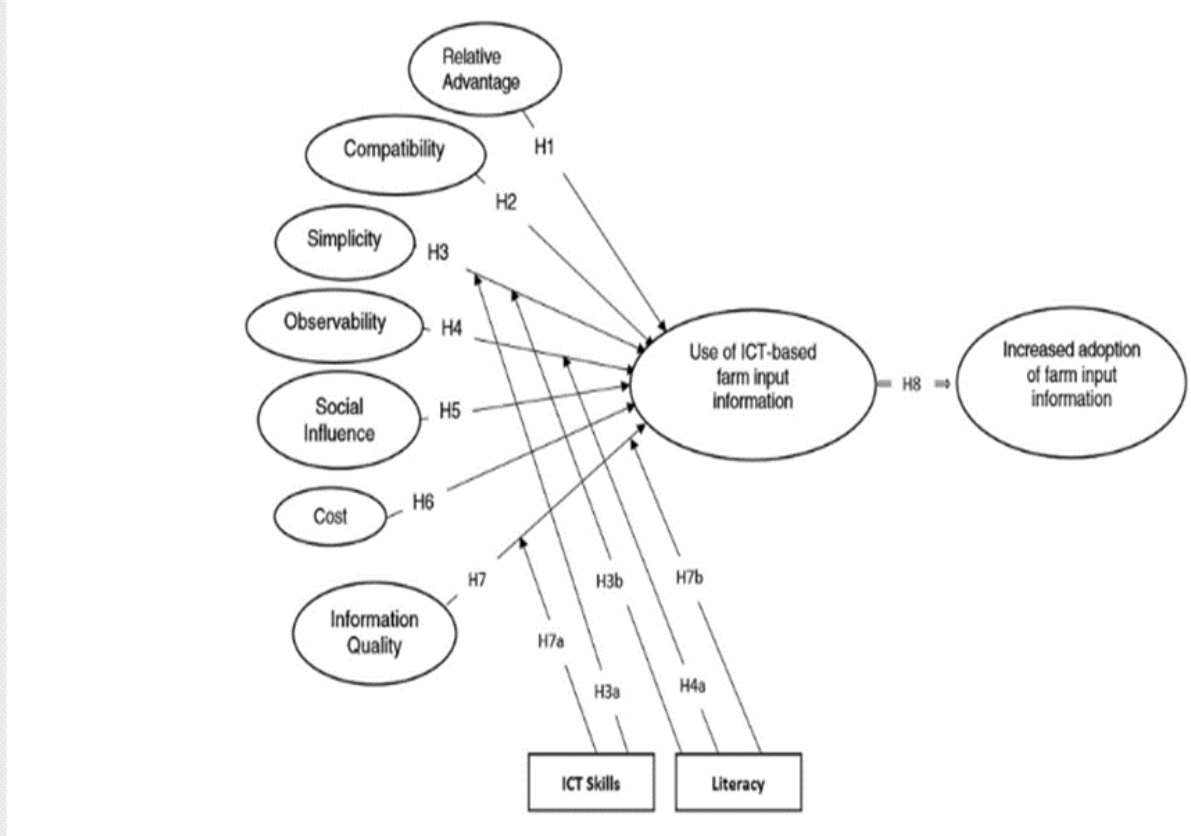


Figure 8: Factors affecting the use of ICT adoption
Source: Kante et al. (2019)

1.7.7 Perceptions of youth on farming

Agriculture may be perceived as the apex of economic growth, but most youth across the world, especially those in developing counties like South Africa, look down on it. It is an area that is considered backward and left to the unfortunate, the illiterate and as a last resort when it comes to career choice (Njoroge & Kinyua, 2014). It calls for policymakers to pay attention to this important sector of the economy.

Anyidoho, Leavy and Asenso-Okyere (2012) assert that the youth have distanced themselves from agriculture. African countries in particular have an obligation of developing policies that will attract more youth to farming. Nowadays, farming has numerous value chains which can be an opportunity or contribute towards addressing the high unemployment rate (Lokeswari, 2016).

The negative perceptions created around agriculture need to be reviewed for the youth to participate, as this causes poor labour absorption of young potential entrepreneurs into the agricultural sector. “Young people are the ideal catalysts for such change given their greater propensity and willingness to adopt new ideas, concepts and technology which are critical to changing the way agriculture is practised and perceived.” (Ayinde et al., 2015)

The above section of the proposal has provided various key definitions: conceptual framework, critical success factors, the role of agriculture, the role of the South African National Development Plan, factors that limit emerging farmers to move into commercial farming, youth unemployment, the importance of ICT, ICT challenges, and youth perceptions on farming.

1.8 THEORETICAL FRAMEWORK

The research employed a mixture of theories, namely Roger’s diffusion of innovation and Kurt Lewin’s change theories.

1.8.1 Roger's diffusion of innovation theory

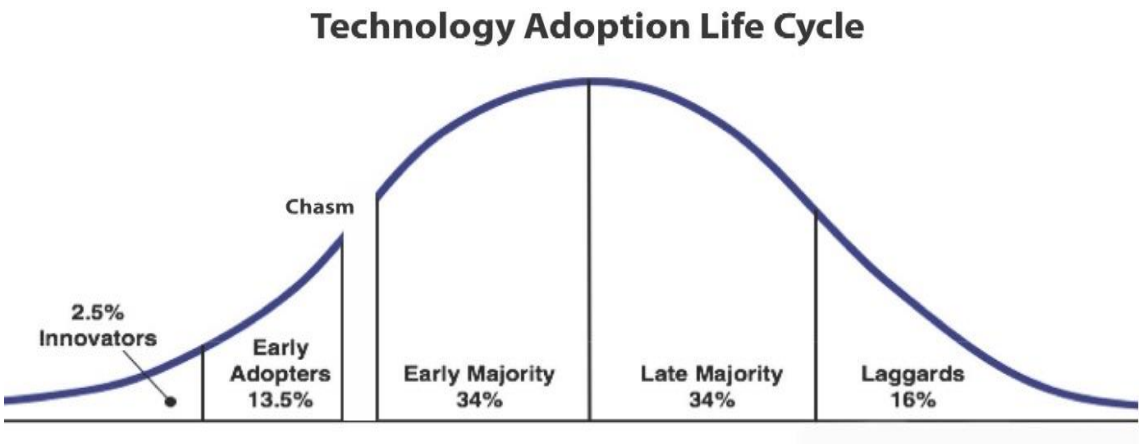


Figure 9: Technology Adoption life cycle
Source: Maeli (2016)

The above theory affirms that the adoption of ICT happens in various stages from innovators, early adopters, early majority, late majority, and laggards. The researcher ill apply this theory as conceptual framework to study rural farmers' adoption of ICT by rural farming cooperatives and he will probably follow the same stages as depicted in the theory.

The researcher has found Roger's diffusion of innovation (DOI) theory relevant to this study, as ICT adoption has long found expression in farming. However, the adoption of ICT in farming comes with conditions, such as the following:

Maeli (2016) further states that the curve highlights the acceptance of new ideas by society through five stages and their characteristics as depicted in the following table:

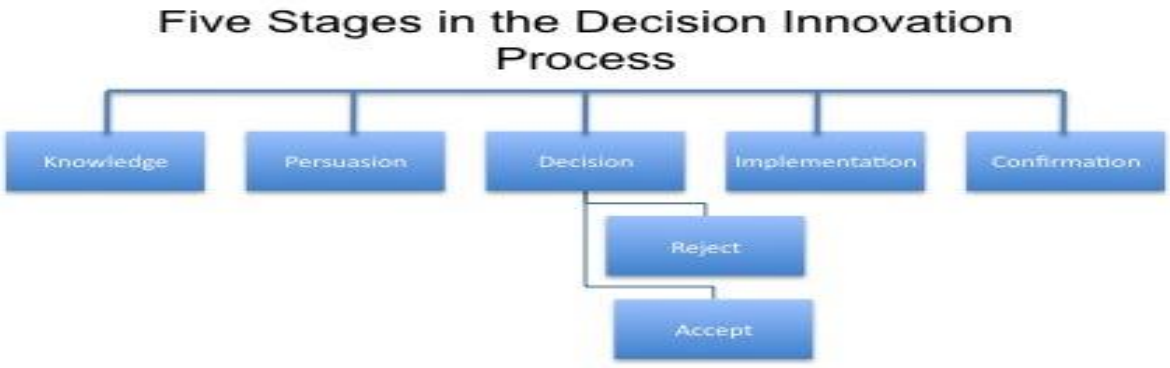


Figure 10: Five stages in the decision innovation process
Source: Sahin (2006)

The Decision Innovation process is a system that follows a chronological order, from knowledge acquisition, persuasion, decision making, implementation, and confirmation. It is at the decision stage where the adoption is either accepted or rejected. Once accepted, the process continues to the next stage of implementation and ultimately arriving at confirmation.

1.8.2 Kurt Lewin theory

The researcher aimed to strengthen the adoption of technology by employing the Kurt Lewin Theory of Change. The researcher is of the view that change is necessary in farming to realise subsistence changing to commercial farming. Change happens in stages, as reflected in this theory.

Morrison (2014) affirms that change will only be effective if the people involved embrace it and help put it into practice.

1.8.2.1 Stages of change

He further states the three stages of change as depicted below:

Figure 11: The three stages of change
Source: Morrison (2014)

The theoretical framework of this study was centred on the two theories: Roger's diffusion and Kurt Lewis theory. The assumption of this study was that if the former theory is adopted, it will give rise to the latter. In other words, the adoption of ICT in farming will change the status quo whereby subsistence farmers will change to commercial farming. The Kurt Lewis theory may further explain how rural farming cooperatives adopt and use ICT in their agricultural practice.

The researcher found the two theories appropriate for this study as they are both chronological and logical. He is convinced that the adoption (Roger's diffusion of innovation theory) of ICT

can bring about change (Kurt Lewis Theory). However, the researcher fully understands the dynamics that come with both adoption and change, as they are not automatic. It cannot be concluded that whenever there is adoption, change will follow suit.

1.9 IMPORTANCE OF THE STUDY

The effective and efficient adoption of ICT for development of the emerging farming cooperatives and SMMEs in Limpopo Province can close the existing gap between the social and economic objectives of the cooperatives. The emerging farming cooperatives in Limpopo Province still focus on subsistence levels, with little movement towards the commercial stages of enterprises, something very critical for poverty alleviation, unemployment and economic growth.

ICT can create the culture of the emerging farming to obtain information from internet on climate, treatment of livestock and crops, marketing, production, etc. Communication between clients and network can be strengthened through gadgets like mobile applications.

The policy makers and implementers could use the findings as a benchmark for subsequent studies on the similar topics. The business incubators could also use the findings to improve their incubation plans.

The findings of the study should be instrumental towards the strengthening of the cooperatives compositions and also during the planning and strategic reviews.

1.10 RESEARCH METHODOLOGY

Kothari (2004) defines research methodology as “the systematic, theoretical analysis of the procedures applied to a field of study”. It involves procedures of describing, explaining and predicting phenomena so as to solve a problem; it is the ‘hows’; the process or techniques of conducting research.

The research is descriptive and exploratory by nature aiming to obtain answers from the “what and how” questions. A qualitative research method, according to Mouton and Marais (in Seroka, 2007), has the following spinoffs:

- It is in-depth.

- It enables the researcher to fathom the respondents' inner thoughts and perceptions together with the understanding of the context within which they are expressed.
- The approach provides the researcher with an opportunity to pick up non-verbal cues from the respondents which become handy when in understanding their backgrounds.

1.10.1 Research design

The research design refers to "the overall strategy that one may choose to integrate the different components of the study in a coherent and logical way" (Kothari, 2004). This is done to ensure that one addresses the research problem effectively. Research design constitutes the blueprint or the roadmap for the collection, measurement, and analysis of data. According to Kothari (2004), "research design is a plan, a roadmap, heart of the study and blueprint strategy of investigation conceived so as to obtain answers to research questions". The research design of this study will comprise the population, sampling and data collection techniques.

1.10.1.1 Population

A population is defined by Banerjee and Chudhury (2010) as the entire group from which some information is required to be ascertained. In this study, the population was obtained from the Limpopo Economic Development Agency [LEDA], which comprises the incubated rural emerging farmers.

The study focused on Limpopo Province, excluding all the other eight provinces. In Limpopo Province all other cooperatives except the farming cooperatives were excluded. Not all the farming cooperatives were the focus of the study; only the incubated cooperatives. Furthermore, the study excluded urban and semi-urban cooperatives. Due to the study limitations alluded to above, data were collected from the available participants.

The following table is a representation of the entire pool of the incubate cooperatives in the five Districts of Limpopo Province from which the emerging farming cooperatives will be obtained:

Table 2: Summary of cooperatives in Limpopo Province

District	**Cooperatives**
Capricorn	18
Mopani	20

Sekhukhune	18
Vhembe	22
Waterberg	15
Total	**93**

Source: LEDA (2018)

The cooperatives in the above table consist of agriculture, manufacturing, services, retail, construction, tourism, and mining, of which agriculture cooperatives are 56 (60,2%).

The population of this study will mainly focus on agriculture cooperatives in the five districts of Limpopo Province as shown in the table below:

Table 3: Number of incubated agricultural cooperatives per district in Limpopo Province

District	**Number of agricultural cooperatives**
Capricorn	08
Mopani	10
Sekhukhune	13
Vhembe	17
Waterberg	08
Total	**56**

Source: LEDA (2018)

1.10.1.2 Sampling

This is the method of selecting research participants from the population. It is a procedure that ascertains fair representation of the participants. Through fair sampling, accurate data can be obtained for generalisation of the research undertaking.

The researcher employed non-probability sampling techniques, namely convenience and purposive sampling. It is as a result of the participants' availability and time that dictate the sampling procedure.

1.10.1.3 Data collection techniques

According to Ngulube and Ngulube (2015), there are various techniques for data collection, namely questionnaires, various features of interviews, observations, and artefact analysis.

Initially, the study planned to use multiple dimensional collection method comprising three phases. However, this approach did not materialise, as it was later found that most of these are actually not cooperatives, but individual businesses with registered family members. Semi-structured interviews were conducted with the available participants; hence, the expected number was not reached as indicated in the limitations of the study.

1.11 ENSURING RIGOUR AND TRUSTWORTHINESS

Quantitative research is known for using validity and reliability to establish the trustworthiness or rigour of the findings and the analysis of the research. Qualitative research is different from its counterpart, as it primarily uses four criteria to validate the findings and data analysis and they are the following as described by Korstjens and Moser (2018).

1.11.1 Credibility

Credibility in qualitative research is more concerned about the truth about the findings of the research. More focus of credibility is to establish whether indeed the information is plausible and represent the original data from the participants. In this study credibility has been achieved through a multiple set of questions, commonly known as triangulation

1.11.2 Transferability

Transferability is more concerned with the degree to which the research findings can be transferred to other contexts using different participants. The study employed probability sampling which hoped to allow for generalisation of the findings but unsuccessful due to low participant turnover, which also culminated into fewer representation of the participants.

1.11.3 Dependability

Dependability in qualitative research is about the stability of the findings over a particular period of time. In this study, dependability will be realised through exposing the findings to other peer researchers

1.11.4 Confirmability

Confirmability is particularly concerned with the dominance of the researcher in data analysis. In this study any form of the researcher's bias has been cited in the limitations of the study.

1.12 ETHICAL CONSIDERATIONS

Ethical considerations are defined by the Australian Law Reform Commission [ALRC] (n.d.) "as an accumulation of values and principles that address questions of what is good or bad in human affairs". It further states that ethics search for reasons for acting or refraining from acting; for approving or not approving conduct; for believing or denying something about virtuous or vicious conduct or good or evil rules.

The research intended to comply with the ethical considerations, including the following, as enumerated by Cresswell and Cresswell (2018).

1.12.1 Respect for participants

Participants in a research study remain key and respect for these critical research stakeholders was upheld at all times. In this study, the researcher ascertained that participants receive unconditional respect. Participants' titles were used throughout the interviews. For example, the researcher used Mr, Mrs, Ms, Dr, etc.

1.12.2 Informed consent

Informed consent is one of the founding principles of research ethics. It is the principle of two constructs, namely information and consent. The initial construct, information, means that the participant has to be informed of all the research entails, including purpose, risks, benefits, etc. It is at this stage where the researcher should establish trust by being transparent and honest to the participant. This is the first stage that has to take place before the start of data collection. In this study, all cooperatives received a request letter from the researcher with attachments like a permission letter from LEDA and Ethical Clearance (Rec-240816-052) from UNISA's Ethics committee. The researcher waited for the response from the cooperative in the form of consent, allowing for the participants to be part of the data collection process. The study has LEDA as the gatekeeper, it but entered into an agreement with participants.

1.12.3 Obtain permission for recording

The participants were informed well in advance about what will happen during the data collection process. This included asking the participants the permission to record the proceedings.

1.12.4 Voluntary participation

Participants were not forced to participate in the study and they were free to withdraw at any time they wished, with no penalties for withdrawing during the process. Participants were not required to provide any reason for their withdrawal.

1.12.5 No harm

The study on the adoption of ICT for the development of the incubated rural farmers in Limpopo Province has no potential of harming the participants. The interviews were conducted telephonically and all participants remained unharmed.

1.12.6 Preservation of anonymity and confidentiality

No participant's name has been divulged anywhere in the reports, recordings or even during the data collection process. Instead, fictitious names (pseudonyms) were used, rather than using real names. Furthermore, the participants' names of districts were not mentioned during the data collection process. Instead, district codes will be used. For instance, Capricorn may be coded as A; Mopani as B; Sekhukhune as C; Vhembe as D; and Waterberg as E.

1.13 CLARIFICATION OF TERMS

1.13.1 Information and communication technology

Information and communication technology is defined by Oladele (2015) as "the technologies that provide access to information through telecommunication. It focuses primarily on communication technologies which include internet, wireless networks, cell phones, and other communication mediums". In this study, ICT will include old and modern technologies, as well as software applications used in farming.

1.13.2 Cooperative

According to the *Cooperative Act 14 of 2005* (RSA, 2005), 'cooperative' refers "to an autonomous association of persons united voluntarily to meet their common and social needs and aspirations through a jointly owned and democratically controlled enterprise organized and operated on its cooperative principles".

1.13.3 Subsistence farming

Subsistence farming is defined by Hallam (2017) as "the farming whose products are intended to provide for the basic needs of the farmer with little surplus for marketing". In this study the farmer's production will refer to both crops and livestock.

1.13.4 Commercial farming

Hallam (2017) defines commercial farming as "the type of farming in which crops are grown for commercial use only". This type of farming requires a large piece of land measured in hectares, which also requires more labour and machinery. The operational meaning of this term will refer to both crop and livestock farming wherein the farmer aims to make more profit from marketing.

1.13.5 Poverty

Mamman et al. (2015) define poverty as a "multidimensional phenomenon related to the inadequacy or lack of social, economic, cultural and political entitlements". The study will employ this term to refer to the inability of the emerging rural farmers to meet their socioeconomic needs, specifically limiting factors like poor physical infrastructure such as poor roads, lack of transportation to the markets from the farms, lack of marketing skills and information, poor market infrastructure, high transaction costs, and insufficient land availability (Khapayi & Celliers, 2016).

1.13.6 Unemployment

The International Labour Organization [ILO] defines "unemployment as the share of labour that is without work but available for seeking employment". It is further defined as a situation

where someone of working age is not able to get a job but would like to be in full-time employment (Pettinger, 2019).

1.13.7 Business incubation

Business Incubation is a "process of enterprise development where entrepreneurs are on sustained basis nurtured to survive and grow under controlled conditions". An incubator helps incubates to remove bottlenecks that affect their growth and long-term survival (LEDA, 2018). The study will employ this term to refer to all incubated cooperatives in Limpopo Province.

1.14 CHAPTER LAYOUT

The chapters of this research project are structured as follows:

1. Orientation of the study
2. Literature review
3. Research methodology
4. Data collection
5. Data analysis, presentation and interpretation
6. Conclusion of the study

CHAPTER 2:
LITERATURE REVIEW

2.1 INTRODUCTION

In between the millions of roads and information signs found in the length and breadth of the national and local roads of South Africa there are boards with the following message:

"If you ate today, thank the farmer" and some translated in Afrikaans as "*Het jy geëet vandag, bedank die boer*". Although these messages are in different languages, they mean exactly the same. The above, although mostly not taken seriously, have an important message. The message simply depicts the significant role of farming in our lives. However, there are numerous questions that one may pose after seeing the above message. Among the many questions that come to one's mind is:

What is the rural farmer's input towards food production in South Africa?

The use of the term 'rural' in this study should be understood as a delimitation of the scope, as the same question can be posed in urban areas, with due consideration of the fact that some of the commercial farmers also come from rural areas. In other words, the study focused on the rural areas of Limpopo Province where commercial farmers may also be found.

The above question is prompted by the fact that many of the commercial farmers alluded to above are those who are able to produce surplus food for commercialization, whereas most of the farmers produce for subsistence. The produce of most subsistence farmers is limited and to feed their own families, not for the formal markets. Subsistence farmers will often just have a small surplus to sell or exchange.

Most of the commercial farmers who have migrated from subsistence to commercial levels have adopted technology to enhance their farming. The majority of the subsistence farmers, especially those in developing countries, have not reached the stage of adopting the information and communication technology [ICT].

Farming has always been instrumental for human survival. It is one sector that even the poorest communities depend on for the same reason mentioned. However, in this era, where the world population is expected to increase tremendously, the need to embrace ICT in agriculture

becomes critical. Rural farmers are used to the traditional way of farming; however, the time to switch over to the modern farming methods is due. There is a clarion call for communities, including those in South Africa, to embark on income-generating projects or businesses (Marais & Botes, 2006). The argument raised by both Marais and Botes (2006) is that the income-generating projects or businesses have the potential to develop local communities and further make people more self-reliant; ultimately making livelihoods more sustainable. The researcher is in full agreement with the above argument, given the fact that farming is one of the pillars of economy. Unfortunately that element is not fully explored, especially in most rural areas.

The study will draw its strength from the philosophy of Alvin Toffler who approximately 50 years ago once said: "The illiterate of the 21st century will not be those who cannot read and write, but those who cannot learn, unlearn and relearn." – Alvin Toffler (1970).

Although this dictum was shared about half a century ago, it is still more appropriate today, as there is an urgent need for the rural farmers to change their traditional way of farming or at least adopt blended farming practices. The need to inculcate modern farming methods is relevant in present times.

In the previous chapter, a foundation of this study was laid by proving the roadmap for subsequent chapters. This chapter will therefore focus specifically on the key concepts of the study, namely the adoption of ICT in farming; cooperatives; incubation and the applicable theories. Furthermore, the study will look into the various international, regional, national and local perspectives.

2.2 DEFINITION

Information and communication technology [ICT], according to Ratheeswari (2018), refers to technologies that provide access to information. It includes the internet, wireless networks, cell phones (mobile phones), and any communication medium.

2.3 BRIEF HISTORY AND EVOLUTION OF ICT ADOPTION

Aleke (2010), purports that the first appearance of ICT was in the form of computers in Nigeria in 1963 to conduct the national census. The ICT adoption is argued as that of following in the

traditional diffusion of technology innovation theories based on the earlier work of Rogers (Aleke, 2011).

In between 1963 and 1973, Nigeria had about 20-25 computers and about six were owned by multinational companies. In 1977, total number of computers grew to 70. It was during this time that many universities, government departments and other institutions in Nigeria began to show interest in ICT.

Although the country has continued to witness continuous investment in ICT, the reality is that, contrary to the more optimistic views, the "digital divide" of ICT applications continues to widen (Mbarika, Jensen & Meso, 2002). The reality is that with a weak physical and knowledge base, it is unlikely that this digital divide will narrow over the next few years.

2.4 BENEFITS OF ICT ADOPTION

Many farmers across the globe are uneducated and they solely depend on the traditional farming methods and myths. They do not reap the benefits that come with modern technologies (Srivastava, 2018). The use of technology is found to be having the potential to augment the traditional methods of farming which are predominantly used by rural subsistence farmers, including cooperative farmers. These farmers depend mostly on rain, which in most cases gives low yields (Muyanga & Jayne, 2014).

Asiedu-Darko (2013) affirms that most farmers, particularly those in developing countries, have low agricultural knowledge, especially about the technical aspects of the sector and this may impact negatively on the socio-economic conditions of the small farmers. A recommendation to disseminate the sector with an appropriate information at the right time becomes critical for agricultural change.

The significance of the information that comes with ICT is undisputable, besides the challenges that are associated with accessibility, costs, and illiteracy. The fact that ICT is not a solution or panacea to the market challenges has been widely accepted in numerous studies. However, the meaningful contribution that comes with technology is well documented. The role of ICT on information dissemination has been well captured in many researches and this can be a helpful platform for farmers to acquire information for business growth.

The extension services in many developing countries are not adequately funded. This leaves the sector not having recent farming information. Sometimes the information, even if available, is irrelevant and not applicable to small farmers for productivity. ICT can close the gap of information poverty and also contribute to the sustainability of agricultural development. Technology will therefore augment the sector by reorienting itself for the total development of the small production systems.

Most rural communities like Limpopo Province are vast, with fewer extension officers. For instance, Limpopo has one extension officer per district, which makes the servicing of the farming cooperatives and small farmers ineffective, as these extension officers provide face-to face information to their clients. Extension officers often have challenges of resources like vehicles due to breakdowns and their vehicles have to undergo some services. This results in irregular visits to their clients. During their absence, there is no replacement until they are back from leave. The worst case is when the officer has passed on, as it takes long for the replacement to be appointed. The effective adoption of technology can come in handy to access these officers to close the distance gap as well as provide farming information. The distance travelled alluded to can be shortened through short message services (SMSes), WhatsApp, e-mails, Facebook, Twitter, etc. ICT can enhance and open up new communication channels and thereby reduce costs, especially if the information is such that the farmer can understand and implement without major risks and difficulties.

Some studies point out that the extension officers are fully aware of the benefits of the role that technology can play in improving the agriculture sector. Some of these officers believe that ICT integration can yield positive spin-offs if it can be inculcated in all the areas of agriculture, including the extension work, as information is a necessity for agricultural extension (Oladele, 2015)

ICT has the potential to expand the thin markets that are turned around to become accessible and known to the few not known to most farmers. The information that comes with technology can reduce the existing information asymmetries, thereby reducing uncertainty in activities and transactions. It is for this reason that ICT infrastructure like network connectivity or broadband, especially in rural areas, be made available and zero-rated to cover those in abject poverty.

Besides the benefits of technology in farming, its role has not been demonstrated adequately, especially in the rural areas. Most rural people have not been exposed to the role of technology and this may be one reason that the embracement is slower and in some instances non-existing.

2.5 THE ROLE OF ICT IN AGRICULTURE

Farming requires access to information in order to realise the most pertinent aspects of maximising production and accessing the markets. Technology is the enabler for globalisation, as it allows for effective information flow to all people across the globe. However, ICT should not be considered the catholicon development of all the rural development but just an instrument that has the potential to assist the rural poor to leapfrog and supress the traditional hurdles to development. Technology is the tool that improves access to information, thereby expanding the markets and strengthens the employment chances as well as adding value to the government services to perform better. Oladele (2015) further states that effective ICT strategies should allocate the basic technological devices for connectivity, access and, most importantly, the development of human capacity.

"Africa has a cumulative body of agricultural information and knowledge, know-how and practices that need to be shared continent-wide and applied for improved livelihoods and sustainable development" (Oladele, 2015). This statement is in agreement with the Sepedi proverb which says, "*Rutang bana ditaola, le se ye natšo badimong".* Loosely translated into English, it means elders must share the wisdom and expertise with youth; and not die with such body of knowledge. However, this wealth of information and knowledge, although relevant, is sometimes impossible to find. It is indeed true that Africans possess very rich knowledge, which has been instrumental over ages. It is the same indigenous knowledge that is able to preserve their agricultural produce, from the time it is harvested to the following ploughing season. In Sepedi, there are methods of keeping grain intact until the next season for ploughing comes. They use the ash from specific trees to preserve the grain from decomposition. There are more other indigenous knowledge systems that have assisted them having their food unharmed for many years. The Pedis, especially those in GaNkwana, Sekhukhune have a way of provoking the clouds for the rain to come down called "*mohlapo"*. In this practice, the young girls – virgins – are tasked by the traditional authority to go and fetch water from the river with calabashes and pour the water in a specific place identified by the traditional healer appointed

by the traditional authority. Given the rich agricultural information and knowledge among the indigenous people, especially in Africa, one is tempted to ask whether the technological information is really what they are gunning for.

Information is an indispensable element when it comes to the facilitation of farming and nurturing rural development. It is also beneficial towards bringing the social and economic changes. Further than its socioeconomic spinoffs, agriculture is a crucial component is towards bringing life to the natural resources. ICT plays a critical role in developing the agricultural system (Gopinath, Kalpana & Shibu, 2016).

Information and knowledge are considered to play a leading role towards rural agricultural development. The two are recounted among the chief productive resources. They play a pivotal role in securing food security and sustainable growth. Technology is a key input to economic growth and development internationally, regionally, nationally and at local level.

2.6 INTERNATIONAL PERSPECTIVE

The diffusion of the internet among the world population is a reflection of the importance of information that can be obtained from such platforms. The internet has recently gained momentum, as shown in the following seven regions of the globe:

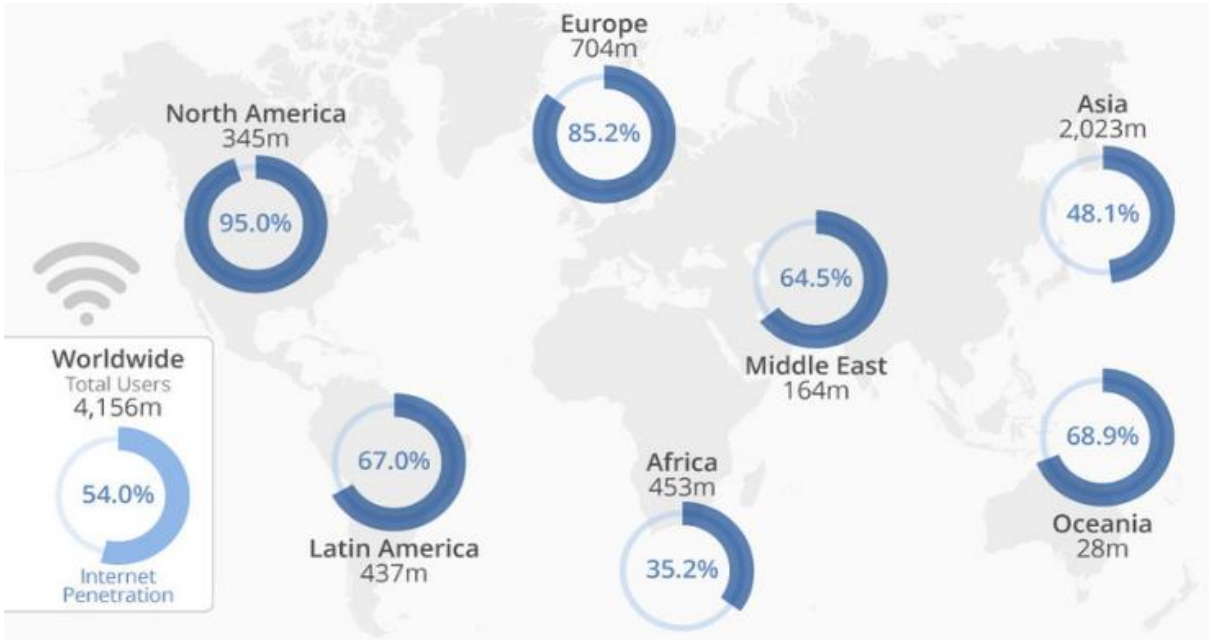


Figure 12: Internet penetration by region
Source: Internet World Statistics [IWS] (2017)

In 2017, the world population was approximately 7,6 billion. The above figure depicts that the global internet penetration stands at 54% with 4,156 million users. From the world's seven regions, namely Africa, Asia, Europe, Latin America, Middle East, North America, and Oceania. North America is the highest when it comes to internet penetration (95,0%). Approximately 345 million people in that region use the internet. The second-highest region, with greater internet penetration is Europe at 85,2%, covering 704 million. Africa is the lowest region in terms of internet penetration at 35,2%, covering 453 million with Asia being the second-least at 48,1%, covering 2.023 million people. Although Asia may have the second-least number of internet users, its coverage is almost the sum total of the six regions, at 2,023 million.

The adoption of technology in other countries across the globe has been demonstrated well, as in the case of the Kingdom of Saudi Arabia. Technology is treated as one of the tools that have been used to address their social needs, especially food security.

2.7 SAUDI ARABIAN CASE STUDY

There are countries like the Kingdom of Saudi Arabia that benefitted tremendously from the introduction of information and communication technology. The country was able to produce a bigger variety of crops, vegetables and fruit through the support of modern technology. However, the role that technology plays in supporting farming is not clearly unpacked, except to mention it in passing, which raises many questions that may require responses. What is known is that the country gained self-sufficiency and export for the surplus produce, but not all of them.

Technology plays a significant role in Saudi Arabian farming. Because of the scarcity of water, the government uses ICT for water recycling. For example, wastewater is treated and used exclusively for farming. The infusion of technology in farming yields very good spinoffs as the wastewater can be used in irrigation schemes. This strategy sees every drop of water – either clean or waste – as important (Al-Shayaa, Baig & Straquadine, 2012).

The above case study has revealed that the Kingdom of Saudi Arabia used ICT to solve its problem of water scarcity through recycling. The wastewater is recycled for another important benefit of food produce. In this way, technology is adopted to solve problems, another dimension not frequently mentioned.

There is looming consensus that technology is very instrumental in organising the farming sector, but not all countries have come to terms with that. Some of the African countries like Morocco are a bit behind when it comes to ICT integration.

2.8 AFRICAN PERSPECTIVE

In the study conducted by Dhehibi et al. (2020), on agricultural technology transfer preferences of smallholder farmers in Tunisia's arid regions it is argued that the majority of African countries have not matched the successful requisites for agricultural revolution, which turned the sector to lag behind for many centuries. This has caused many farmers in developing countries to remain in the dark when it comes to the adoption of new technologies. It still remains evident why most farmers in rural areas are not conversant with the agricultural inputs like fertilizer usage and pesticides, as well as the best farming practices, including the feeding protocols. While the above statement may be among the many reasons for poor farming methodologies in many developing countries, the socioeconomic conditions of those directly affected become the epicentre of the argument. It cannot be completely true that African countries fail to meet the requirements for a successful farming revolution, forgetting the other political reasons that Africa as a continent went through. Where was the time to focus on such farming methods? Africa has been dominated by colonialism from North to South. Countries like Zimbabwe obtained their freedom earlier than South Africa; hence, it was able to practice good farming methodologies. In Zimbabwe, farming is the primary economic activity, followed by mining. Most importantly, the country uses a blended kind of farming, but mostly traditional methods learned during colonialism. This is among the reasons why Zimbabwe is able to cope in terms of food security, even during these trying times. However, the Global Report (2020) on food security shows that the country is facing a bleak future due to various factors like climate change, which has depleted the amount of rainfall. The country has not received adequate rainfall in the past decade. The report further indicates that most of Zimbabwe's food security comes from the 70% subsistence farmers. Unfortunately, the country has fewer irrigation systems, which may also be a factor that can exacerbate the food insecurity problem.

Colonisation of the majority of the African countries cannot go unnoticed as one of the primary factors that bar black people and other minority groups from the opportunity to develop themselves. The need to afford Africa the 'benefit of the doubt' is necessary.

Although some African countries still lag behind in terms of technology embracement, there is light at the end of the tunnel, as shown by most countries in Sub-Saharan Africa when it comes to internet usage.

2.9 SUB-SAHARAN AFRICA AND OTHER COUNTRIES PERSPECTIVE

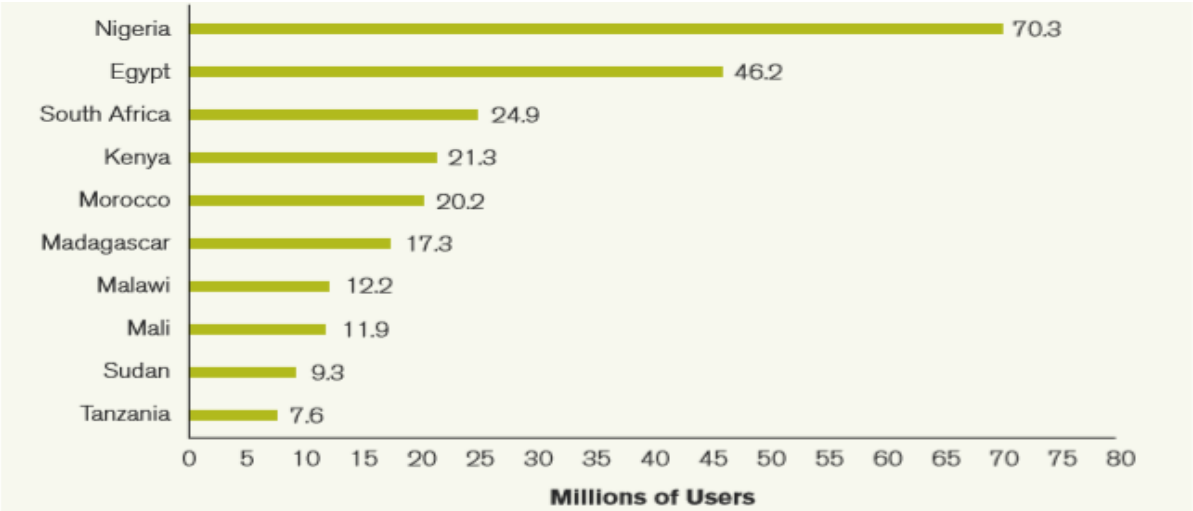


Figure 13: Internet users across Africa
Source: General Household Survey [GHS] (2018)

From the ten countries in the continent above, Nigeria has the highest number of internet users (70,3%), followed by Egypt with 46,2%. South Africa is in the third position, with 24,9%. The country with the lowest number of internet users is Tanzania with 7,6%. The difference between the highest and the lowest internet users stands at 62,7%. The difference between Nigeria and South Africa in terms of internet users is 45,4%. It is apparent that Nigeria accesses more information from the internet than most African countries. However, what is not known is the purpose the information is used for. Perhaps another issue that may be raised can be the affordability of data in Nigeria.

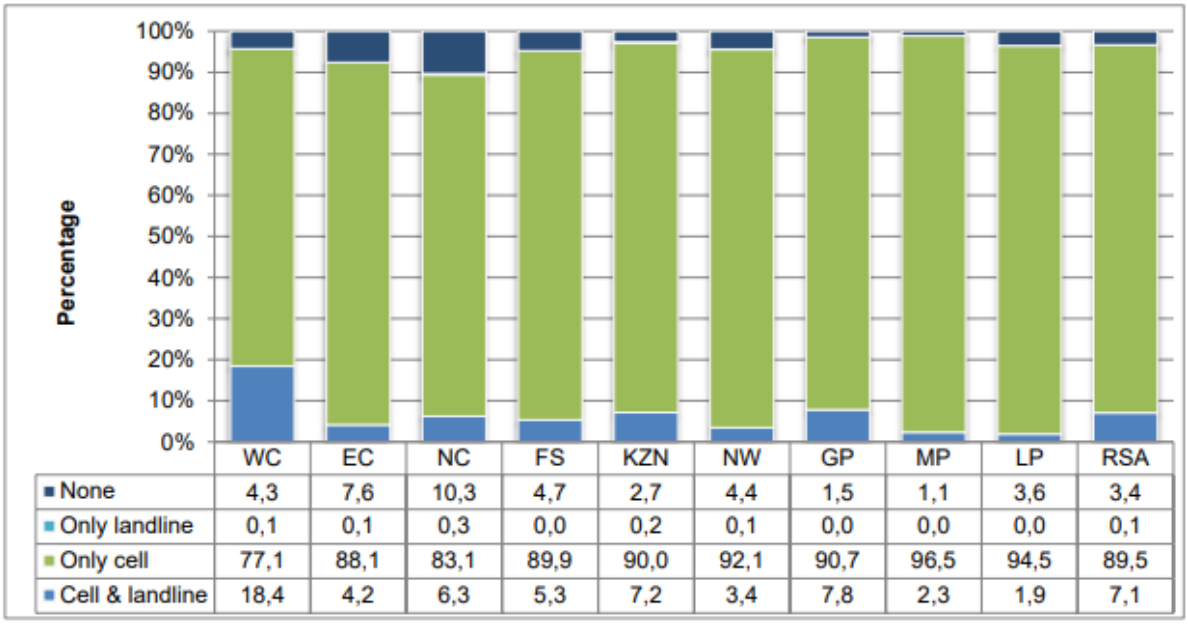
The following section of the study will provide a perspective of ICT availability in South Africa. The perspective will paint a picture of the different types of information transmission tools, especially the statistics of households in South Africa, with special reference to the nine

province of the country. Further coverage will be on the usage of internet, as well as time spent per country and projections.

2.10 SOUTH AFRICAN PERSPECTIVE

Information, which also makes ICT tools requisite, is an important factor that adds value to the production factors. The development of progressive and sustainable agriculture needs access and the adoption of technology tools, which underline the contemporary information system. However, it is argued that access to these ICT tools depends on the availability of the requisite infrastructure like landlines, mobile phones, computers, data, and network connectivity like broadband, and modern farming content (Anyan & Frempong, 2018).

Besides the criticisms of the mobile devices, the use of these devices has increased tremendously. Given the internet use of the mobile phones in South Africa (Digital 2020 Globe Overview, 2020), the following diagram depicts the use of mobile phones in South Africa:



	WC	EC	NC	FS	KZN	NW	GP	MP	LP	RSA
None	4,3	7,6	10,3	4,7	2,7	4,4	1,5	1,1	3,6	3,4
Only landline	0,1	0,1	0,3	0,0	0,2	0,1	0,0	0,0	0,0	0,1
Only cell	77,1	88,1	83,1	89,9	90,0	92,1	90,7	96,5	94,5	89,5
Cell & landline	18,4	4,2	6,3	5,3	7,2	3,4	7,8	2,3	1,9	7,1

Figure 14: Percentage of households who have a functional landline and cellular telephone in their dwellings by province

Source: General Household Survey (2018)

The above diagram illustrates the various disparities of both landlines and mobile phones in the nine provinces of South Africa. The province with the highest landline prevalence is the Northern Cape at 0,3%, followed by KwaZulu-Natal at 0,2%, and in the third place three

provinces (Western Cape, Eastern Cape and North-West) at 0,1%. The provinces with 0,0% landlines are the Free State, Gauteng, Mpumalanga and Limpopo.

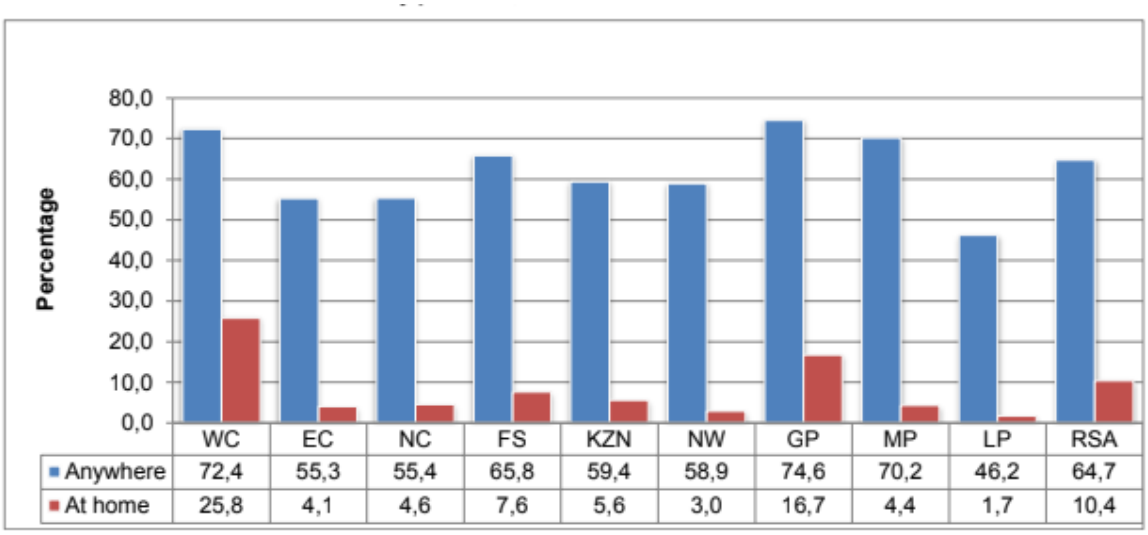
Limpopo Province, as the focal point of this study, is not doing well in terms of landlines, except for mobile phones, standing at 94,5%, which is higher than most of the provinces after Mpumalanga.

The use of mobile phones in the nine provinces of South Africa has increased tremendously. The province with the highest percentage of mobile phones is Mpumalanga at 96,5%, followed by Limpopo Province at 94,5%. North-West takes the third place with 92,1%. In the fourth and fifth places are Gauteng and KwaZulu-Natal at 90,7% and 90,0%, respectively. Four provinces in the bracket of 80%–89% are the Eastern Cape, Northern Cape, Free State and Limpopo. The Western Cape displays the lowest percentage when it comes to mobile phones, at less than 80%. The use of landlines in South Africa has since plummeted to less than 1%, as mobile phones have taken over, as shown in the above analysis.

The recent spread of mobile networks in most developing countries, including South Africa, has brought a huge challenge to the services like telecommunication (Telkom). The ladder uses landlines that are more static, compared to the dominant mobile services like Mobile Telecommunication Network (MTN), Vodacom and Cell C.

The World Bank (2008) reports that South Africa has approximately 98% coverage of the mobile network signal. This coverage gives the use of the mobile phones an advantage over the non-mobile competitors. It is for this reason that mobile phones are widely used in South Africa. However, the accessibility of these devices are not immune to critique, especially the high cost of data and airtime. The recent case of the outcry on the high cost of data was raised by the many university students in South Africa with the #datamustfall campaign. The campaign has drawn a lot of attention for many governments to intervene. The high cost of data is alleged to be among the causes of inequalities between rich and poor, calling for data to be zero-rated.

The availability of the ICT infrastructure is only effective when it is being utilised. These tools are meant to provide information which can be obtained from the internet, as illustrated in the following diagram:



	WC	EC	NC	FS	KZN	NW	GP	MP	LP	RSA
Anywhere	72,4	55,3	55,4	65,8	59,4	58,9	74,6	70,2	46,2	64,7
At home	25,8	4,1	4,6	7,6	5,6	3,0	16,7	4,4	1,7	10,4

Figure 15: Percentage of households with access to the internet at home, or which at least one member has access to, or use the internet per province

Source: General Household Survey (2018)

According to the graph above, the access of anywhere outside home is higher than the households accessing internet at home. It is only in the Western Cape where there is higher access of internet at home of 25,8%, followed by Gauteng Province at 16,7%. Otherwise all the remaining provinces (Eastern Cape, Northern Cape, KwaZulu-Natal, Limpopo, Free State, North-West and Mpumalanga) have internet access at home (less than 10%), with North-West the least (3,0%).

However, Gauteng Province is the highest when it comes to internet access anywhere, at 74,6%, followed by the Western Cape at 72,4%. Mpumalanga is the third-highest province at 70,2%. Free State Province is fourth at 65,8%. Four provinces, namely the Northern Cape, Eastern Cape, North-West and KwaZulu-Natal have less than 60%, but more than 50% internet access anywhere. Limpopo is the only province with an anywhere internet access of below 50%. The difference between the highest and the lowest provinces in terms of anywhere internet access is 26,2%.

Limpopo Province is mostly rural and the above-average, anywhere internet access is a reflection of the disparities between rural and urban areas in South Africa.

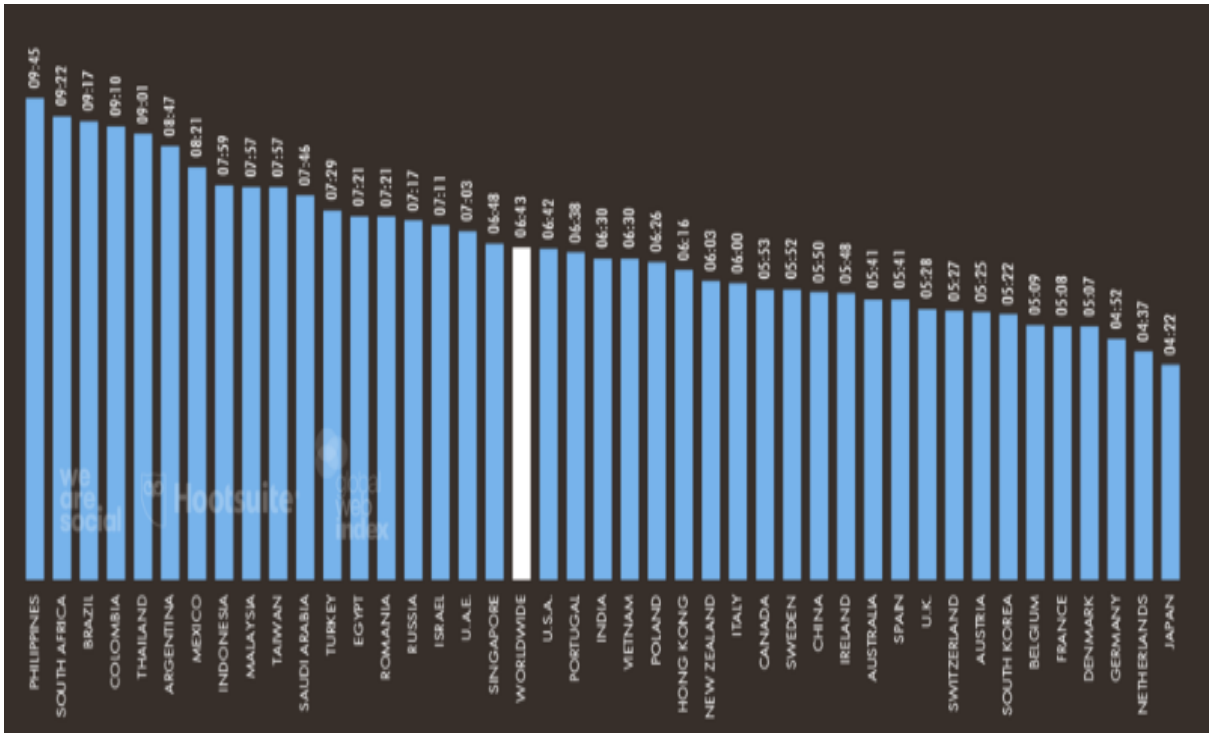


Figure 16: Time spent on internet per country
Source: Kemp (2020)

Figure 16 above illustrates that from the 42 countries across the globe, South Africa is one of the countries with the highest time spent on internet usage after the Philippines. Japan comes last from the countries above when it comes to the time spent on internet use.

The use of internet in South Africa as the platform for the provision of information is projected as indicated below.

Table 4: Projections of internet use in South Africa (2015–2025)

Year	**Percentage of internet usage as projected**
2025	62,3%
2024	61,4%
2023	60,3%
2022	59,1%
2021	57,8%
2020	56,3%
2019	54,7%
2018	52,9%
2017	50,9%

2016	48,9%
2015	47,0%

Source: Clement (2020)

Projections for internet usage in South Africa in 2025 will be at 63,3% which is 6% above the present penetration in 2020. The growth looks very meagre when looking at the importance of technology in this contemporary era, as development is mostly determined by the volume of information one possesses. The need to fast-track information accessibility through various technological platforms in both developed and developing countries is something that needs to occupy the first place on the development agenda.

2.11 THEORIES

The study on ICT adoption employed two theories namely Roger's Diffusion of Innovation [DoI] and Kurt Lewis Change Theories. These two theories have been found to be relevant to the study. The researcher chose these theories with the assumption that the adoption of technology in farming may effect some changes to the sector, thereby transforming some of the rural farmers from subsistence into the commercial sector of farming. However, the two theories cannot happen simultaneously. Instead, the DoI shall precede the Change theory, as the latter is the output and the former the input.

2.11.1 Roger's Diffusion of Innovation Theory

2.11.1.1 Origin of the Roger's Diffusion of Innovation Theory

The Diffusion of Innovation Theory, which originated in communication, was developed by E.M. Rogers in 1982. It is one of the oldest theories in the social sciences. It is considered to be among the many theories that have been used in various fields of research (Seeger & Wilson, 2019). The Diffusion of Innovation Theory has been used successfully in various fields like agriculture, health, social work, criminal justice, and marketing. Seeger and Wilson (2019) further assert that simple and easy-to-apply innovations are likely to be adopted.

"Adoption means that a person does something differently than what they had previously, i.e. purchase or use a new product, acquire and perform a new behaviour." (LaMorte, 2019) This research study finds the theory appropriate, as the intension of the research is to transform the

agriculture sector from a position of seeing mostly the rural farmers lagging behind in the sector. The key to adoption is for the person to see the idea and its outcome as new.

Innovation is defined by Smude and Courtight (2015) as "an idea, practice, or project that is perceived as new by an individual or other unit of adoption". In most cases, innovation is associated with something "new, uniqueness, value, benefits, and change". It also carries the notion of change for the better and innovation.

It is assumed that once ICT is adopted, changes on the part of the rural farmers could be realised. The rural farmers who were initially the reservoirs of the traditional farming methods will be transformed and become new and unique farmers. In so doing, the newly changed farmers will reap the benefits of transformation as well as getting the value of their initiative.

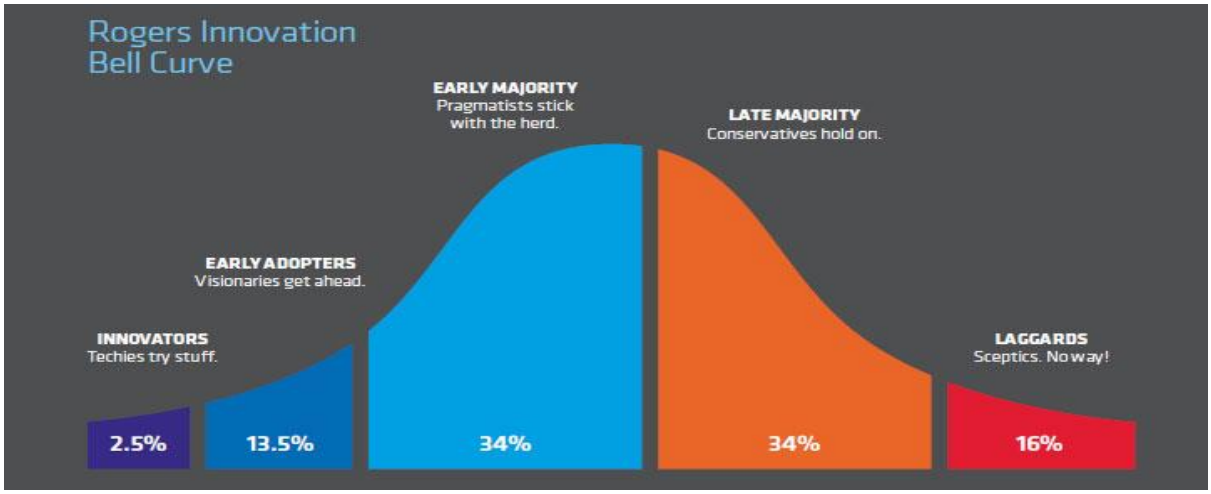


Figure 17: Five adoption categories
Source: LaMorte (2019)

The innovation adoption curve of Rogers is a model that classifies adopters of innovations into various categories, based on the idea that certain individuals are inevitably more open to adoption than others. The sum of late majority and laggards takes up to 50%, which represent an unacceptable amount of resistance to implement in high stakes.

The following table presents the different types of adopter and their characteristics:

Table 5: Types and characteristics of adopter

Types of adopters	Characteristics
Innovators	Brave people, pulling the change
Early adopters	Respectful people, opinion leaders, try out new ideas but carefully
Early majority	Thoughtful people, careful but accepting change more quickly than average
Late majority	Sceptic people who use ideas or products only when the majority is using it
Laggards	People, caring for "old ways", critical towards new ideas and will only accept it if the new idea has become mainstream or even tradition

Source: LaMorte (2019)

Apart from the types and characteristics of various adopters, there are five innovation qualities that depicted in the following figure:

2.11.1.2 User-Innovations qualities

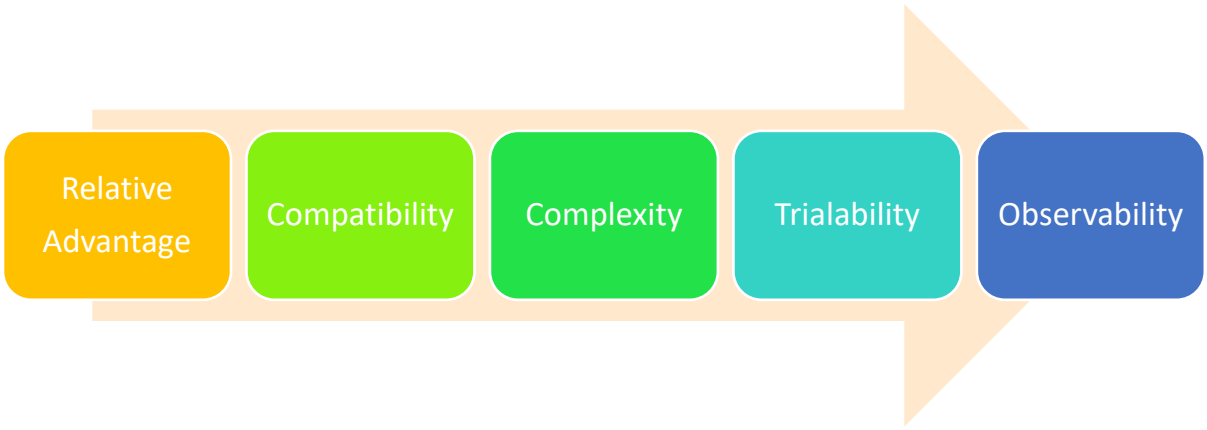


Figure 18: Five Perceived User- Innovation Qualities
Source: Seeger and Wilson (2019)

The above perceived user innovation qualities are sequential and they are some of the conditions that may lead to the acceptance or rejection of technology. They are briefly discussed as follows:

- **Relative advantage** refers to the user's perspective in relation to the benefits that the adoption may bring. The 'usefulness' of technology in the user's life has greater chances of being adopted and vice versa.
- **Compatibility** is the coexistence of technology and the user's social life. It is more conditional, as it determines the rate at which the adoption can be integrated in the

existing values, experiences and the needs of the user. There is a high likelihood for the adoption of technology to take place if the alluded needs are met.

- **Complexity** refers to the level of difficulty of technology. It is more on the 'user-friendliness' of the devices, which is also a determining factor of adoption. If the devices are friendly and easy to operate, chances of embracement are high and vice versa.
- **Trialability** is about the ability of the innovation to be tested before any commitment or investment happens. The user needs to be afforded an opportunity to put the innovation under trial before making any commitment to it.
- **Observability** is about the extent to which the spinoffs of the innovation are tangible to the user which determines the possibility of adoption.

2.11.1.3 Criticism and limitations of Diffusion of Innovation Theory

The Diffusion of Innovation Theory is not without criticisms, as discussed hereunder:

While optimism was encouraged to implement modern techniques of agriculture that primarily focuses on the increment of production with due consideration of obtaining good quality of the produce. Pessimists, on the other hand, state that it will take many years for developing communities to learn new practices (Petry et al., 2019). This statement has an element of undermining the intellects of the people in developing communities. The fact that developing communities use traditional methods of farming does not translate into them not changing to modern way of farming.

In the study conducted by McRoberts and Franke (2022) on the "diffusion model for the adoption of agricultural innovation …", the models currently used in agricultural extension research projects are heavily simplified. It is further asserted that the adoption of innovation in agricultural is slower than what has been predicted.

The pessimist ideology of sticking to the traditional methods of farming is advocated by Noda and Noda (2016), who suggests that primitive knowledge be maintained and modern methods be ignored. The same sentiments were widely echoed in the Alto Solimoes Region encouraging the Ribeirinho farmers to practise traditional farming without adopting the new techniques of farming.

It is further argued that the Diffusion of Innovation Theory works better in the adoption of behaviour, rather than the cessation of the behaviour. Most people in rural areas live in abject poverty and Limpopo Province is amongst them. The adoption of technology requires the availability and access of devices, something this theory pays less attention to. Recent studies on the embracement of technology has mentioned the high costs of technological resources as one barrier that hinder the adoption of technology on numerous occasions.

Apart from the Diffusion of Innovation Theory, which is considered to be the input for the adoption of technology, the Kurt Lewis Theory of Change will serve as the gauge to determine whether the process has succeeded or not. The Change Theory is considered to be the output of the adoption process, as it will be described in the following section of the chapter.

2.11.2 Kurt Lewis Theory of Change

2.11.2.1 Origin of the Kurt Lewis Theory

The Kurt Lewin's Theory of Change was developed in the 1940s. It is one of the oldest theories of organizational change, which is still considered relevant today. This theory is considered to be the cornerstone model for understanding change in various organizations.

The model is known by its three tiers of unfreeze – change – refreeze, as illustrated in the diagram below.

2.11.2.2 Stages of Change

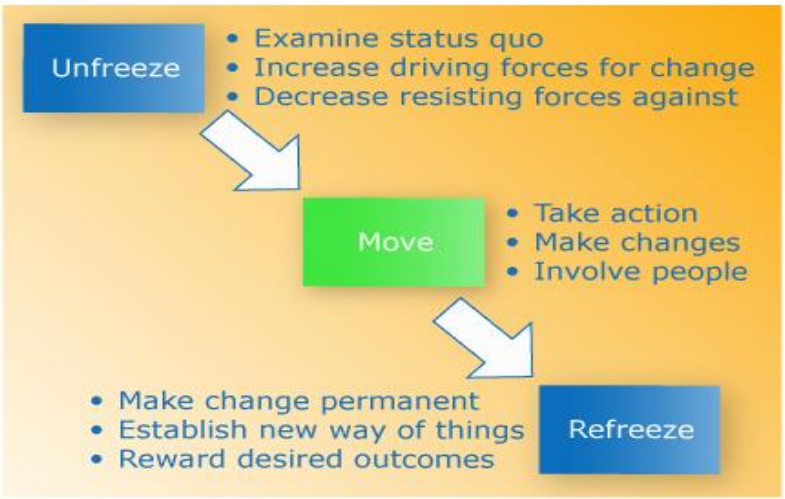


Figure 19: Stages of Kurt Lewin' Change Model

Source: Adapted from Hussain et al. (2018)

The Change Model is appropriate in the study as there is a need to transform the rural farmers who are still glued to the primitive methods of farming. The leadership of the farming cooperatives needs to conduct a situational analysis that shall be critical for preparing the process of introducing change in the sectors. Once the facts and preparations have been conducted, an action that needs a gradual pace follows and ultimately, the effected change is locked (refreeze). The process of effecting change should be treated as a gradual process that should take into account the different learning paces as well as behavioural patterns of the members involved.

2.11.2.3 Action-Oriented process of Change

Change is a process that requires numerous actions, as illustrated hereunder:

Figure 20: Action-Oriented process of Change
Source: Morrison (2014)

Cooperatives are also organizations that should be transformed; hence, change is necessary. The Kurt Lewin's Change Model has been widely defended by numerous studies citing its simplicity and being easy to understand, even by people with low educational levels. The theory aims to change behaviour, especially where resistance to change can emerge. It is cited as one of the theories that are built on a lot of rationale and sense. Besides the enumerated advantages that come with the Change Theory, some argue that the theory is not detailed

enough, as there are some gaps that need to be filled when applying the theory. Its rationale seems rigid and shows no reflection of modern times. Airion and Crolley (2020) further state that the theory is more combative rather than nurturing,

2.12 Behavioural changes approach

Changing farmers' behaviour towards ICT adoption is a process that Malcolm and Godwyll (2010) unpack in five stages, namely knowledge, persuasion, decision, implementation, and confirmation. This process is illustrated by means of the following diagram:

Figure 21: A Model of the Rogers Five Stages in the Innovation-Decision Process
Source: Malcolm and Godwyll (2010)

The above innovation-decision process of Malcolm and Godwyll (2010) will be unpacked hereunder:

2.12.1 Knowledge

The innovation-decision process begins with the Knowledge Stage. One cannot begin the adoption process without knowing about the innovation. In this stage, a person first becomes aware of the technology. Perhaps he sees someone use the technology in real life. He may also see said technology advertised on television or read about it in a magazine or on the internet. A peer or mentor may inform him about it as well.

2.12.2 Persuasion

A person moves to the next stage, the Persuasion Stage, when he/she moves beyond simple awareness of the technology. It is the stage characterised by the influence from those in leadership. A person begins to show interest in the technology and seeks out information about the technology: costs, features, user reviews, etc. It is at this point that the person begins to consider him/herself as a potential user of the technology and begins to actively consider whether or not to adopt the technology into her regular activities.

Persuasion towards the adoption of technology requires effective leadership that will be at the forefront of cooperatives to strife for change as illustrated in the following diagram:

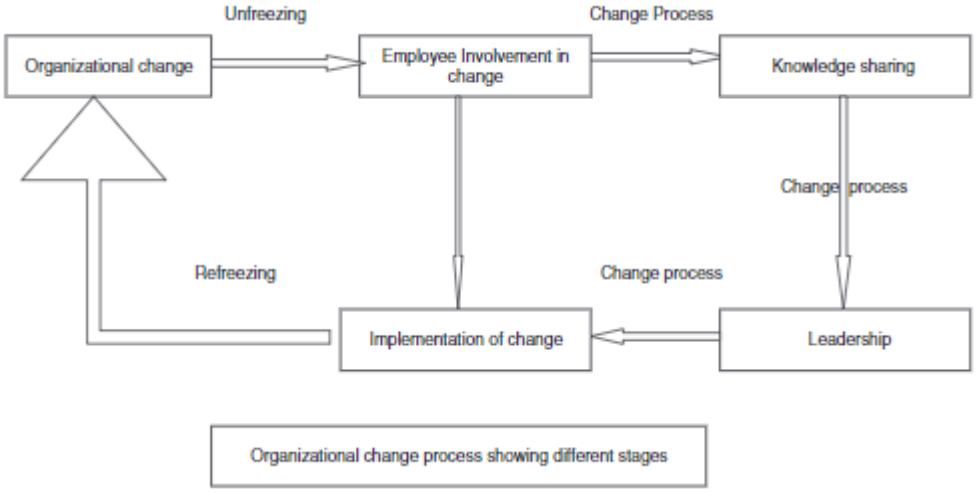


Figure 22: Kurt Lewin's Model of organisational change
Source: Adapted from Hussain et al. (2018)

2.12.3 Decision

At the decision stage, a person makes the choice to reject or adopt the technology. This personal process involves the weighing of advantages, disadvantages, costs, benefits, and trade-offs. The decision to not adopt – rejection – is an active choice not to acquire the technology or ever use it. Otherwise, the person begins to use and integrate the technology into his daily life.

Although this stage is perhaps one of the most critical for understanding technology adoption, it is perhaps one of the most difficult to study. Roger's theory asserts that the process of deciding occurs silently and invisibly to the outside researcher; one can rarely capture the exact

moment of decision. Instead, the researcher can only access the adopter's reflections and retrospectives of the decision to adopt or not, sometimes months or years later. Such data are, of course, fraught with validity concerns.

2.12.4 Implementation

The task of integrating the innovation into regular use is called the Implementation Stage. This can be a slow, time-consuming process. For the person involved, changes to her usual habits and practices may be necessary. The technology is also being evaluated at this time to see if it meets expectations.

During this stage, reinvention may occur. Reinvention refers to the process by which a person adapts or modifies a technology to meet his needs better and improve its overall compatibility.

2.12.5 Confirmation

Once the processes of integration and reinvention have completed, the final stage, the Confirmation Stage, has been reached. At this point, the person finalises his decision regarding the adoption of the technology. One option is exactly that – adoption. At this point, the person is committed to using the technology to its fullest potential it can serve in his life.

According to Fregene (2008), decision-making is a process comprising a sequence of stages with a distinct type of activity occurring during each stage. The adoption process, as a decision-making process, goes through a number of mental stages before making a final decision to adopt an innovation. A diffusion of innovation within a social system takes place through its adoption by individual or groups. Adoption is a decision to make full use of an innovation as the best course of action available. The decision to adopt an innovation involves a process composed of learning, deciding, and acting over a period of time. It is basically a mental process. The way in which an individual adopts an innovation involves the following five sequential stages (Petry, Sebastião & Martins, 2019): **Awareness** stage, **Interest** stage, **Evaluation** stage, **Trial** stage and **Adoption** stage (**AIETA)**.

2.12.5.1 Awareness Stage

This is the starting stage where the farmer comes to know the existence of the new idea, but he does not have full information about the idea.

2.12.5.2 Interest Stage

The farmer develops an interest in the innovation and seeks additional information about it, either from extension officer or from fellow farmer or from any source, which he feels is credible. That means the farmer acquires more information about an innovation or idea by wanting to know what the innovation/idea is, how it works and what its potentialities are.

2.12.5.3 Evaluation Stage

At the evaluation stage, the end-user makes a mental application of the new idea in the present and anticipated future situations and decides whether or not to try it. He judges the utility of the innovation, makes an assessment whether the idea is applicable to his own situation and, if applied, what the result would be.

2.12.5.4 Trial Stage

Farmers may not take up any new idea and an innovation right away on a large scale, because he/she does not want to take risk, even though the potential of the idea has been proven. The new idea is applied on a small scale in order to determine its utility or feasibility and applicability in own situation.

2.12.5.5 Adoption Stage

Being satisfied with the performance of the new idea tested on a small scale in his own situation, the farmer uses the new idea continuously on a full scale. Trial may be considered as the practical evaluation of an innovation. It provides the advantage of the innovation and hence the farmer takes a final decision and applies the innovation in a scale appropriate to his own situation on a continued basis.

2.13 CRITICAL SUCCESS FACTORS FOR ICT ADOPTION

2.13.1 Government policies

The success of farming in certain countries like the Kingdom of Saudi Arabia has been realised due to the support from government. The country has eased its policies by providing land for free, low interest rates on loans, and efficient farming extension services. However, the

Kingdom of Saudi Arabia has policies on agricultural produce, which include the disallowance of wheat export.

The country has adopted initiatives that are meant to develop and promote farming from traditional practices to modern agriculture. Evidence to this initiatives is the establishment of rural roads and irrigation networks, as well as export facilities.

The government further introduced policies that aim to support farming by way of low-cost water, fuel and electricity. The support of the government by means of several policies is strongly echoed by Xaba and Urban (2016). However, it becomes futile if policies remain documented without effective implementation. If the many government policies in developing countries, including South Africa, were implemented effectively and efficiently, a significant amount of growth and development could have been registered. More action on these government policies is therefore sine qua non for enterprise development.

Audu (2017) asserts that governments should consider recognising the importance of the use of technology in rural development as well making it cheaper for the poor to access information uploaded on technological platforms like internet. The farming information should be quality assured and be tailor-made for the end-users. Furthermore, governments across the globe, especially those in developing countries, should ascertain that policies are crafted to improve rural communities.

Policies should continuously be revised to make ICT affordable, be within reach and simple to use by the rural small farmers, including cooperatives. There should be seminars and workshops looking at educating the major stakeholders on how to make use of the devices.

There is an urgent need to accelerate the share of educational and farming information to the users. This can be possible through the setting of the strong very small aperture terminals [V-SATs]. This is possible through cooperation, collaboration and, most importantly, harmonized efforts, including mobilising resources, from stakeholders.

2.13.2 Strengthening the agricultural extension systems

Farming requires support not only from the government, but also from certain support systems. The Kingdom of Saudi Arabia has assigned extension officers to ascertain that farmers are sustainable. The farming extension agents in Saudi Arabia have been tasked to practise

sustainable farming for the realisation of reasonable farming produce. They are further assigned to advocate the conservation methods towards the natural resources, especially water, as the country is a desert and commodities like water become a serious challenge. Extension officers are tasked to ascertain that farming communities are provided with up-to-date information on the available markets for selling farming commodities.

Although the scope of the extension agents has increased, this has changed the perceptions of these agents to the better, as revealed by the study conducted by Al-Subaiee, Yonder and Thomson (2005).

Most projects apportion their success to training as one of the critical pillars. In Saudi Arabia, the success of agriculture is embedded in a variety of technical skills, which make training vital. The country achieved its farming success through transforming farming from traditional to modern, which required an immense modification of the sector. Modification is a skill that cannot happen without undergoing rigorous training and capacity building. For effective and efficient technology skills transfer, the institution has to undergo a transformational route as well. The country introduced scientific farming programmes, which should be acquired through training.

Holmner, Britz and Ponelis (2010) contend that many countries achieved the status of knowledge societies because they have invested heavily in human capacity. They argue that many countries on the African continent, the 'last mile' to the information and knowledge society, has the potential to become the 'lost mile', due to the limited human capacity. The investment in ICT infrastructure, as it happens in many countries, should be aggressive in South Africa when it comes to human capacity. In so doing the country will reap the fruits of the investment.

2.13.3 The role of universities (institutions of higher learning)

Many countries across the globe have partnered with institutions of higher learning for development. Unfortunately, this is less conspicuous in South Africa. Those that contribute to farming like the University of Free State [UFS], provide free short courses in animal husbandry and financial management skills. Although the UFS has no ICT specific programme to develop the local farmers, there are other programmes wherein IC is included.

The researcher will give a brief reflection on the contributions of the two universities where this study project is taking place, namely the University of Limpopo (UL) and University of Venda [UniVen].

The University of Limpopo, Turfloop Campus, has a Faculty of Agriculture and Science comprising four centres, namely the Centre for Rural Community Empowerment [CRCE], Limpopo Agricultural Technology Station [LATS], Rural Development Innovation Hub [RDIH], and the Green Technology Centre [GTC]. All these centres operate differently and they assist communities upon request. For example, the CRCE mainly focuses on three areas, namely research, training and networking. The research component mainly provides support to students who pursue their studies in an agricultural-related field. The university provides training to the farmers on various aspects like animal and plant production, as it has recently done in the Vhembe District of Limpopo Province. Furthermore, the institution assists the farmers with networking and creating linkages with other stakeholders and some local municipalities like the Molemole, Maruleng and Lepelle-Nkumpi Municipalities.

The type of support given to both students and farming communities can be summarised as in the figure below:

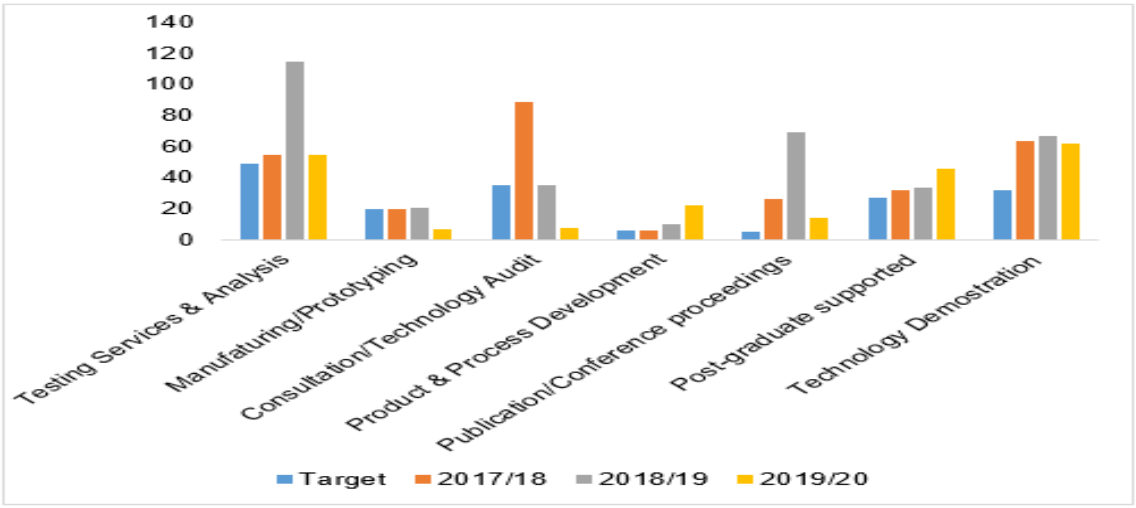


Figure 23: Summary of the University of Limpopo Support
Source: 2017/18 -2019/20 Annual University Reports (AUR)

The above Annual University reports of the UL show that the product and process development have been the least in terms of contribution, compared to the other sectors like testing services

and analysis, with manufacturing and prototyping as the second from the bottom. There has been moderate support across the three financial years in technology demonstration with uneven contributions in areas like a consultation/technology audit and postgraduate support.

The Limpopo Agro-Food Technology Station [LATS] assists farmers in the analysis of food like milk, Swiss chard, *Cleome gynandra*, *Cucumis myriocarpus*, juice, instant powder and mango achaar. The university also helps local farmers with soil testing and make recommendations regarding the type of plants suitable for the soil. The institution receives or goes out and takes soil samples, especially if the field is within the reachable distance of less than a 200-km radius.

Another institution that supports the local farmers in Limpopo Province is the University of Venda [UniVen]. This university and the UL are the only ones found in Limpopo Province. UniVen has numerous programmes designed to enhance farming. However, the institution provides its support mostly to farmers in the Vhembe District. Perhaps the reason for supporting the local communities may be apportioned to proximity. The institution has, among others, on farm research and development on pigeon pea to improve soil fertility, animal feed supply during dry seasons and human nutrition. Various training programmes are provided to the local farmers upon request, which include the development of agricultural cooperatives as well as irrigation farming. There is special advice in the development of the Nwanedi Agrihub. The university also assists the communal property associations [CPA] with developing the strategic plans and to become more cohesive. Lastly, the institution works jointly with the Agriculture Forum to produce an Agriculture Development Strategy for Vhembe District. There are other supports provided on request.

From the above support provided by the three institutions discussed briefly above, it becomes apparent that the initiatives are available to assist the local farmers. However, there is still more to be done, especially in the area of ICT. The above discussion reflects that little is done to introduce the local farmers to ICT as one of the critical components for successful farming in the 21st century. The other factor that needs urgent attention is making the local communities aware of what these institutions can offer to them. Farmers, especially those in rural areas where there are challenges of communication, need to be reached through other media platforms like the radio.

The question that comes to one's mind is why the University of Venda focuses specifically on the Vhembe District, while the province has four more districts. The University of Limpopo, on the one hand, regards the province as a whole, as evidenced by providing support to other districts like Capricorn, Vhembe and Mopani.

The researcher's conviction is that if the solutions derived from many researches were implemented, South Africa could not be where it is today. The partnership between government and universities is wanting; yet these institutions have solutions for the many problems the country encounters daily. Unlike other countries that underutilise these institutions of higher learning, Saudi Arabia taps its development from the King Saudi University [KSU]. The university is very instrumental in agricultural development, with an exclusive Department for Agricultural Extension. There are programmes for agricultural development that encapsulate the provision of modern agricultural knowledge, as well as the upgrading of the communication skills of the extension agents. Further mandate from the government to the KSU is to equip the farming communities with technological skills and knowledge, ascertaining sustainable agricultural practices (Al-Subaiee et al., 2005).

Many countries across the globe, including those in Africa, are called to consider playing an active role in agriculture. It should be noted that universities produce volumes of information on a daily basis that can be useful for agricultural development. These institutions have quality information and knowledge that can be critical for broader economy growth and competitiveness.

Universities are better placed to embrace traditional farming knowledge as the indigenous knowledge systems is gaining momentum. The consideration of the experiences and knowledge possessed by the rural farmers, if embraced through modern platforms, can strengthen the sector as well as encourage traditional farmers to embrace ICT.

Universities or institutions of higher learning have the capacity to generate and transfer knowledge as well as skills that are necessary to develop and support knowledge-based economy. Lately, universities have become central areas in government policy development.

> Repositioning African universities with emphasis on research, development and technology transfer requires an institutionalized IPR and technology transfer strategic policies and institutional support structures (Payumo, Lemgo & Maredia, 2017).

Africa has already registered progress pertaining to the use of universities as strategic government partners to strengthen the agriculture sector. For example, Ghana is one of the countries in Africa that is already addressing the United Nation's Millennium Development Goals [UNMDG] (Payumo et al. 2017) focusing primarily on the first goal of eradicating poverty by improving the agriculture sector.

2.13.4 Education

Oladele (2015) asserts that higher levels of education has a positive impact on access to information, especially the extension officers, who are required to provide daily farming information. Furthermore, the need for the extension offers to upgrade their qualifications is deemed necessary, as this will alleviate the information deficiencies experienced by most rural farmers and it will accelerate modern information flow. However, Seroka (2017), in his position paper on causal factors for ICT adoption in Limpopo Province schools, argues that the time for teachers to be seen as the sole reservoirs of information should be discouraged. For extension officers to be the only informants, will undoubtedly cause farmers, especially those in poor rural communities, to become too dependent. Information should not reside with a few individuals only, as this can exacerbate the existing gap of the haves and the have nots.

In the study conducted by Jose and Lokeswari (2018) on the users and non-users of ICT in farming communities, it was found that education, farmers' perception and poverty dominate the factors that affect the use of technology among the farmers. Oladele (2015), in the 'effect of information and communication technology on agricultural education', has been found to be among the determiners of ICT adoption.

2.13.5 Hedonic and utilitarian systems

The adoption of ICT, according to Jere and Maharaj (2017), is premised on two systems, namely hedonic and utilitarian systems. The two systems have been identified as critical for ICT adoption. The hedonic systems suggest that use is the predominant variable determining the embracing of technology. On the other hand, the utilitarian systems consider usefulness of technology as the determining variable for adoption. However, it is argued that ease of use is considered to be the most important variable when it comes to ICT adoption. In order words, devices should be simple and easy to operate as usefulness can be realised afterwards. Illiteracy

in most rural developing countries is high and making the devices easy to operate can eliminate the so called “technophobia”, fear of technology amongst them. It is undoubtedly true and rational that ease of use should be considered first before the usefulness of technology.

Another component that has been added to the two systems is culture. Culture has been identified by Jere and Maharaj (2017) as an independent variable not to be overlooked, as it is also one of the significant predictors of technology adoption as well as diffusion among the small farmers. The two define culture as follows:

> culture refers to the collective mental programming that these people have in common, the programming that is different from other groups’ culture being a conditioning of behaviours of a group to be similar with one another but can be differentiated from other groups.

Culture has been found to be one of the primary deciders of ICT adoption including the cultural aspects that are available in the social system.

They have further developed a model that illustrate ease of use, usefulness and culture as the core components for ICT adoption, as depicted in the diagram below:

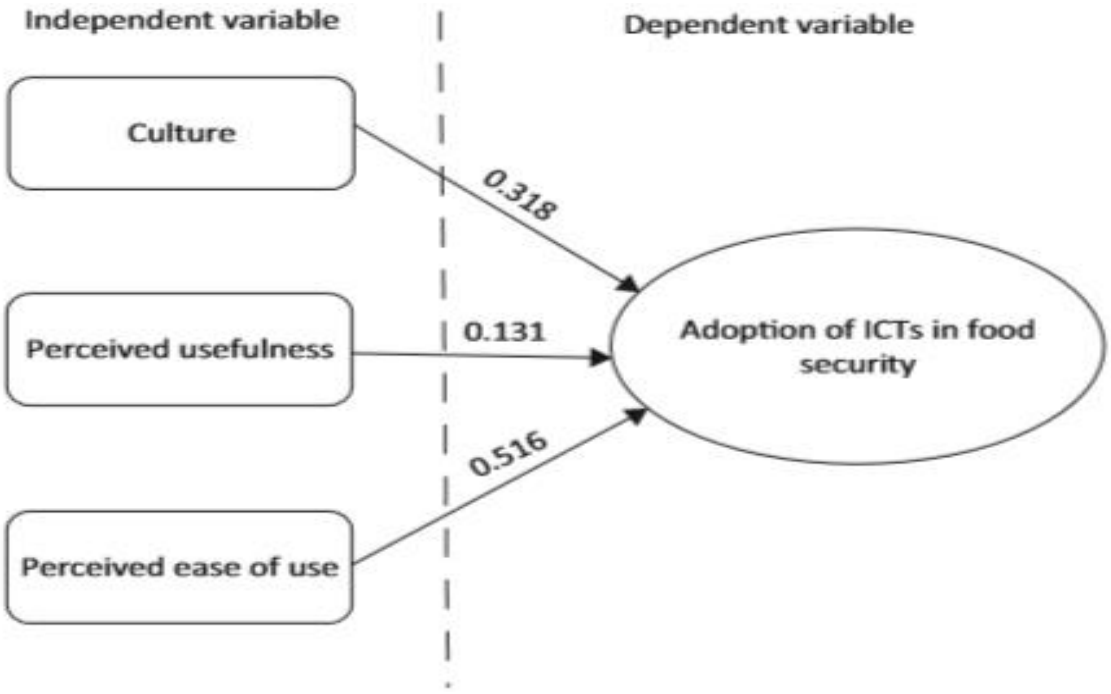


Figure 24: Dependent and independent variables of ICT adoption
Source: Adapted from Jere and Maharaj (2017)

Figure 18 shows that the perceived ease of use has the highest influence (0.516) when it comes to ICT adoption in food security. It is followed by culture with a mean of 0.318, and the least influence is the perceived usefulness at 0.131. What is noticeable in this model is that culture should not be underestimated when it comes to ICT adoption, given its mean influence in the above model. However, some argue that the broad nature of technology makes it somewhat problematic when it comes to embracement and diffusion variables.

2.13.6 Computer self-efficacy

Self-efficacy is defined as a belief in one's own abilities to perform an action or activity necessary to achieve a goal or task (Buabeng-Andoh, 2012). Simply put, self-efficacy is the confidence that an individual has in his/her ability to do the things that he/she strives to do. The amount of self-confidence in the use of computer is a condition for the teacher to start integrating ICT in the farming fraternity. If the confidence is low, the usage will be low and vice versa. Currently, it is still unknown regarding the amount of computer knowledge and skills late majority and laggards possess. However, it is assumed that they possess low levels of confidence which may sometimes not be true.

Lack of confidence is sometimes seen as a contextual factor towards ICT integration. "Fear of failure" may also be a contributory factor to the farmers' lack of confidence and this may add to the late majority and laggards groups (Beggs, 2017).

2.13.7 Effective demonstration of ICT in farming

The effectiveness of technology in farming is widely acknowledged. The need to make the efficient flow of communication and information becomes crucial for the benefits of technology to be realised.

One other factor that hinders the adoption of technology is the need to demonstrate the impact of ICT in farming, especially among the rural community, something that has not been conducted adequately. This is another critical area that is overlooked and unfortunately it impacts significantly on ICT embracement.

Demonstration of the role of technology in farming can further show the effectiveness of the platforms. The effectiveness of ICT in farming productivity has been attended to less, as most farming information is still obtained from the extension officers as the sole provider of farming

informing. For example, many rural farming communities in Limpopo Province wait for the extension officer to make a formal pronouncement when to start preparing the soil. They rely on the extension services to share information regarding the climate condition and how that particular year will affect farming, as in the case of the Dikgolo Farming Cooperative in Limpopo Province.

In the study conducted by Csótó (2010) on the dynamics of using ICT for farming, the argument of effective use of technology in farming is raised. The study acknowledges that many countries across the globe, including developing countries, have begun to integrate ICT in many programmes; however, its effectiveness in terms of use is still not visible, especially in farming.

The effectiveness of ICT usage will be much realised as one of the ingredients of the decision making process. The effective use of ICT can be realised through critical thinking. Otherwise the desired results are unlikely to be achieved. In the ICT adoption model developed by CSótó (2010), emphasis for effective use of technology is on the assessment of the needed information prior for its usage; what the information is aimed to achieve; indicating trust among the implementers and, most importantly, the economic advantage of the information.

2.13.8 Pluralism

Pluralism is defined by Sajesh, Padaria and Sadamate (2018) as the existence of a variety of agencies, service providers, models and institutional arrangements, which may be either public, private, community based or non-governmental organisations [NGOs], to support the farming sector.

This type of system has now been practised in many countries worldwide. In South Africa, pluralism also takes place in various sectors of the economy and agriculture. Many agricultural service providers are available to provide services like training of farmers on numerous business skills. Most of them are private, NGOs as well as those from government. The unfortunate part of this practice is that there is no synergy and coordination amongst them. Sometimes they provide similar services and compete amongst themselves. The need to complement one another is critical for the growth and learning from one another. This is one of the setbacks as government money is spent for duplication of services.

Pluralistic services have been found to be very beneficial by almost all governments for the same reason alluded to above and also to make a contribution in the economic mainstream. However, this practice is not without flaws, as detected by Sajesh et al. (2018) and listed hereunder:

- Lack of coordination and synergy among agencies
- Unhealthy competition amongst the agencies
- Duplication of services provided

For government extension agents, pluralism can be a serious element demoralising the extension agents or officers. The agents may view the service as those attacking their skills and knowledge, which may culminate in an exodus of government agents to start their own private practices or consultants.

2.13.9 Andragogy

Andragogy is the art and science of helping adult learners (Holt, 1995). In Greek, *andragogy* Greek means the man leading, compared to *pedagogy*, which in Greek means child-leading. The term *andragogy* could be equivalent to the term *pedagogy*. However, it should be noticed that the term *pedagogy* has been used since Ancient Greek times, while Alexander Kapp, a German educator, originally used the term *andragogy* in 1833 (Knowles, 1984).

The researcher adapted andragogy to be suitable in this study because most farmers are adults who should have a say in their own development. The concept is derived from the education profession where the teaching of adults differs from the teaching of children (pedagogy). The researcher found this concept suitable for the study, as the extension officers should implement methods that are in line with adult learners, especially when conducting training workshops for farmers.

The methods of andragogy suggest that adult farmers' needs and experiences be infused in the training programmes. Consideration should also involve ascertaining that the training outcomes are meant to solve the farmers' challenges, otherwise the adoption levels will be futile and remain in the laggard stage.

Andragogy comprises various forms of trainings like in-service and on-the-job training. The two concepts have some commonalities, but the difference is where they happen. The former

happens outside the employment premises and led by an outsider, while the latter is an internal process.

Timsal, Awais and Shoaib (2016) define training as the "planned intervention that is designed to enhance the determinants of individual job performance". Training has the benefit of reducing frustration and anxiety that are in most cases created by the volume of work the employees face. Timsal et al. (2016) state that training, if correctly conducted, enables employees to handle a workload effectively, because training is considered a tool meant to strengthen individual skills, knowledge and abilities. It further affords the person engaged to have a good understanding of the business. In the study conducted by Marais and Botes (2006), business training is one of the key components needed to ensure a greater degree of efficiency and productivity. Training should not only focus on the technical skills, but a balance should be maintained between business skills as well.

Amadi (2013) defines in-service training as a workshop for employees, including professionals, paraprofessionals, and practitioners. The purpose of in-service training is to afford these employees the acquisition of new knowledge as well as new methods that are meant to improve their skills needed for proficiency in the workplace.

In the study conducted by Amadi (2013) on the professional development of teachers in Nigeria, the in-service training provides skills and knowledge for personal development. The study highlights the benefits of in-service training as that of acquiring innovative methods that can be implemented in the classroom.

Timsal et al. (2016) define on-the-job training [OJT] as training given to paid employees while in full production. The training focuses on the provision of knowledge and skills essential for adequate job performance. The OJT is premised on four criteria, namely reaction, learning, behaviour and result. Reaction is primarily concerned with the feeling as well as the assumptions the trainees attach to the training programme. Learning is about the acquired skills and knowledge critical for employees' effective performance of the work. Behaviour refers to the employees' ability to apply the acquired knowledge practically. Lastly, results are considered to be the various factors that are more on productivity like costs reductions as well as the achievement of the expected targets.

The following section of the study will provide detailed discussion of the behavioural changes approach that is also a critical component of ICT adoption if farming. The section will provide the stages of the innovation-decision as key concepts of behavioural change.

2.13.10. Leadership styles

It is defined as the manner of and approach of providing direction, implementing plans and motivating people (Howell & Costley, 2001). Leadership is a relational process; one leads because there are followers. No followers, no leadership. The primary styles of leadership are:

- **Authoritarian or autocratic leadership style:** It is the style of leadership characterised by instruction with no opinions from the followers. For example, a leader using this type of style will always say: " I want both of you to …" (Howell & Costley, 2001).
- **Participatory or democratic leadership style:** Although the leader still takes charge of the organisation, here the leader ascertain that everyone is included in the game with due consideration of the team's inputs. It is one type of leadership style characterised by "let's work together rather than working in silos" (Howell & Costley, 2001).
- **Delegative or laissez-faire** (free rein): In this type of leadership style, the leader is not in control of the organisation; instead, most decisions are taken by everyone in the team. There is high shirking of responsibilities, especially when wrong decisions have been taken (Howell & Costley, 2001).

2.14 CHALLENGES OF ICT ADOPTION

The adoption of ICT is not immune from challenges. Mainly these challenges are two-fold namely, extrinsic and intrinsic challenges as discussed in the following section of the study:

2.14.1 Extrinsic factors

These are the factors that are external or outside the agent's control; however, they have an effect on him or her. In this article, extrinsic factors will be those factors that the farmer's non-adoption of ICT is a result of the outside factors other than himself or herself. The farmer has no control over the situation; however, the consequences impact negatively on the farmer.

2.14.1.1 Gender

One of the factors facing the low adoption of technology is the disparities between women and men. In the study conducted by Oladele (2015), it is revealed that in South Africa, about 76% of extension agents are men and only 24% are women. The findings are also supported by Aboh (2008) in a study conducted in Imo State.

Gender is among the factors impeding technology adoption. The 'usefulness and ease of use' have been documented in numerous studies as factors that determine the ICT adoption between men and women (Frempong, Paul & Fusein, 2013). They argue that the technology acceptance model [TAM] have been found in many studies for men to have seen the benefits of technology; hence more of them are technology users. On the other hand, women are found to be not 'user friendly', as shown by low levels of usage among most women. In other cultures like the Indian culture, almost 50% of the women do not use technology because of cultural practices (Frempong et al., 2013).

2.14.1.2 Age

Age is another factor that compromises the adoption of ICT among the aged. The coining of the 'born before technology' abbreviated as **BBT** concept by many people from rural countries, including South Africa, emanates from age as a factor. These people use age as reason not to adopt technology and it has an influence as well as a negative attitude on ICT adoption. Older people are said to be conservative when it comes to technology adoption. Agriculture, especially in developing countries, is mostly dominated by older people and this might be the reason why the sector has low adoption of technology.

Age as another contributory factor towards the slow adoption of ICT is evidenced by the findings of the study conducted by Oladele (2015), which reveals that the majority of the extension officers are middle aged. This can have some implications for ICT usage, as the elderly show less interest is integrating hi-tech communication devices. Instead, they prefer oral to printed information channels. Unlike elderly extension officers, the youth prefer higher level of ICT usage. The two disparities can create unhealthy working relations and competition between the two ages, which may compromise the access of information to the sector.

2.14.1.3 Cost of data and airtime

Numerous challenges face digital adoption and one is the high cost of data and airtime which is primary for information accessibility. South Africa has about 98% network coverage, which is the reason that more people have resorted to the use of mobile phones as to the landlines. The penetration of mobile phones has increased tremendously, to the detriment of landlines in South Africa. The use of mobile phones go with data and airtime, which have become exorbitant for most rural people in developing countries, including the farmers. Most rural people use the '**please call me**' option of the mobile phone services. Unfortunately this not meant not provide information, but to seek the attention of another person with airtime to call back. The recent culture of the mobile phones customers jumping from one network service to the other is in most cases associated with the users comparing data and airtime costs. The competition among mobile network providers with seasonal promotions is a result of seeing clientele decrease Csótó (2010).

Information according to Csótó (2010) has an important role to play in the modern era and agriculture is not immune. Gaining, processing, using and evaluation of information are critical for farming success. According to Csótó (2010), information can be obtained from three sources or channels:

- **Personal network.** This is the information that is obtained from people and nowhere else. For example, it can be information shared face-to-face by a person in a workshop or at gatherings.
- **Printed media**. Printed media information is found on paper like newspapers, magazines, journal articles, flyers and noticeboards. It is information that in strictly found in printed sources.
- **Electronic media-advanced source of information**. This the information is found in sources like internet, radio, television and tapes.

From the three channels of information, personal network seems to be the source of most information that many rural farming communities rely on, compared to the other two channels. It is argued that relying on one mode of information may not be adequate, especially in cases of emergency. Limpopo is one of the predominantly rural and vast provinces of South Africa and relying on one source of information for farming is not feasible. It is therefore

recommended that the three channels be combined frequently, as this will undoubtedly augment one another, as one source may not be enough.

2.14.2 INTRINSIC FACTORS

According to Thompson (2014), *intrinsic* means *internal* or *inside*. Within the context of this study, intrinsic factors will refer to all factors the farmer has control over. Some of these factors are as a result of perceptions and attitude of the farmers themselves.

The integration of ICT to enhance quality farming is unavoidable (United Sates Agency for International Development [USAID], 2010). The traditional way of farming is gradually fading away with the modern technologies of farming gaining momentum through the rapid spread of information networks accessed by digital platforms like mobile phones, radio and television. Drones and robotics are some of the newly introduced technologies that are beginning to be used in numerous programmes, farming included. For example, the introduction of **Faromatics** in Spain is one such example of the most recent technologies in robots used by chicken farmers to monitor their flocks. This device, commonly known as the **ChickenBoy**, is armed by many cameras and sensors zooming around the chicken area. It obtains data on air quality, temperature and humidity, including how the chicken house operates. Furthermore, the device can detect dead animals and conduct analysis regarding the cause of death, thereby focusing on the faeces and any other intestinal diseases. In so doing, farmers are able to get better information and save costs, while providing optimal conditions for the livestock. The use or non-use of ICT is no longer an issue; the focus of technology should be on the end-user, how it is being used, and its purpose.

2.14.2.1 Technicism versus the Luddism philosophies

The adoption of technology in many spheres of life, including farming, is clouded by a myriad of challenges. Because people's life experiences are different, with different philosophies, or attitudes towards technologies, emerged within the same culture and cross different cultures. The group that describes itself as Technicist, are the technology adopters, thinking that technology makes them smarter and that it is panacea to all their problems and needs (Simons, 2015). Auerback (2015) states that the Luddists, those against technology, feel that it makes them incapable and it is of supreme danger to mankind, because it prevents them from having

a good understanding of our fundamental nature and of themselves. This group further is convinced that technology is meant to render people unemployed (Pettinger, 2017). Although the move to oppose the adoption of technology by this group more than a century ago was initially violent, I personally think that the group advocated human independence. The power of Luddinism may be silent, but visible in Roger's theory regarding the laggards. Some non-adopters of technology believe that they have the requisite knowledge and experience to be self-reliant.

The above philosophies have an influence on farmers' perception and attitude. The farmer will either view the adoption of technology positively (Technicism) or follow the Luddist philosophy. The two also have an effect on Rogers' theory to be employed in this study.

2.14.2.2 Perceptions

They further express that the adoption of technology also depends on the end-user's value attachment, which brings perception as another factor that drives the process of adoption. The farmers' perceptions of ICT may be viewed as a way of replacing their hard-earned farming skills and knowledge. In the study by Seroka (2017) on the causal factors of ICT adoption in schools of Limpopo Province, it was found that most teachers do not embrace technology in their daily teaching and learning, as they perceive ICT as a strategic way of replacing them. The same perception of the teachers can be associated with the low levels of farmers' adoption of technology for the same reasons raised by some teachers. Some rural farmers still hold the view that farming should remain a hard labour sector and the introduction of new farming devices like drones and smart cameras for collecting farming data is a way of making their traditional methods redundant. There are pockets of rural farmers who consider technology as 'witchcraft', which proves the limited amount of information these farmers have on the subject.

2.14.2.3 Attitude

Dhehibi et al. (2020) argue that not all farmers are able to adopt new technologies. They further state that the farmers' willingness has bearing when it comes to the adoption of technology. This statement brings an element of the end-user's attitude towards ICT adoption. This is another crucial component that cannot be overlooked, as it is congruent with Rogers' diffusion theory used in this study.

Attitude can be one factor that determines whether the adopter becomes an early or even late adopter of ICT. The farmer's poor socioeconomic conditions like illiteracy and poverty cannot be ruled as the only reason for unwillingness to adopt technology.

The findings of a study conducted by Anyan and Frempong (2018) state that the attitude represents the mental and neutral state of readiness, organised through experience. They further argue that attitude has an influence on the individual's response to all situations and objects. It is therefore important not to underestimate the powers that attitude has on ICT adoption. Positive attitude is an important ingredient requirement for ICT use and success of farmers, especially the rural cooperatives.

The provision of ICT infrastructure and connectivity are fruitless without considering the attitude of the extension officers. For example, a paper by Seroka (2017) on ICT adoption in schools in the Limpopo Province indicates that many schools have been provided with technological devices for teachers to integrate in their daily teaching; however, these material are still unopened in their boxes. The teachers' attitude towards ICT integration was found to be the main cause for underutilisation of the devices. Even in the case of farming, a positive attitude should be inculcated strongly among the extension officers and the end-users alike. Undoubtedly, the need to develop the users' competence is core for the successful adoption of technology.

2.14.2.4 Illiteracy

Illiteracy has been well documented by many studies as among the many hindrances of ICT adoption. Many people in developing countries, especially those in rural areas, are illiterate. This is one critical component that is considered a drawback regarding technology adoption. Modern agricultural practices have information that is mostly found in various technological platforms of like mobile phones, TVs, radios and other media resources. It therefore requires of the farmer to have the necessary literacy skills to apply the information. For example, the Limpopo Department of Economic Development, Environment and Tourism [LEDET], through its subsidiary, Limpopo Connexions, developed the **Mashemong** farming platform to provide local farmers with information on various aspects like available markets, production prices, methods of ploughing, climate matters, etc. The effectiveness of this important platform depends on the literacy levels of the end-users.

Illiteracy as a barrier towards ICT adoption has been well documented in many studies. However, this challenge continues unabated, as no academic efforts are made to ameliorate the situation, apart from the many government laws, which include education as a development pillar as in South Africa.

Besides illiteracy as a challenge for the adoption of technology in farming, language is another factor that should not be underestimated. The two seem to be similar, but they are different.

2.14.2.5 Language barrier

Many rural farmers, especially those in developing countries, are unable to comprehend the digital language that is more technical to follow. Digital language is more foreign, (mostly English) to rural people who mostly speak languages like Sotho, isiXhosa, and isiZulu. The study took place in Limpopo Province that is dominated by the Sepedi, Xitsonga and Tshivenda-speaking people. The challenge of the digital language prompted many researchers to recommend considering technological terms in local languages to accommodate the end users.

The benefits of ICT have not been demonstrated adequately to the end users, which may be another contributory factor towards the low adoption of technology in farming. It is therefore arguable that farmers, especially those in rural communities, are not aware of the advantages that come with these platforms. The complexity of technology adoption requires some form of demonstration, which is thus far lacking in most developing countries.

The adoption of ICT has identified rural incubated farming cooperatives as the focal areas. In the subsequent section of this chapter, attention shall be given to fully understand the concept of cooperative, with more focus on farming across the globe.

2.15 COOPERATIVES

2.15.1 Definition

Cooperative is defined in the *Cooperative Act 14* of 2005 (RSA, 2005) as “an autonomous association of persons united voluntarily to meet their common economic and social needs and aspirations through a jointly owned and democratically controlled enterprise organized and operated on cooperative principles”.

Cooperative formation occupies the critical space of the South African National Development Plan [SANDP] 2030 and has been adequately infused into the national community development programmes.

During the apartheid regime, cooperative development was one the strategies Afrikaners used for economic empowerment. “In the pre-apartheid era, the state created enabling conditions for such white cooperative development through financial, regulatory, and technical support.” (Satgar & Williams, 2011)

The development of cooperatives were racially motivated during apartheid. In this sense, this strategy benefited mostly the minority, the Afrikaners. Post-1994, the cooperatives mainly focus on the black majority under the banner of Black Economic Empowerment [BEE] (Westoby & Botes, 2020).

However, the development of cooperatives is clouded by numerous challenges. In the study by Westoby and Botes (2020) on community development, they argue that “large-scale state planning, without real attention to organic local knowledge and needs identification, can be quite catastrophic”. The development of the cooperative should be needs oriented, other than just being pushed down to the people. The people should first identify the need that can be addressed by the establishment of the cooperative. The development of a cooperative should always be coupled with a purpose derived from the end users. There should be an avoidance of the ‘one-size fits all’ as all community needs are not the same.

The South African Vision on cooperatives, as enshrined in the DTI (RSA, 2012) states:

> To move towards a growing, self-sustainable and integrated co-operative sector, supported by all stakeholders, contributing to economic growth, poverty reduction and employment creation, as well as assisting in bringing about economic transformation and an equitable society in South Africa.

From the above vision statement, critical reasons why cooperatives exist are that cooperatives are meant to be sustainable; eradicate poverty; provide employment; and contribute to the economic development of the country.

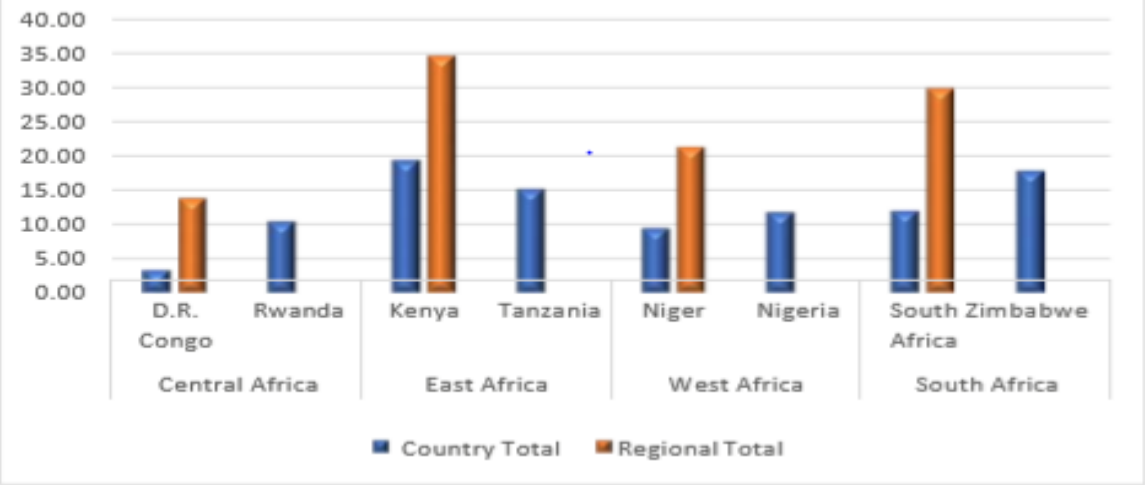


Figure 175: The primary cooperative's use of ICT in African Regions
Source: International Cooperative Alliance [ICA] (2012)

In Africa, East Africa is the highest (34,8%) when it comes to ICT usage, where Kenya tops the countries within that region. The second-highest region is Southern Africa with 30,0% and Zimbabwe records a high utilisation of ICT within the region. West Africa is the third in ICT usage with 21,4% and Niger leads in the region. Central Africa is the lowest when it comes to ICT usage, with a record of 19,9% and the Democratic Republic of the Congo [DRC] comes last in the region.

In South Africa, the trends of cooperative registrations and deregistrations are illustrated in the following figure. The figure shows that a low number of cooperatives have been registered between 1922 and 1994. However, the country received many cooperatives between 2010 and 2011, as shown in the following graph:

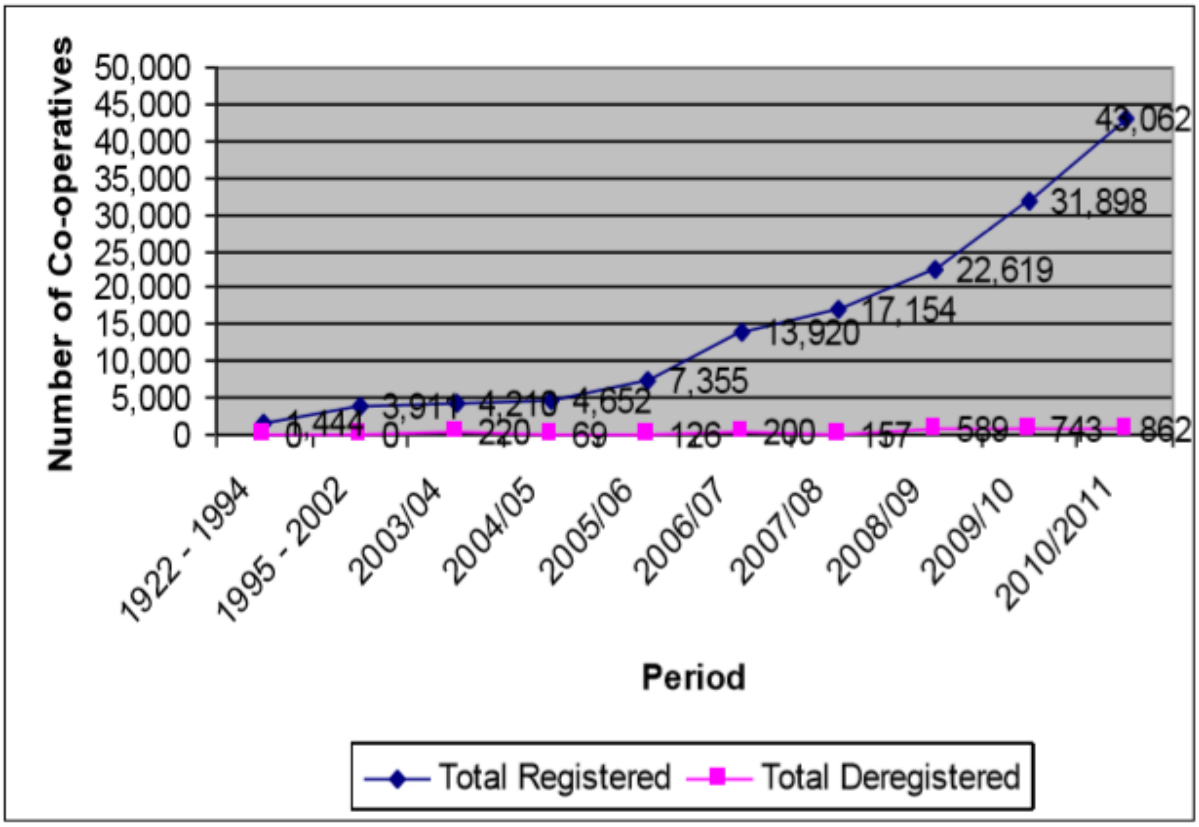


Figure 26: Trends in Co-operative Registrations and De-registrations

Source: Registrar of Co-operatives, Statistics of Co-operatives in South Africa (1922–2012)

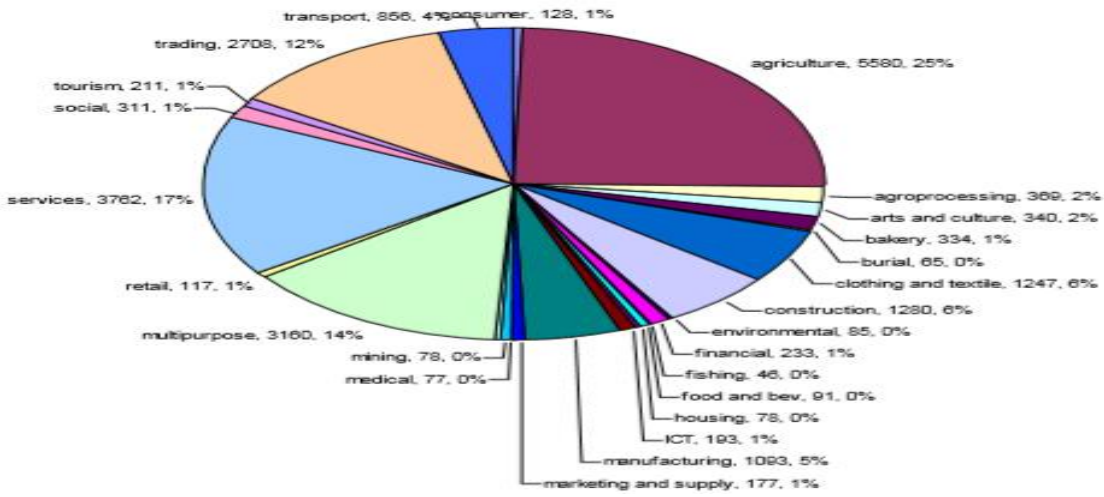


Figure 27: Different cooperative types

Source: DTI (RSA, 2012)

The following bar graph shows that the South African province with the highest number of registered cooperatives is KwaZulu-Natal with 26%. The second-highest province is Gauteng with 20%. Limpopo Province occupies the fourth position with 12% and the least is the Northern Cape Province at 2%.

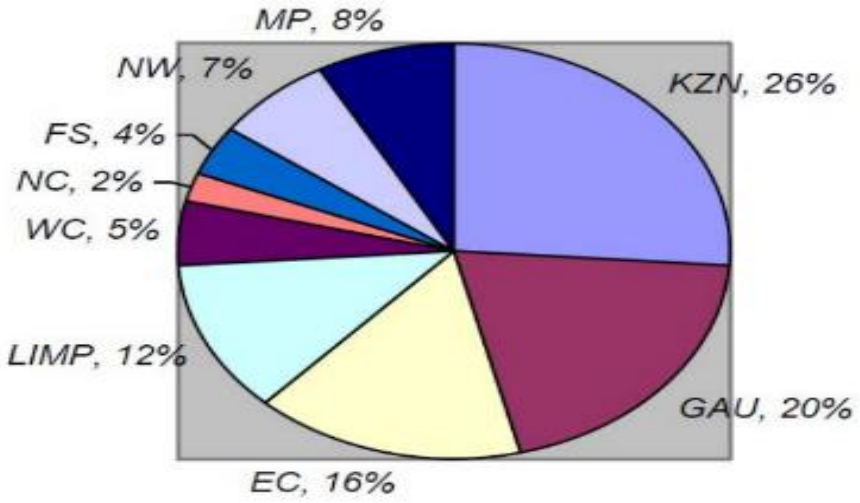


Figure 28: Overall provincial picture of cooperatives in South Africa
Source: Adapted from the CIPC Register 1922–2011

The spread of cooperatives across various sectors in South Africa shows that agriculture tops all the other sectors with 25%, with services second with 17%. The lowest sector is transport, with 4% participation.

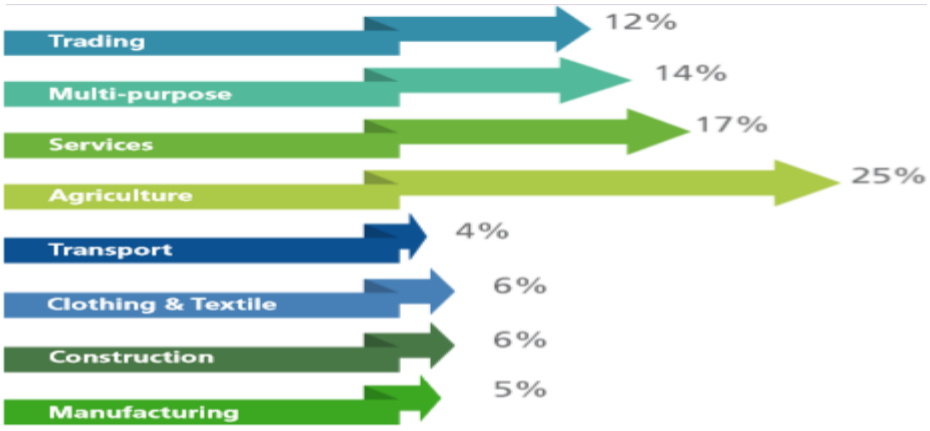


Figure 29: The spread of cooperatives across various sectors
Source: Stats SA (2020)

Limpopo Province is among the many other South African provinces with registered cooperatives. It is the province with five (5) districts (Capricorn, Mopani, Sekhukhune, Waterberg and Vhembe) as shown in the map below:

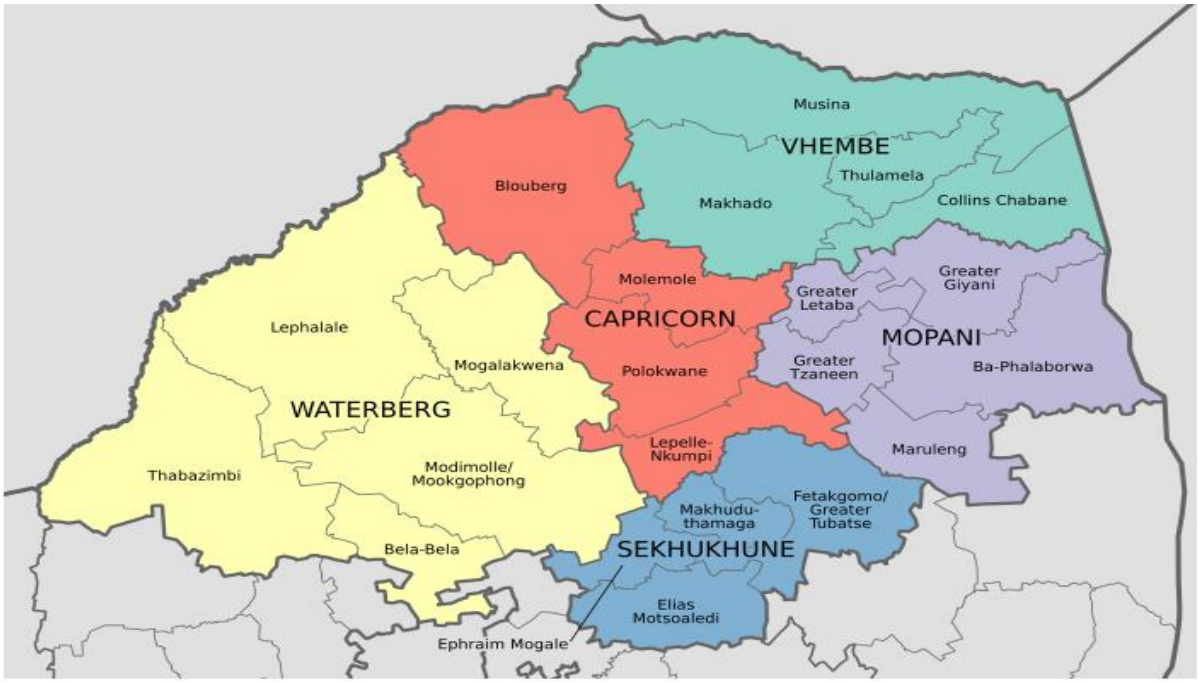


Figure 30: Five districts of Limpopo Province
Source: Stats SA (2020)

Of the five districts of the Limpopo Province, Capricorn has the highest number of people with a total number of 1 930 436. The second-highest district is Vhembe with a total population of 1 393 949. The district with the least population is Waterberg, with a population at less than a million of 745 758. The districts with a population that is closer to each other are Mopani and Sekhukhune, though the latter has the highest number, with a difference of 10 577 people (Stats SA: 2020). The total population of the province is estimated to be 5 404 868, as shown in the following diagram:

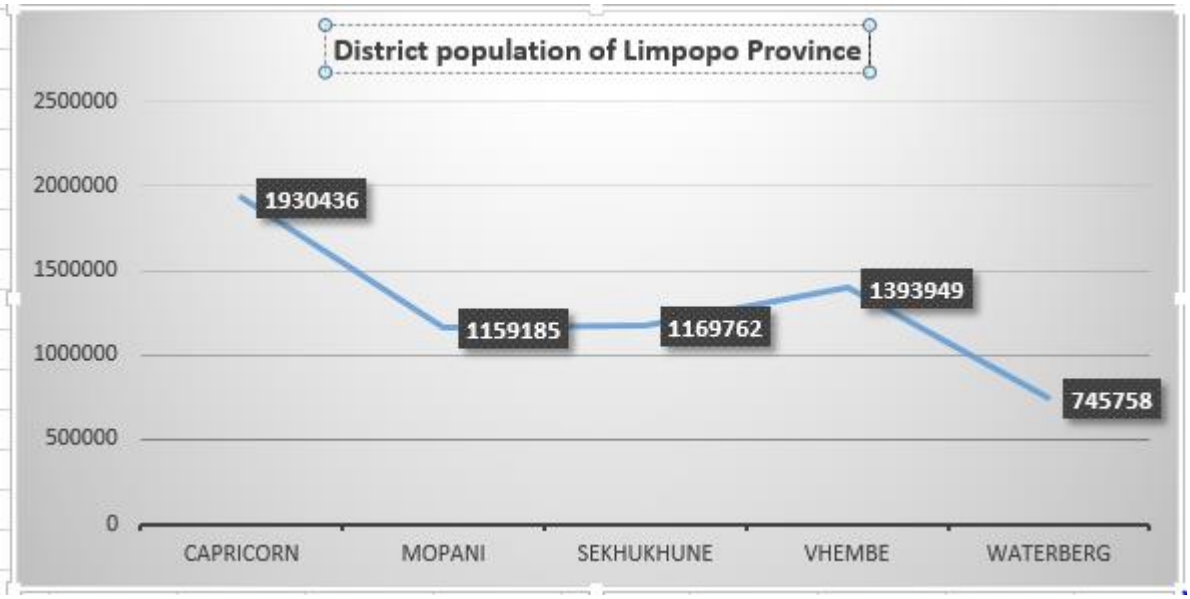


Figure 31: District population of Limpopo Province
Source: Stats SA (2020)

In the 2017/18 financial year, Limpopo Province had a total of 93 incubated cooperatives. This number includes all types of cooperatives, namely agriculture, services, tourism, manufacturing, retail, construction and mining. Vhembe District has more cooperatives (23,7%) than all the other four districts. Waterberg District has the least number, with 16,1% cooperatives. Mopani is the second-biggest district, with 21,5% cooperatives. Both the Sekhukhune and Capricorn Districts have an equal number of cooperatives, with 19,4% each.

The following graph depicts the number of incubated registered cooperatives per district of the Limpopo Province, which comprise the population of the research project.

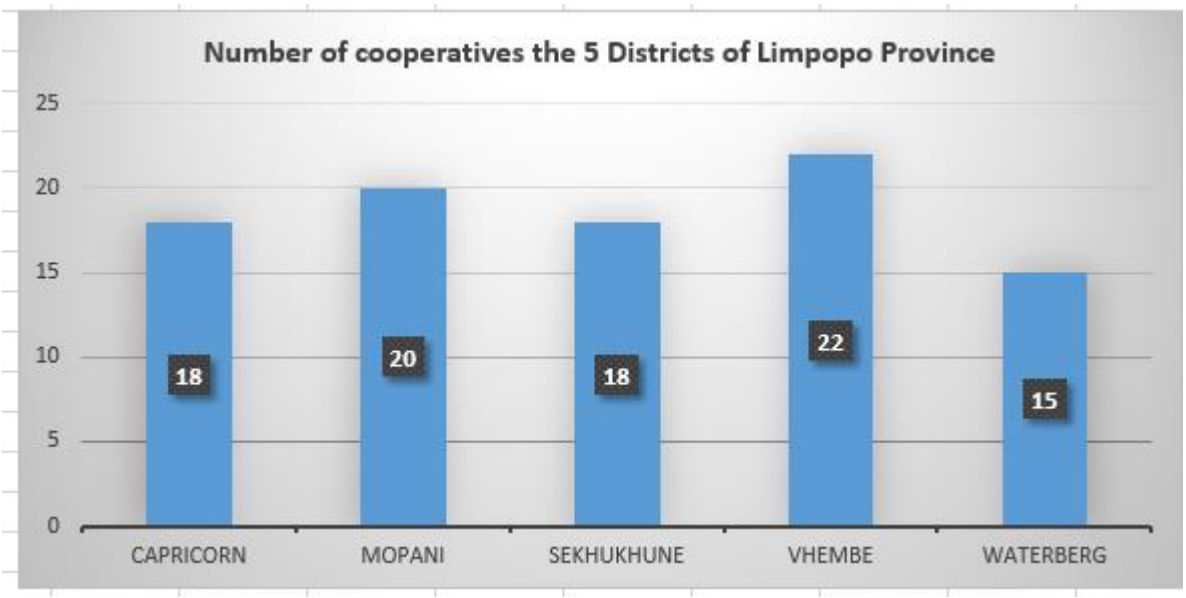


Figure 32: Number of cooperatives in Limpopo Province
Source: LEDA (2018)

When one looks at Figures 27 and 28, something unusual crops up, as Capricorn District with the highest population has fewer cooperatives than the Mopani and Vhembe Districts. The number of cooperatives seems not to follow the trend of the population. The Sekhukhune and Capricorn Districts have an equal number of cooperatives (18), but the population difference between the two stands at 760 674. The inference therefore can be that population has no direct influence on the number of cooperatives.

2.15.2 Benefits of cooperatives

Most countries, including those in Sub-Saharan Africa, like Rwanda, use farming cooperatives for food security. According to Yengoh (2012), the majority of the Sub-Saharan African population are small-scale farmers. The Rwandan community identified cooperatives as a tool for poverty eradication and rural people mobilization (Mbanza & Thamaga-Chitja, 2014). In Rwanda, cooperative as a concept has been introduced under the umbrella term of **Ubuntu**, which means humanity. The term is further associated with some concepts like cooperation, solidarity, mutuality and reciprocity. From these concepts, one can simply deduce that cooperatives are about people who aim to work as a unit. A cooperative is primarily about joining hands to achieve a common goal. The critical characteristics of a successful cooperative are social capital and trust.

In the study conducted by Mbanza and Thamaga-Chitja (2014), 70% of the non-cooperative participant members in Rwanda reconsidered the desire to join cooperatives after working as individuals, citing social, economic, political and cultural reasons. For example, these non-cooperative participant members mentioned that cooperatives are frequently favoured by government policies and support. Cooperative members spend most of their time together and this becomes an opportunity to create social networks. Cooperative members exchange ideas through constructive engagements. Most governments and donors prefer to support a collective rather than individuals. This is congruent with the South African government's strategy of addressing the triple challenge of poverty, unemployment and inequality. South Africa is giving priority to cooperatives to channel resources to a group, rather than an individual. Companies that participate in government tenders are afforded more bidding points, compared to individual entrepreneurs. Joining a cooperative as Mbanza and Thamaga-Chitja (2014) assert, is a way of positioning oneself for many benefits.

Mavimbela, Masuku and Belete (2010) identify agricultural cooperatives as members working together to eradicate poverty. They further indicate that cooperatives provide goods and services as well as the technical services to its members for increased income and savings.

The benefits of cooperatives are not immune to criticisms. In the same study alluded to above, some non-cooperative members mentioned that cooperatives have a constitution that must be followed to the letter. Furthermore, a cooperative is viewed as a limited bureaucratic structure that is very static, and non-compliance with the rules comes with punitive measures.

2.15.3 Key principles governing cooperatives

Cooperatives in many countries are premised on democratic values and principles. These principles are people-centred. The voices of those involved become primary and should be prioritized. Democratic principles are there to promote an autonomous atmosphere that encourages the end-users to craft the solutions of their own problems.

- Voluntary and open membership
- Democratic member control
- Member economic participation
- Education, training and information
- Autonomy and independence

- Concern for the community
- Cooperation among cooperatives

The above enumerated cooperative principles are implemented across many cooperatives. There are some criticisms, as they are premised on two critical concepts, namely democracy and autonomy. The two concepts are new in countries like South Africa, which gained its freedom in 1994. Unfortunately, the two concepts are mostly abused, though they are meant to liberate, especially the historically disadvantaged individuals [HDIs]. Some like Royera, Bijmanb and Abebec (2017) argue that cooperatives often show weak internal governance, which results in low performance.

2.15.4 Types of cooperatives

According to the *Cooperative Act no. 14 of 2005* (RSA, 2005), cooperatives are not at the same level. They differ in terms of levels as discussed hereunder:

2.15.4.1 Primary cooperative

A primary cooperative is formed by a minimum of five members. Its objective is to provide employment or services to its members as well as to facilitate community development. From this description of the primary cooperative, one can deduce that the people involved in this level of cooperative have an obligation, which includes the provision of employment or services as the main objective of the existence of the cooperative and also to ascertain that the cooperative contributes towards community development.

2.15.4.2 Secondary cooperative

A secondary cooperative is formed from at least two primary cooperatives. According to the *Cooperative Act No 4 of 2005* (RSA, 2005), a secondary cooperative is formed to provide sectoral services to its members and may include juristic persons comprising a minimum of two or more cooperatives in the case of a secondary cooperative, as well as a minimum of two or more operational primary cooperatives in the case of a secondary cooperative.

2.15.4.3 Tertiary cooperative

A tertiary cooperative is defined by South African Institute of Professional Accountants [SAIPA] (2018) as a sectoral or multi-sectoral cooperative whose members are secondary cooperatives and whose objectives are to advocate and engage organs of state, private-sector and stakeholders on behalf of its members, in line with its sectoral or geographical mandate.

2.15.5 Characteristics of a cooperative

A cooperative in terms of the *Cooperative Act no 4 of 2005* (RSA, 2005) has the following characteristics:

- It is an enterprise which cannot be established by a single person
- The members of a cooperative have a common need or purpose
- Goals are achieved through cooperation
- All members have an equal benefit to the dividends

Although cooperatives do have challenges, as reflected in the many that deregistered from the Companies Intellectual Property Commission [CIPC]) registers, there are those who succeeded and are still doing exceptionally well. The following sections aim to determine the critical success factors of the farming cooperatives.

2.15.6 Critical success factors of farming cooperatives

2.15.6.1 Development of entrepreneurship

Entrepreneurship is defined as the act of creating a business or businesses while building and scaling it to generate a profit (Ferreira, 2013). A cooperative by its own nature is a business. It has to live by the principles of business, which include profit making and risk taking. The need to build an entrepreneurship is crucial for the development of sustainable farming cooperatives, especially in rural areas of developing countries. Entrepreneurship is built from a collection of attributes, which include personal values, managerial skills, experience and behaviours (Mufallo, 2015).

Unfortunately, most rural cooperatives and more particularly farming, exist and maintain the subsistence levels with little or no effort to move out of the subsistence bracket. From the

definition of entrepreneurship, it is crystal clear that a condition exists for an institution to be termed a business. Profit is the central qualification of any business. Governments across the world need businesses to make a contribution to the mainstream economy. South Africa is no exception, as it needs businesses to address some of the triple challenges, namely poverty and unemployment. It therefore becomes critical for governments, especially those in developing countries, to pay attention to developing and inculcating policies, with a special focus on moving the cooperatives from the subsistence bracket to commercial. Cooperative extension services are better placed to execute that role.

According to Lans (2010), businesses have to adapt to changing circumstances. Adaptation for change will afford businesses to participate fruitfully in the competitive platforms through experimentation with alternative farming and cultivation methods. In so doing, it brings a shift that will be able to cope with new challenges. South Africa, like other countries (Ghana and Nigeria) in Africa, have policies to motivate the entrepreneurship to increase more skills and knowledge for businesses to attain growth.

2.15.6.2 Human capital

Matshekga and Urban (2013), affirm that skills and knowledge are pivotal for farmers, especially those in rural areas, to compete in the agribusiness world. They emphasise the need for the social and economic importance of human capital. They advocate that the best of all capitals is to invest in human beings. Although physical resources are crucial for any business development, human beings should be prioritised when it comes to development.

In the study by Barham et al. (2015), they uphold the notion that knowledge is able to provide people with increased cognitive abilities, which brings more potential yields. They further argue that investment in human capital has proven to be positive in many statistics.

Infusing technology into farming has been confirmed as one element that has the potential to create employment. However, it is argued that an attempt to combine the farmer's knowledge and experiences with ICT does not usually yield the expected outcomes. The consequences of such an attempt is alleged to result in labour-force resistance. The need to motivate farmers to change towards embracing farming digitalisation is needed, although lack of education, costs related to technology access, as well as knowledge and skills may obstruct the good intensions. However, the development of human resources is key when it comes to the transformation of

agriculture into business, especially in developing continents like Africa. The continent also needs to pay more attention to building a strong leadership for a successful agricultural sector (Payumo et al., 2017). Provision of effective training and skills may also add value to agribusiness sustainability. It is further stated that thus far technology is limited to the big farming institutions mostly found in developed countries.

2.15.6.3 Effective incubation

Most newly established businesses do not consider incubation as a critical component of business growth. Incubation is one such element that is missing in most farming businesses. It is the support and guidance provided by matured businesses. This is a critical element necessary for sustainable business growth. It is one area that has not been fully explored in many research projects, especially in the rural farming cooperatives of Limpopo Province. This study deems it necessary to fill the vacuum. The lack of incubations among the faming cooperatives in Limpopo Province is asserted by the 3rd Annual Report of the Department Agriculture, Forestry and Fisheries [DAFF, 2013/14). Although the province prides itself to be the second-biggest in terms of number of cooperatives, no incubation is provided (DAFF, 2013/14). This is one sustainable pillar of business development that is less conspicuous in the farming fraternity, especially in the rural farming cooperatives, as illustrated by the following table:

Table 6: List of incubators, provincial location and key contributing stakeholder

Incubator	Province of Location	Key Contributing stakeholder
African Rose Enterprise Development	Gauteng	Private
Essential Oils Business Incubator	Gauteng	SEDA
Serafields Pty Ltd	Gauteng	ISP
Beniocourt Pty Ltd	Gauteng	ISP
Mpumalanga Agri-skills Development and Training	Mpumalanga	SEDA
Sugar Cane Incubator	Mpumalanga	SEDA
Eskom – MASDT Incubator	Mpumalanga	ISP
Alfred Nzo Agro Manufacturing	Eastern Cape	SEDA
Eastern Cape Castor Incubator	Eastern Cape	ISP
eMonti AgriBEE Incubator	Eastern Cape	ISP
Agri Mega	Western Cape	ISP
BioAgritek Investment	Northern Cape	ISP
Demispark	Northern Cape	ISP
Droogfontein Incubation Farm	Northern Cape	ISP
Natal Maize	Kwazulu-Natal	ISP

Source: Adapted from Tzaneen Agricultural Business Incubator: Business Plan (2017)

Table 7 shows the South African provinces (Gauteng, Mpumalanga, Eastern Cape, Western Cape, Northern Cape and KwaZulu-Natal) that benefit from incubation. Limpopo, Free State and North-West do not currently benefit from incubation. However, it is still not known whether the list still remains the same after three years, as the researcher has not accessed the recent report, if any.

Besides the critical success factors of the farming cooperatives enumerated above, the study also intended to pay attention to the challenges encountered by other cooperatives, as discussed in the following section.

2.15.7 Challenges facing cooperatives

2.15.7.1 Lack of infrastructure and resources

The study conducted by Shava and Hofisi (2019) reveals that the success of cooperatives depends on good infrastructure. Most cooperatives are found in rural areas where there are no proper access roads. It becomes very difficult for potential clients to pay visits to the cooperatives that are on the outskirts of towns. Cooperatives, on the other hand, are not able to

take their produce to markets that are far away, as such trips come with exorbitant transport charges. Consequently, the produce is either sold cheaply or it perishes and high loss results.

Another critical infrastructure that has bearing on cooperatives is the lack of network broadband. Limpopo Province is one of the provinces without broadband. Network connectivity is through private service providers like Vodacom, Mobile Telecommunication Network (MTN) and Cell C. It becomes difficult for many cooperatives to access data and airtime due to the costs involved.

The issue of limited resources like smallholdings as one of the enterprise hindrances, including farming, is mentioned by Xaba and Urban (2016). They assert that the majority of the historically disadvantaged black farmers are still without arable land, which makes business growth not feasible, although that is no guarantee of business success, as it happened in Zimbabwe.

2.15.7.2 Lack of intra-governmental coordination

Cooperatives are on their own. These institutions were established with good intensions, but most government departments, especially in South Africa, operate in silos and this leaves this strategic tool to idle. In the study conducted by Shava and Hofisi (2019), it is revealed that cooperatives receive little support due to the lack of intra-governmental coordination. The study cites issues of funding, training and development as among the areas that receive low attention, while political fighting within government departments has been detected as among the many causes of poor coordination. The cooperative funding allocations are determined by political affiliations. There is a strong allegation that when cooperatives have to be supported, questions like political affiliations are raised, which become a strong deciding factor for a cooperative to receive financial support.

Harsher regulatory practices can be one of the setbacks of business growth. The Food Safety Standards Authority of India [FSSAI] is one such example that introduced restrictions on both imports and exports of products, resulting in possible innovative farming business ventures. These restrictions were further seen in the marketing, including future trading in India (Philroy et al., 2014). As a result of the various rules and regulation that come with each sector, poor knowledge as well as the application thereof becomes a hindrance to business growth. It is therefore important for each country that is characterised by low illiteracy levels like in South

Africa to ascertain that the government rules and regulations are fully comprehended through the extension agents through workshops and advocacies.

2.15.7.3 Limited investment in cooperatives

Access to finances is well covered in numerous studies as one of the obstacles of entering many businesses, including farming. The early stages of agribusiness require capital, for which public-sector banks usually demand collaterals as well as creditworthiness before any transaction is approved. Many financial institutions opt for high interest charges as a way of mitigating the risk. The banks have thus far not had alternative risks mitigations beside the exorbitant interest charges, which in most cases are unaffordable, or lenders fail to repay it and ultimately see their assets repossessed as the last resort. These unpalatable consequences leave the onlookers and other to take a risk. Besides the psychological effects that come with unsuccessful risk, it should, however, be noted that in business success and risk taking are interwoven.

In study conducted by Nchabeleng (2017), on the determinants of the financial bootstrapping strategies used by small, medium and microenterprises in Fetakgomo Municipality, the financial challenge faced by the business start-ups is mentioned and mitigated by the introduction of bootstrapping. Bootstrapping is defined as creative ways of acquiring the use of resources without borrowing money or raising equity financing from traditional sources (Nchabeleng, 2017).

There are numerous studies that confirm that most cooperatives collapse due to funding. Many farming businesses are unable to grow due to the lack of access to credit and government clearances, etc. Financial and other managerial skills as well as the inability to access raw material are among the many deterrents for newcomers to enter the farming business. The low levels of scientific knowledge, especially access to contemporary technology, are counted as hindrances of the sector. Although there are various factors like financial management skills that lead to the collapse of farming projects, some cooperatives experience limited funding. Inadequate entrepreneurial skills and some farming strategies, especially among the rural farmers, which ultimately become a burden to agricultural development and business sustainability (Xaba & Urban, 2016). Most rural farmers still experience a shortage of knowledge and skills base, which adds to the business drawbacks. Government initiatives

should work towards improving the national skills profile for cooperatives to compete successfully. The achievement of the requisite skills will make cooperatives to occupy a strategic position as well as maintain market presence. It is critical that the provision of these skills be situational and specific in order to obtain a particular outcome.

2.15.7.4 Lack of monitoring and evaluation [M&E]

Callistus and Clinton (2018) contend that a lack of effective and efficient monitoring and evaluation [M&E] results in poor utilisation of resources. It is therefore important that M&E be implemented holistically and continually throughout the project to attain its intended value. Value for money is central when it comes to state resources (Bathopele Principles, 1997). More government resources in South Africa are channelled to support institutions like cooperatives. For example, the Limpopo Department of Agriculture and Rural Development Budget Vote 04 of the financial year 2019/20 allocated support and development to an amount of R1,1190 billion to farmers. This was the highest amount of the all programmes, as depicted in the following figure:

Figure 33: Programmes and budget allocations
Source: Limpopo Department of Agriculture and Rural Development Budget Vote 04 (2019/20)

The above programmes shared a total amount of R2,014 381 000 billion. The Farmer Support and Development programme was allocated the biggest stake of R1,190 billion (59,1%). This is the allocation meant to provide support to farmers through agricultural development programmes for sustainability and competitiveness. One question that comes to one's mind is: "Does the allocation receive proper monitoring and evaluation to achieve its intended purpose?" If the response to the question is 'yes', undoubtedly, farmers in Limpopo Province are being developed. Monitoring ascertains that what has been planned does happen and evaluation, on the other hand, seeks to establish whether what has been planned brings change.

2.15.7.5 Lack of access to markets

In today's competitive environment, finding suitable markets for many agribusinesses is one of the challenges facing many farmers. This is mostly found among the rural farmers in developing countries. The situation is further exacerbated by the growing online markets wherein the use of technology gains momentum. Selling and marketing of farming produce have become an insurmountable task for most rural farmers. With the advent of globalisation, the search for cheaper and quality products is plausible. For example, the mushrooming of online businesses is found in almost every corner of the globe. Online or e-commerce is some of the formidable challenges emerging farmers are faced with daily. It may be one of the reasons that forced most entrepreneurs to opt for the informal markets due to the high competition in the formal markets. Product evaluation is necessary as some farmers, especially the rural farmers, could not yield quality produce due to various factors, including information deficiency, particularly in the food processing sector.

Among the many other challenges facing the rural farmers to access the formal markets is the quality of the farmers' produce. It has become a catcall which makes the majority of the farmers to opt for informal markets with often lower prizes. The increase in produce and high demands for certain produce bring high competition among the farmers. It also gives the customers an opportunity to develop some requirements and criteria for the type of products they want (Royera et al., 2017).

One among the many reasons that lead to business collapse, especially cooperatives, is the inaccessibility of markets. Some rural farmers, especially those who are illiterate allege that unfair business practices happen in the available markets, e.g. the unfriendliness of the

language used at many livestock auctions. It is true that the auctioneers use a specialised language that is mostly fast and sometimes inaudible to follow. One is still not sure why the language should be that fast. In such instances, the owner of the animals may feel robbed when the final bid is not what he/she has anticipated. There are a further allegations of nepotism among auctions and bidders who have close ties with auctioneers by lowering the price or the other way round. This may be among the reasons that most rural farmers prefer informal markets rather than the available markets, as illustrated in the following table:

Table 7: List of farming markets used by most farmers in Limpopo Province to sell their produce

Institutions supplied	Number of cooperatives supplying
Pick n Pay	2
Friendly Supermarket	1
Vhembe Fresh Produce Market	1
NTK (Cooperative)	1
Golden Foods	1
Johannesburg Fresh Produce Market	2
Am-Pak	1
Durban Market	1
Mozambique	1
Botswana	1
Spar	1
Total	13

Source: Adapted from DAFF (2013/14)

The findings of above table reveal that there are fewer farmers' markets in Limpopo Province, regardless of the clarion call by government to support local producers. These farmers have identified local and national markets like the Johannesburg Fresh Produce and Durban markets to sell their produce. In some instances, it is not the markets that do not have an interest in the local produce, but the capacity of the local producers to provide quality produce. The issue of capacity among the local farmers in particular is one area that is frequently cited by the markets.

In the study conducted by Royera et al. (2017) on cooperatives, partnerships and the challenges of quality upgrading in Ethiopia, contract farming arrangements [CFAs] have been recommended as a strategy to afford the start-ups into the formal markets. This can be a better mitigation for the rural farmers, who frequently have no access to the formal markets to sell their produce. The strategy will further transform them from a subsistence to a commercial farming system. However, this strategy is not without criticism. One criticism is the opportunity of the established farmers to abuse the newcomers to the sector, which may further develop a dependency syndrome, often leading to weak internal capacities. It is further argued

that the strategy is not sustainable and fair and it is still scant in some cases (Royera et al., 2017). There is still a need for enough skills to handle the strategy.

2.15.7.6 Lack of skills

The need for farmers to acquire various skills is well documented in the study by Xaba and Urban (2016) on the enterprise skills and performance. They advocate that skills are critical for business success. Skills remain a pivotal element to improve business productivity as this increases and strengthens business adaptability towards change. Management, marketing, production and technological skills are key in an enterprise that aims to succeed. Furthermore, farmers are encouraged to be innovative in their production in order to remain competitive and relevant to the markets. Farmers need to have the requisite skills that will add more value to the business performance. However, Genis (2012) argues that being proficient in business skills remains a challenge to many enterprises, including farming, which is one of the primary reasons for most businesses to remain static and ultimately collapse. Skills and innovation are interwoven. Skills work better when an element of innovation is embedded.

According to Dhehibi et al. (2020), innovation is the key to agricultural growth and poverty reduction. It is unfortunate that innovation is one area that has not been mastered by most businesses, as evidenced by many businesses that are formed of a single idea. Factors like illiteracy are among the many hurdles that obstruct rural farmers. Most businesses ideas are not preceded by research, which should be the basis of why it should be established. For example, it is not strange to find similar businesses in a particular location. After 1994, many spaza shops mushroomed at every street corner, but gradually they collapsed, because the idea was not backed by research. Sometimes lack of farming commitment and absence of passion for agribusiness remain the major hindrances to sustain performance.

Besides cooperatives as part of this study, another critical part that needs to be understood is the role that incubation can play in sustaining the rural farming cooperative. Incubation is termed a better strategy in business development and this section intends to look into that part.

The need to have agribusiness entrepreneurs equipped with knowledge, including financial and human resources management, is key. Access to the relevant information brings social and financial spinoffs. Being fully successful in farming business also requires adequate knowledge of government policies as well as the relevant regulatory matters that may have an effect on

the start-up venture. Start-ups need to have networking skills to strengthen the business and widen the market entry.

Farming may be one sector that is associated with hard labour. However, emerging farmers, especially those who intend to turn farming into a business, should possess at least the primary skills for entrepreneurship survival. Some of these skills are intrinsic, like self-motivation and sales knowledge, including finances. Other extrinsic skills that be acquired through training to support the agribusiness.

Research study is better understood through the inclusion of a case study or more. In this research project, the researcher has case studies from different countries across the globe. One such case study is the one in Saudi Arabia that has already been cited in the previous section. The Saudi Arabian case study is an international example. There are two more case studies, namely the Argan Oil Cooperative in Morocco, North Africa, and the Dikgale Farming Cooperative in Limpopo Province, South Africa.

The two cases have been identified to learn how cooperatives are constituted and sustained. One of the points worth noting in this study is the high collapse of cooperatives, as recorded in numerous studies, and it will be crucial to identify the critical variables that keep the cooperatives sustained regardless of the myriad of challenges.

2.15.8 Case Studies

2.15.8.1 Case study: Argan Oil Cooperative in Morocco, North Africa

The Argan Oil Cooperative is one of the many cooperatives established in Morocco, in North Africa. It was established in 2007 with a membership of 53 women. The inequality between men and women was the main reason that prompted the establishment of the cooperative. The Moroccan Government initiated policies that were meant to bring equality between the two genders.

It was a cultural practice for women in the Middle East and North Africa [MENA] not to participate in the economic activities of their countries, apart from the educational qualifications they may possess. It was for that reason that only 46% of the female population in MENA had educational qualifications. Women in those regions are confined to household chores like babysitting, cooking and cleaning the house.

The little they could do economically was to crush the argan nuts and help their husbands to sell these along the road. Although they kept doing that for ages, it never became a growing business until they thought of establishing a cooperative.

The members appointed Jamila Raissi to be the Managing Director of the cooperative. Because of her passion, accounting and leadership skills, Jamila Raissi has been successful in leading the Argan Oil Cooperative. The cooperative grew from 53 to 72 women members who are frequently engaged in training programmes, teaching them how to run a business.

The cooperative is able to generate income and the dividends are shared among the members. Today the Argan Oil Cooperative members are able to pay their children's educational fees. The success of the cooperative is drawn from the effective implementation of democratic principles. For example, all members have an equal say in the cooperative, as is evidenced by the flexible time of coming to work. These women are afforded time to attend to their household actives, whereafter they can join the crushing of the nuts.

Another contributory factor towards the growth of the Argan Oil Cooperative is the availability of technology. Although the argan nuts are still crushed by hand, they are roasted using the technological equipment to produce body oil. Tourism is the cooperative's main market, including online selling of their produce.

From the case study of the Argan Oil Cooperative above, numerous critical success factors can be seen, as enumerated hereunder:

Firstly, there is visible government support as one primary factor that has added value to the success of the cooperative. It is through the revised government policies in favour of women that they see themselves participating in the mainstream economy. Women are no longer confined to household chores, but also participate in income-generating activities, like their male counterparts. The dependency syndrome of women on their husbands could be reduced as they also make a contribution to support their families. The government policies have also addressed the inequalities between males and females.

Secondly, the presence of an effective leadership that provides direction of the cooperative is another critical element towards the success of the cooperative. The leadership has been able to develop programmes that every cooperative member participates in.

Thirdly, the various skills like accounting have been very instrumental in taking care of the cooperative's finances, which saw the members receiving the dividends. Equal sharing of the dividends made it possible for the members to pay for the education of their children,

Fourthly, the availability of markets is core in every business. Tourism and technology have been the main marketing components of the cooperative. Many cooperatives are unable to succeed due to the unavailability of markets, as well as strategies like technology to sell the produce. It is for this reason that today we see the argan products on the shelves of many stores in Africa, including South Africa and abroad.

Fifthly, the cooperative also have programmes to address the women's emotional challenges. The scars of inequalities that women have suffered for many years is something that cannot be left unattended.

Finally, Morocco unlike many other countries, South Africa included, has an effective policy on cooperatives. The registration of a cooperative is not an easy process. Members undergo a ten-step process, namely members should have a vision; team building; develop a plan; have funding; understand the mechanism of a co-op; reconfirm commitment; wait, wait and wait; develop the legal documents; organize the general assembly; and get started. These procedural steps are followed to the letter and can schematically be represented as follows:

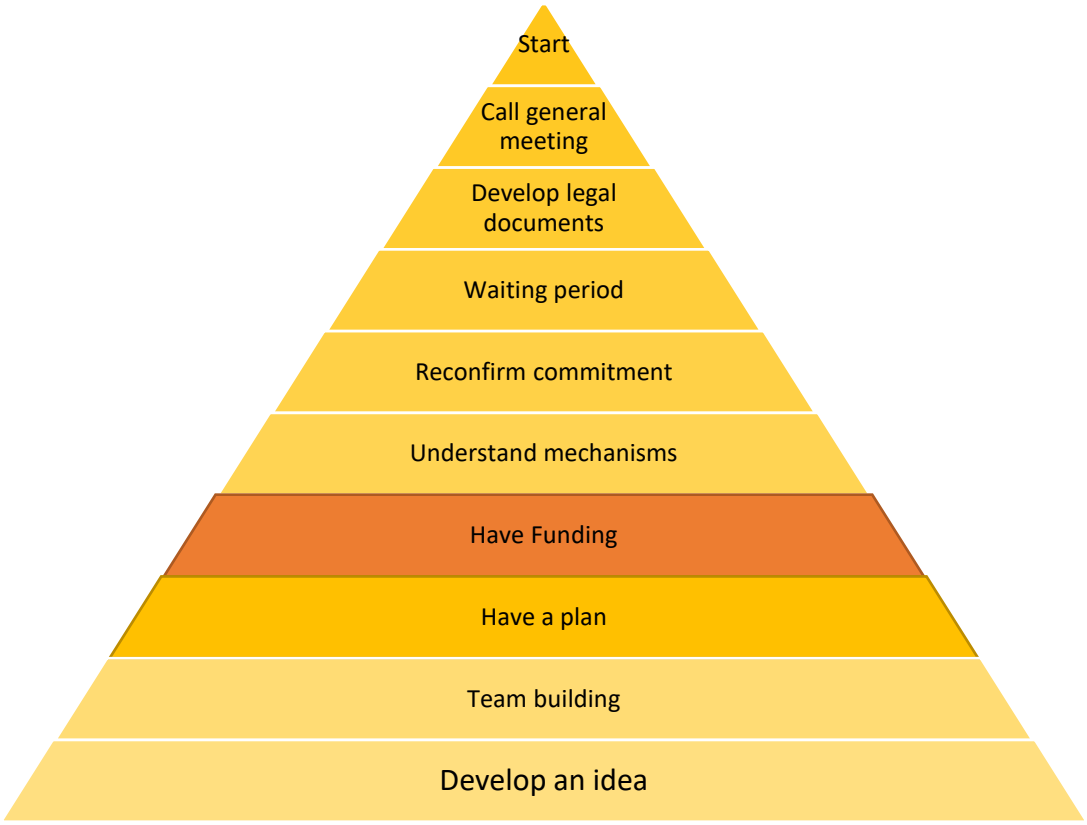


Figure 34: Ten steps process of registering a cooperative in Morocco
Source: Own

2.15.8.2 Case study: Dikgolo Farming Cooperative in Limpopo Province, South Africa

The Dikgolo Farming Cooperative is one of the farming projects found in the north-eastern part of Limpopo Province, South Africa. The project is situated approximately 29 kilometres outside Polokwane. It was established in 1999 through the South African concept of the Settlement Land Acquisition Grant [SLAG]. It is a government strategy of buying a piece of land and giving it to traditional leaderships for distribution to its communities, specifically for farming purposes. The cooperative owns about 34 hectares of arable and grazing land.

The cooperative initially comprised 65 members, but the number has since dropped to 34, with 27 active participants. There are at least 26 women and three men, with no youth involved. The executive committee is made up of three members: a chairperson, secretary and treasurer. Most executive members, who are the voted members to lead the project, possess secondary education up to Grade 12, with a female teacher serving as a co-opted member. Co-option happened because of lack of the requisite skills like ICT among the members. The cooperative

has an effective constitution, which is the document of authority when it comes to managing the project. The success of this cooperative is mainly apportioned to the effective implementation of the constitution. Cooperative members implement the constitution to the letter in matters like meetings, managing absenteeism, fines, determination of dividends, farming rules and regulations and markets.

The Dikgolo Farming Cooperative mainly derives its support from the government and the community. The provision of resources like dipping medicines and farming information mostly comes from extension officers that frequently pay visits to the site. Furthermore, the extension offers share market information with the cooperative. However, the cooperative does not make use of such opportunities, alleging that markets pay low prices for their produce. Travelling distance to the markets and packaging are among the reasons that see Dikgolo Farming Cooperative not to see the gains of the available markets. One is not certain of the quality of produce that the cooperative takes to the markets. It is for this reason and many others that the Dikgolo Farming Cooperative resorted mostly to informal and local markets. They mostly sell their produce like livestock and vegetables to the local communities. For example, most of the people who support the cooperative by buying the produce are funerals, weddings, local butcheries and individuals. They are able to generate a better profit through informal than formal markets.

The cooperative has sustained its existence, but it is not immune from challenges, which encapsulate the following:

- The cooperative seems to have a challenge when it comes to financial management, as they keep on selling livestock and personal contributions for transportation costs. For example, the cooperative once had 88 cattle, but to date only 12 cattle remain. However, the strategy that keeps the cooperative intact is the one sharing the livestock when they deem it necessary, which afforded members to accumulate about 220 cattle in total. The means that each member of the cooperative has his/her own livestock and a hectare of land. Sharing the livestock is one critical sustainable measure that has kept the project intact thus far.
- Besides the many calls to invite youths to the project, they are still unsuccessful. However, it is rumoured that the old members within the cooperative are not ready to

work on a succession plan. This is besides the call by both government and executive to plan for retirement.

- Top-down management is still rife in the Dikgolo Farming Cooperative as the finances of the project are run by the government. For instance, the members complained about the unfinished irrigation system that was started by one service provider from the Limpopo Department of Agriculture and Rural Development. They allegedly had 'no say' in the finances of the project, except to keep records for auditing purposes.
- Information and communication technology [ICT] is still a serious challenge for the cooperative. Most members of the cooperative, including the executive, have no ICT-related skills and infrastructure. However, they need to adopt ICT, since it is in the cooperative plan. The chairperson, who is the youngest among the members, is the only one able to receive messages and use WhatsApp to work on project activities. This includes receiving and downloading documents assisted by the co-opted member. It was also reported that the expenditure for calls, downloading and printing of papers are among the expenditure that the project has to face on a daily basis. They still rely on gatherings, meetings and word of mouth to disseminate messages to the community and potential clientele.
- Farming passion is considered a serious challenge of the project, given the number of members who dropped out of the cooperative since its inception. Approximately 47% of the members have dropped out. It has been reported that most members left the project earlier due to the lack of the financial gains they anticipated. Some members quitted because of the verdicts that arouse from their transgressions.

However, what becomes critical regarding the sustainability of the Dikgolo Farming Cooperative is the mutual understanding of what a cooperative entails. The members, especially the leadership, are fully functional and comprehend that a cooperative should benefit its members, evidenced by the equal sharing of dividends. The members seem to have little autonomy, as demanded by the principles as enshrined in the Act (RSA, 2005) on cooperatives. However, critical for this cooperative are the members and community that benefit from the project. For example, the cooperative is used as a practical centre for farming activities, for example, the recent youths' training on farming from Zwinde Training Academy.

Although the cooperative buys livestock medicines from their own pockets, government support through the extension services is one of the winning cards that lead to project sustainability.

The success of the cooperative is the result of the sharing model that makes each member have some live animals from the project, as well as a piece of land, which are centrally managed by various committees established within the project. The effective implementation of the cooperative constitution in Dikgolo is one of the elements that keep the project going. The constitution is able to manage the imbalances of member contributions, like in cases where the member(s) show few signs of effort. Hard work is rewarded and laziness is punished through the denial of dividends. This is one of the variables that are lacking in most businesses, which sometimes lead to the collapse of the business. Furthermore, there is effective and efficient monitoring and evaluation of production as well as equal caring of the livestock. Farming demands a lot of hard labour and the sharing model was developed.

The Dikgolo Farming Cooperative may not be that strong in terms of ICT adoption, as required by the study; however, there are a lot of farming and business practices that other projects can benefit from.

2.16 INCUBATION

2.16.1 Definition

Incubation is defined as the nurturing and support provided to a newly established enterprise with the intension of ascertaining that it gains growth and becomes an independent entity (Philroy et al., 2014).

The above definition of incubation is premised on three constructs, namely nurturing, assisting the enterprise to grow, and independence. Vulnerability is another aspect that the start-up business is faced with and the incubator serves the purpose of providing protection to the newly established enterprise. Bluntly put, the incubation process plays the role of the ‘chicken and offspring’ role whereby the adult will ascertain that the new business is protected, nurtured, and provided with the critical skills and information.

Although incubation is relatively new in the business arena, it has been seen by Philroy et al. (2014) to be an effective model considered for business growth. The model is further

considered as a viable platform for technology embracement and commercialisation, as it also promotes entrepreneurship. Incubation in business, if properly effected, takes cognisance of the community and thereby achieves positive economic outcomes. Incubation is gradually gaining popularity in many businesses due to its success. It is one of the many reasons that are recently perceived as an alternative model for business prosperity in rural agricultural sector.

An incubation can have both extrinsic and intrinsic benefits, as illustrated in the diagram below:

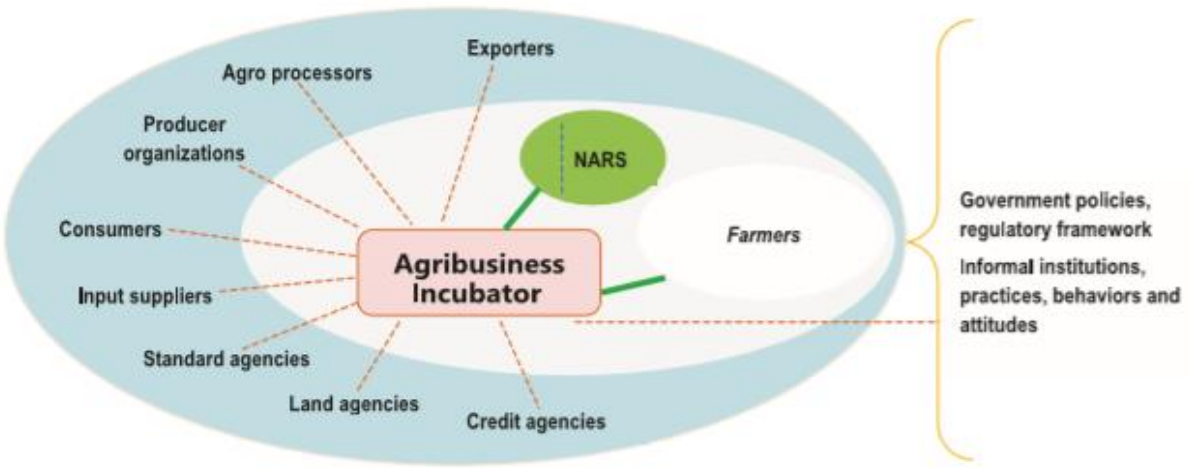


Figure 35: Agribusiness incubation Model
Source: World Bank (2012)

The above agribusiness model indicates two benefits, namely the extrinsic and intrinsic benefits that start-up business farmers can be exposed to. For example, the incubated farmer has numerous advantages, thereby having exposure to the credit agencies, consumer database, other producer organisation as well as the export markets and National Agricultural Research System [NARS[.

Furthermore, the incubated farmer has access to a variety of relevant information like government policies as well regulations governing the sector. The incubated farmer receives personal growth on how to behave and a famer is taught to manage his behaviour as well as attitude moulding (Mitsopoulos et al., 2015). Incubation, according to the International Business Innovation Association [IBIA] (2015), is mainly a process of nurturing a start-up business, providing assistance for the enterprise to grow at the time when it is still vulnerable.

A brief history of an incubation, according to Macqueen and Bolin (2018), was established by the Batavia Industrial Centre [BIC] in New York. It is considered to be the first business

incubator around 1959. The real-estate developer happened to be unable to let the large building with tenants and ultimately decided to pass it to the available tenants with business interest.

While an incubation has grater spinoffs towards building a successful agribusiness, it is not immune from challenges as depicted in the following diagram:

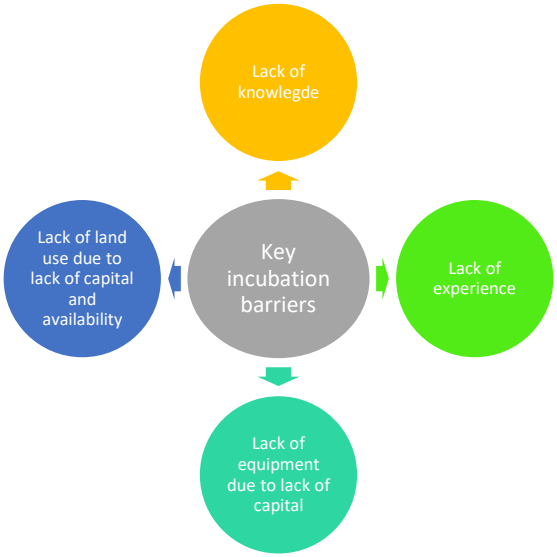


Figure 36: Key incubation barriers
Source: Brown (2015)

Payumo et al. **(**2017), assert that incubation can be one of the many possibilities that can be explored for agribusiness growth. However, incubation in Africa is slowly being implemented to bring change to the agricultural sector.

The incubation of the agribusiness has been confirmed to be a useful tool that can transform the African farming sector into a competitive one. It is, however, argued that developmental tools perform better if they have received adequate support, consideration of sustainability and continuous evaluation. The findings of the study conducted by Macqueen and Bolin (2018) indicate that there is a great difference between businesses that are provided with incubation and those that are without, as illustrated in the following diagram:

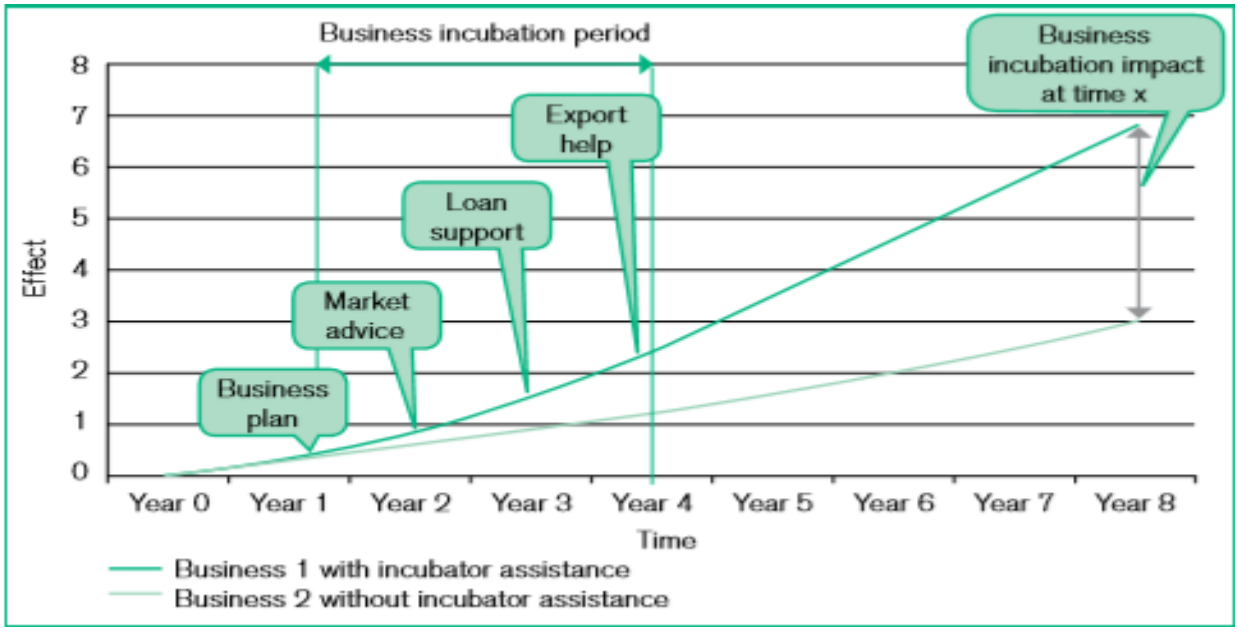


Figure 37: Depiction of an incubated business and those without incubation
Source: Macqueen and Bolin (2018)

The above diagram shows two businesses that were each supported through incubation, and another one without support or incubation. The results of the two businesses indicate that the incubated business grew significantly by almost 7 effects, while the business without incubation remained at effect 3 after eight years. At least the two have been able to show similarity at the half mark of the first year during the business plan stage. However, the growth of the incubated business started to create a gap from year two and became worse at the export stage. The difference between the two reflected a huge difference, almost double in favour of the incubated business.

The interpretation of the diagram above means that incubation can be a helpful tool for business growth. Advice on markets, provision of loan support, maybe through collaterals, and export support are among the primary success factors of a start-up business.

However, the use of incubation for business growth is slowly penetrating in Africa. There are still very few countries in Africa that use this strategy to provide support or nurture the start-up business as shown in the table below:

Table 8: Types of Agribusiness incubations in Africa

Crops/Products	Country	Type of Organisation	Local
Type 1. Agribusiness Value Chain / Sector Development			
cashew, legumes, bananas, poultry	Mozambique	Non-profit	No
bananas	Uganda	Non-profit	Yes
vegetables, fruit, dairy, poultry, rice, maize, and others	Benin, Burkina Faso, Ethiopia, Ghana, Kenya, Mali, Mozambique, Niger, Nigeria, South Sudan, Togo, Uganda	n/a (Grant funded)	No
livestock	Kenya	Non-government organization	No
sesame, honey, dairy	Ethiopia	n/a (grant funded)	Yes
farm inputs for maize and other crops	Kenya	Non-profit	Yes
Type 2. Agricultural Research Commercialisation Incubators			
coffee	Uganda	Non-profit	Yes
potatoes, peanuts, fruit, meat	Uganda	Government	Yes
mango and other fruits	Zambia	Non-profit	Yes
shea butter, honey, and tea	Mali	Non-profit	Yes
livestock and poultry	Ghana	Non-profit	Yes
Sorghum	Kenya	Non-profit	Yes
Type 3. Technology Transfer Incubators			
	South Africa	Non-profit	Yes
dairy, livestock, horticulture and staple crops	Kenya	N/A (grant-funded)	Yes
flowers, fruit, vegetables	South Africa	Non-profit	Yes

Source: Payumo et al. (2017)

Table 5 above shows that Africa has three types of agribusiness incubations, namely Agribusiness Value Chain/Sector Development [AVC/SD], Agricultural Research Commercialisation Incubators [ARCI] and Technology Transfer Incubation [TTI]. From the types of agribusiness incubations in Africa, Kenya dominates all the countries, as it participates in all three types of incubations. Uganda, Ethiopia, Mali and Ghana are the second-most participants. South Africa and Kenya participate in Technology Transfer Incubation.

2.17 CONCLUSION

The chapter gave an exposition of ICT adoption globally, regionally, nationally and locally. This is a wide coverage of the various technological platforms like the internet, infrastructure and success factors, as well as the constraints that are considered to be amongst the primary barriers of technology adoption, especially in developing countries, including the rural areas that are in abject poverty.

The study mainly focuses on farming cooperatives and a wider description of these institutions has been covered. There was also a broader discussion of cooperatives across the globe, with more emphasis on how they are established, including those in Limpopo Province. Various factors contributing towards the success and hindrances of cooperatives have been reflected upon.

Furthermore, incubation as a concept that distinguishes this study from other studies on the same subject has been described. This is the critical element that makes the study unique from other studies covering cooperatives.

Finally, the theories employed in the study have been discussed comprehensively, with more focus on their relevance and rationale in the study. The advantages and drawbacks of the employed theories were also highlighted, as no theory is immune to criticisms and limitations.

CHAPTER 3:
RESEARCH METHODOLOGY

3.1 INTRODUCTION

The previous section of this study provided a theoretical background of the study objectives as well as tried to give answers to the research problem derived from the literature. Research methodology is the section of the research that mainly focuses on data collection, which will be conducted and analysed to confirm or not to confirm the problem statement and research objectives of the study.

This section primarily discussed the route towards data collection, namely research paradigms; qualitative methodology; research approach; data collection techniques; research design (more specifically the population, sampling, and procedures); and data analysis. Justification for the choice of a particular tool or technique as well as stating how they should be applied in the study has been discussed.

3.2 EPISTEMOLOGY

Epistemology is more concerned with "how" knowledge is developed. In most cases, the 'how' question yields numerous responses, which may add to the body of knowledge. Unlike the ontological philosophy that seeks to chase one reality, the epistemology aims for multiple types of knowledge. Epistemological philosophy searches for what constitutes legitimate, acceptable, valid knowledge and how that can be transmitted to others (Saunders, Lewis & Thornhill, 2015). It is against this backdrop that the study opted for epistemology. Data collected in this study comprise both texts and numerical. It is for this reason that epistemology was found relevant. In support of the above statement, Saunders et al. (2015) state that ontology is an abstract philosophy, compared to epistemology. The findings of the study anticipate a range of data, including numerical, textual and visual; hence the researcher found epistemology appropriate, as it is able to handle a variety of data. Most advocates of epistemology opt for the qualitative, as opposed to the quantitative research approach. Cited reasons for the choice of qualitative approach, among others, is the likelihood of deriving various knowledge types, which the quantitative approach fails to yield in most cases. One of the spinoffs associated with

epistemology is that it gives a variety of choice in terms of methods that one may employ. However, it is still the responsibility of the researcher to make a decision and choice from the diversified epistemological assumptions.

3.2.1 Interpretivism

The researcher opted for the interpretivism paradigm, as the objectives of the study could be achieved through a variety of new knowledge emerging from different interpretations. The low adoption of ICT, which is the core of the research problem, may not be caused by a single factor. In some instances, these factors may not be measured, as advocated by the positivists; hence an interpretivist paradigm was sought.

Interpretivism, unlike positivism, supports the subjective nature of research. This means that human beings are much more than mere physical beings. Humans have the capacity to create meaning to the world around them. The argument emerging from interpretivism is that human beings cannot be studied in exactly the same way as the physical beings (Saunders et al., 2015); hence it is critical to see them differently from non-humans. Human beings emerge from different cultural backgrounds with different circumstances, experiences, attitudes and times. It is therefore no surprise that these beings can attach different meanings to the objects around them. The interpretivists do not embrace the perception of the positivists that attempt to have a definite universal 'law' that applies to all. Instead, they are convinced that the rich human insight shall be lost at the expense of generalisations.

> Interpretivists argue that in order to understand human action we need to achieve 'Verstehen', or empathetic understanding – we need to see the world through the eyes of the actors doing the acting. (Thompson, 2015)

The researcher is in full agreement with Thompson's (2015) assertion that experience and different perspectives that individual people have are critical for an interpretivist. It is thus what make human beings to attach different meanings to the same object around them, something that scientific methods cannot achieve. In his argument Thompson (2015) asserts that "the same objective reality" can be seen in many different ways. It is among the reasons that most interpretivists opt for qualitative research methods, which afford them an opportunity to uncover the different realities which positivists are unable to gather. Thompson (2015) further indicates that "interpretivists, or anti-positivists are not just puppets who react to external social

forces as Positivists believe". The main focus of interpretivism is the creation of knowledge that is new and rich with the encapsulation of what the social world and contexts entail.

3.3 QUALITATIVE RESEARCH

The study on the adoption of ICT for the development of the rural incubated farming cooperatives in Limpopo Province has employed qualitative research methods. The aim and objectives of this study hope to uncover the reasons behind the low and lack of ICT adoption in the sector in question. It is through the employment of this research method that results may be realised. Numbers are not predominant in this study; hence, quantitative study has not been considered.

Qualitative research refers to the type of research that mainly focuses on the analysis of words (Jansen & Warren, 2020). It focuses more on the non-numerical data, including body language and observations. This is the research method which solely aims at understanding the complex reality including the meaning of a particular context (Queiros, Farail & Almeida, 2017). It is not concerned with numerical representation of data; instead, it focuses on the in-depth understanding of a particular problem. Queiros et al. **(**2017) refer to the qualitative researcher as both the subject and the object of his research study. The method is concerned with the non-quantifiable aspects of reality with specific focus on the understanding and it provides an explanation in relation to the dynamics in social relations. In short, the qualitative method focuses on acquiring in-depth and detailed information, in contrast to the quantitative research method (Anderson, 2010).

> Qualitative research works with the universe of meanings, motives, aspirations, beliefs, values and attitudes, which corresponds to a deeper space of relationships, processes and phenomena that cannot be reduced to the operationalization of variables. (Maxwell, 2013).

The study's choice of qualitative research method has informed by the following advantages (Rahman, 2017):

- It provides thick data thereby detailing the participants' feelings; opinions, etc.
- It is an interpretive techniques of understanding human experiences
- It is suitable for an ideographic research suitable for to understand different people' voices, meanings and events
- Qualitative research method is able to collect data through direct observation and make an inference

Although the qualitative research method is widely used because of its benefits in social sciences, it is not perfect or free from criticism, as discussed in the section below.

3.3.1 Criticisms of the qualitative research method

According to Anderson (2010), the qualitative research method depends heavily on the researcher's skills. This type of research method is vulnerable to the researcher's idiosyncrasies and can easily be clouded by biases due to the presence of the researcher. Anderson further states that the volume of the collected data is not easily analysable and therefore time consuming. The complexity of this research method makes the findings difficult to be accepted by the scientific community. The qualitative research method is mostly not feasible to maintain, assess and demonstrate rigor. The use of this method sometimes results in critical elements of ethical considerations like anonymity and confidentiality being compromised.

Research is a systemic process that requires a particular approach. This research study opted for the inductive approach, because no preconceived ideas or hypotheses are developed. The inductive approach was regarded as more be relevant in this study, as the topic on the adoption of ICT for the development of the incubated rural farming cooperatives in Limpopo Province had never been researched before. Building new knowledge derived from the data of the participants will without doubt add value to the body of knowledge; hence, the researcher found the relevance of the inductive approach for this study.

3.3.2 Inductive approach

The inductive approach is the opposite of the deductive approach, because it works inside-out, from specific to general. The approach brings no theory or hypothesis; instead, the theory is derived from the collected data. Schematically, the inductive approach, which takes the form of 'hill climbing', can be represented as follows:

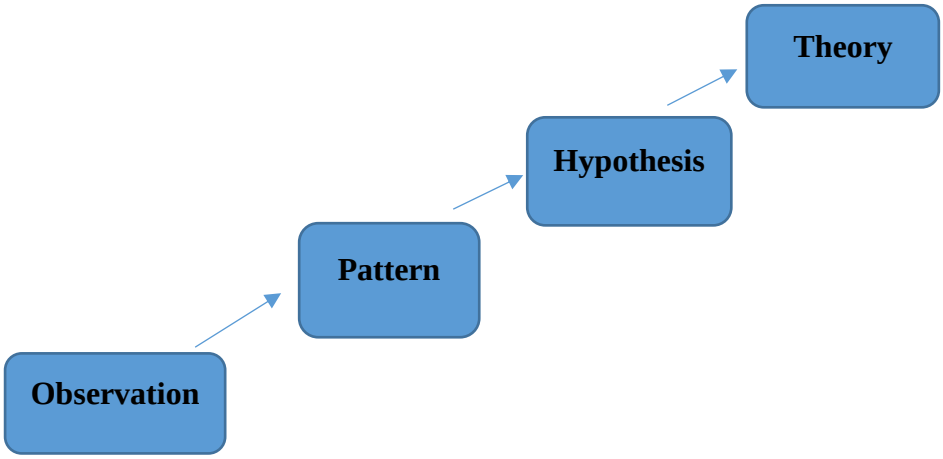


Figure 18: 'Hill climbing' model of the inductive approach
Source: Researcher own conceptual framework

The 'hill-climbing' model above shows that the researcher closely observes what comes from the participants and sees if any form of patterns emerge from the observations. The patterns will assist the researcher to develop the themes. A hypothesis is established and tested and ultimately a theory is developed. In short, the researcher employing the inductive approach or reasoning does not have any preconceived ideas regarding the anticipated findings.

After due consideration of the two qualitative approaches, an inductive approach was followed in this study. The researcher had no preconceived ideas or any form of judgement about the findings of this study project. The assumption of the researcher is that data collected will inform the theories and it is for that reason that the study developed questions rather than hypothesised.

The completeness of the research undertaking revolves around the collected data from the research participants. The following section will pay attention to the data collection techniques, with special focus on interviews.

3.4 DATA COLLECTION TECHNIQUES

3.3.1 Interviews

An interview is the technique of obtaining data from the interviewee(s) through face-to-face interaction. Interviews are primarily conducted face to face; however, in certain instances, the technique can be telephonic or by means of video calls, including Skype. The space that ICT has recently occupied has brought along the use of e-mails as another type of interview

technique (Quad, 2016). Apparently other forms of social media like WhatsApp may also be employed.

Interviews are mostly used in qualitative studies to uncover what other data collection methods like questionnaires cannot do. This is the only method that researchers employ to gather more information about the topic from interviewees. In order to get more responses from the participants, face-to-face and telephonic interviews will be employed. The research took place in rural areas characterised by a high level of illiteracy and a possible need to provide explanations to the participants was expected.

There are various types of interviews, namely semi-structured, open-ended, and focus-group interviews. The differences in these interview types rest in the questioning strategy and number of participants.

Besides the benefits that interviews can bring in the research study, the technique also has some limitations. The method is more delicate and subjective, as the interviewer participates either directly or indirectly. It in is this kind of participation that some form of bias may occur. Bias in any research study affect the integrity and the quality of the findings and the study in general tremendously. It is therefore critical that a researcher employing this type of data collection method should by all means guard against such mishaps to occur. The technique demands the user of this data collection method to possess certain skills, expertise and to be vigilant at all times, with clear objectives of what the study aims to achieve.

The use of interviews in this study was preceded by formal logistical processes like using a letter of permission from the gatekeeper to request cooperative leaders to inform other members about the research study; sharing the research plan, including the duration of the interviews; and requesting other members' contact numbers for stratified random-sampling purposes.

One-on-one interviews not lasting more than an hour were conducted, with each cooperative member – mostly leaders – in a safe space and time of their choice. The researcher gave the participants ample time to respond without putting undue pressure on them.

3.5 VARIABLES

A variable in research is the characteristic(s) that distinguish an object from another. It is the identity of an object or something that brings about the uniqueness of an object. Shukia (2018) asserts that a variable has a characteristic that bears value or identity. A variable has an effect to bring about change in the existence of another object.

There are various types of variables, but for the purposes of this study, two variables were considered, namely independent and dependent variables.

3.5.1 I Independent variables

An independent variable, as the name states, is independent and manipulates the situation or exerts force on an object to cause change. This variable affects the value of another object. It is the input that creates change. It is the agent of change in any given situation.

3.5.1.1 Dependent variables

This is the variable that is manipulated by the independent variable. It is considered to be the outcome of the event of change.

The relationship between independent and dependent variables is that the former act on the latter. They relate in terms of cause and effect.

The study on the adoption of ICT for development of the incubated rural farming cooperatives also anticipated the same cause and effect. The choice of Roger's diffusion and Kurt Lewis' change theories are suitably relevant, as the assumption is that the farmers' adoption of ICT will effect change. The following table depicts the two variables and mitigation:

Table 9: Key variables in the study

Variable number	Variables		Mitigation
	Independent	Dependent	
Xl	**1. Farmers' characteristics**		
	Age	ICT adoption	Attracting more youth into farming through advocacies
	1.1 Literacy levels		▪ Infuse ICT into adult basic education programmes ▪ Capacitate rural extension officers with ICT programmes

	1.2 Poverty		Introduction of government subsidies for rural farmers to afford devices
	1.3 Perceptions		Demonstrate the usefulness and ease of use of technology into farming
X2	2.1 Network connectivity		Provides routers to rural farmers through subsidies
	2.2 Data		Free internet sites for rural farmers

Source: Own

3.6 RESEARCH DESIGN

The main purpose of sampling was to have research participants that were able to provide information for the study. Information or data were derived from the participants in various forms, which included interviews, questionnaires, and observations.

3.6.1 Population

The population of this research project was obtained from the 56 incubated farming cooperatives in Limpopo Province. These are the incubated farming cooperatives established during the financial years April 2018 to March 2020. The LEDA (2018) incubation policy cycles are 24 months. The newly established incubated cooperative (April 2020 to date) was found invalid for this study, due to the spread of the coronavirus, which affected the entire programme badly. The initial cooperative completed the whole programme successfully and that can be of value to the study. However, all these cooperatives are managed by the Limpopo Economic Development Agency [LEDA], which then assumes the role of a gatekeeper and therefore has sole authority over the cooperatives. LEDA is a subsidiary of the Limpopo Economic Development, Environment and Tourism [LEDET].

In order to obtain legal access to the study population, the researcher wrote a letter to LEDA requesting permission to access the incubated population. The request letter included among others the purpose of the study, duration, observance of the ethical considerations, and value that the study will add value to LEDA's activities. A positive response from LEDA was received, allowing the researcher to have access to the participants. The permission also came with lists of cooperatives (farming and non-farming cooperatives) as well as the contact numbers of the contact persons. LEDA also provided an incubation policy for ease of reference.

This list that assisted the researcher to choose between farming cooperatives and non-farming cooperatives.

The map in Figure 39 below shows the five districts of Limpopo Province where the population of the study came from. The five districts are Capricorn, Mopani, Sekhukhune, Vhembe and Waterberg.

Figure 19: Map of the 5 districts of Limpopo Province
Source: Stats SA (2019)

The five districts consist of 22 local municipalities where these farming cooperatives operate. Each of the districts has local municipalities, which are the specific locations where the participants came from. For a better understanding and full knowledge of where the population was derived, it is important to provide the following maps of the local municipalities, starting with Capricorn, Mopani, Sekhukhune, Vhembe and Waterberg.

Figure 20: Map of Capricorn District Municipality
Source: Capricorn District Municipality (2020)

The above map of the Capricorn District Municipality in Figure 40 shows the four local municipalities, namely Blouberg, Molemole, Polokwane and Lepelle-Nkumpi, where the cooperative population was obtained from.

Capricorn District Municipality depends on two primary economic drivers, namely farming or agriculture and mining. Most of the participants in this study are directly involved in the performance of these two sectors of economy.

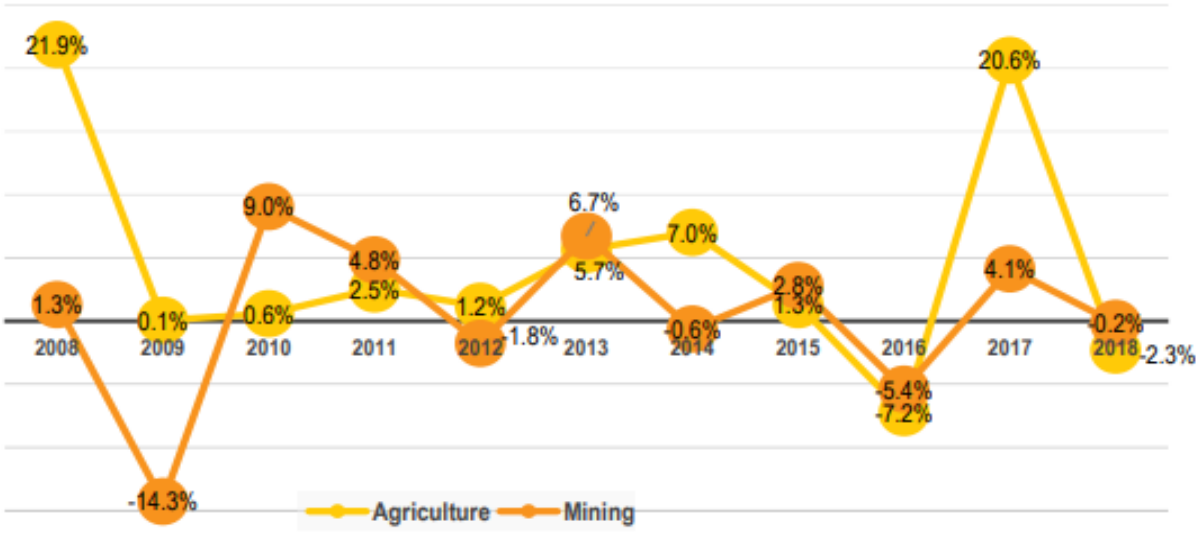


Figure 21: Agriculture and mining performance as two primary economic drivers in Capricorn District (2008-2018)

Source: Capricorn District Municipality [CDM] (2020)

In the ten-year period (2008–2018) as depicted in the Capricorn District Municipality above, farming (agriculture) has seen slow growth between 2008 and2014, and a decline especially between 2015 and 2016, which could be attributed to less than normal rainfall or possibly droughts. The sector gained momentum a year later with a 20,6% growth. Capricorn District Municipality is one of the municipalities where some of these incubation samples came from.

Figure 22: Map of the Mopani District Municipality

Source: Mopani District Municipality [MDM] (2020)

The Mopani District Municipality has five local municipalities, namely Greater Letaba, Greater Giyani, Greater Tzaneen, Ba-Phalaborwa and Maruleng. The farming cooperatives are situated in these local municipalities.

Figure 23: Map of Sekhukhune District Municipalities with four local municipalities
Source: Sekhukhune District Municipality [SDM] (2020)

The Sekhukhune District Municipality has four local municipalities, namely Fetakgomo-Greater Tubatse, Makhuduthamaga, Ephraim Mogale and Elias Motsoaledi. The three sampled cooperatives for this study were obtained from these local municipalities.

Figure 24: Map of the Vhembe District Municipality with four (04) local municipalities
Source: Vhembe District Municipality [VDM] (2020)

Vhembe District Municipality has four local municipalities: Musina, Thulamela, Makhado and Collins Chabane. This district municipality has the highest number of incubated farming cooperatives from which the samples came. Farming and mining are the primary economic drivers of the Vhembe District Municipality, as shown in Figure 44.

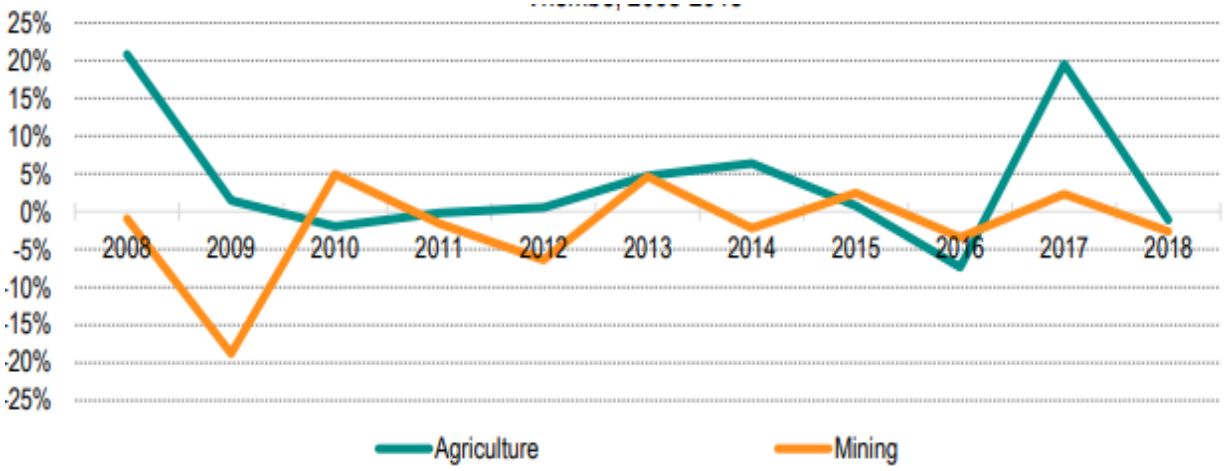


Figure 25: Performance of agriculture and mining in Vhembe District (2008–2018)
Source: Stats SA (2019)

In the ten-year period 2008–2018, Vhembe District Municipality has seen a steep decline in the farming sector of approximately 0% and -5% between 2009–2016, a growth of 20% in 2017, and another decline in the last year (2018). Vhembe District Municipality is one of the areas were research samples were drawn from.

There is an interesting observation from Figures 3 and 7, Figures 40 and 44, Capricorn and Vhembe Districts respectively. The two have more or less the same trend which reflect up and downs of agriculture that could be associated with climate change and drought.

Figure 26: Map of Waterberg District Municipality with five (05) local municipalities
Source: Waterberg District Municipality (2020)

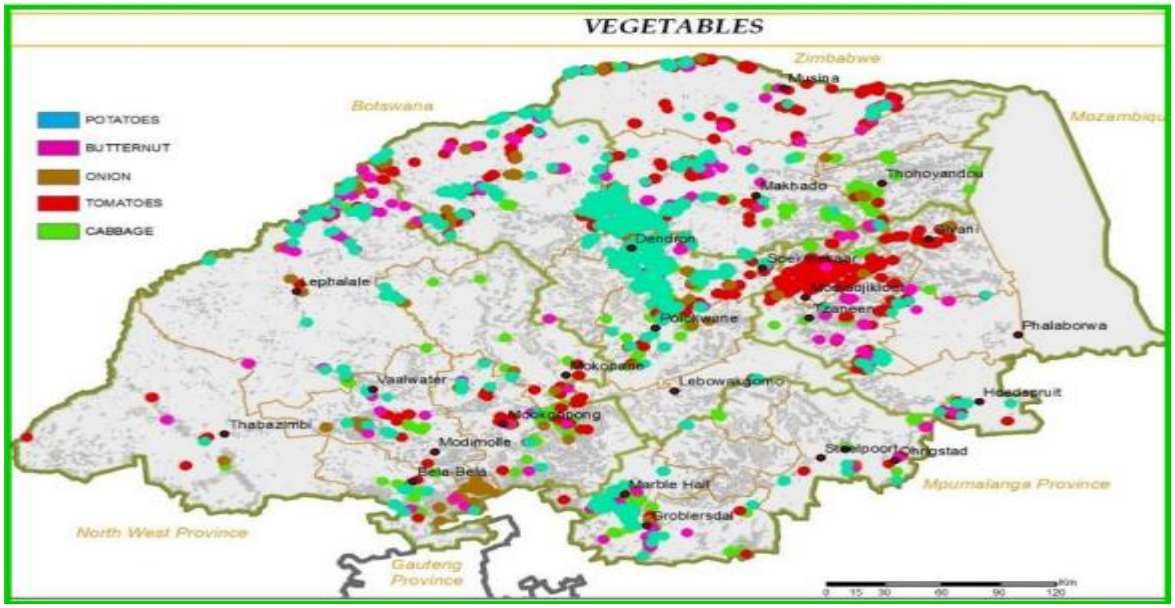


Figure 27: Dominant farming produce in Waterberg District
Source: Waterberg District Municipality (2020)

Vegetable farming is one of the main activities in Waterberg District. The district has vast land of approximately 3 413 300 km^2, used mostly for commercial farming. Cabbage is one of the dominant vegetables in the area, followed by tomatoes and butternut, with onions being the least produced.

The following table is a representation of the key features of the five districts municipalities in Limpopo Province:

Table 10: District population and economic drivers

Name of district	**Key features**		
	Land area in km^2	**Total Population**	**Primary Economic drivers**
Capricorn	21 705	1 372 355	Mining and agriculture
Mopani	20 011	1 150 722	Mining and agriculture
Sekhukhune	13 528	1 194 307	Mining and agriculture
Vhembe	25 597	1 402 779	Mining and agriculture
Waterberg	3 413 300	761 590	Mining and agriculture

Source: Statistics South Africa (2019)

The table above shows that farming is the main economic driver in two districts, namely Vhembe and Waterberg, while farming is the second dominant economic driver after mining in the Capricorn, Mopani and Sekhukhune Districts. Further depiction shows that Waterberg District Municipality has the highest land area of 3 413 300 km^2; yet the least in population. Capricorn District Municipality has the highest population, with 21 705 land area. Sekhukhune District Municipality has the least land area and population of 1 194 307. Sekhukhune may be the highest overpopulated district. However, all the five districts depend on mining and farming as the main drivers of economy.

Table 11: Number of incubated farming cooperatives per district in Limpopo Province

District	**Number of farming cooperatives per district**	**%**
Capricorn	07	12.5%
Mopani	10	17.9%
Sekhukhune	13	23.2%
Vhembe	18	32.1%
Waterberg	08	14.3%
Total	**56**	**100%**

Source: Limpopo Economic Development Agency (LEDA) (2018)

The above table can diagrammatically be represented as follows:

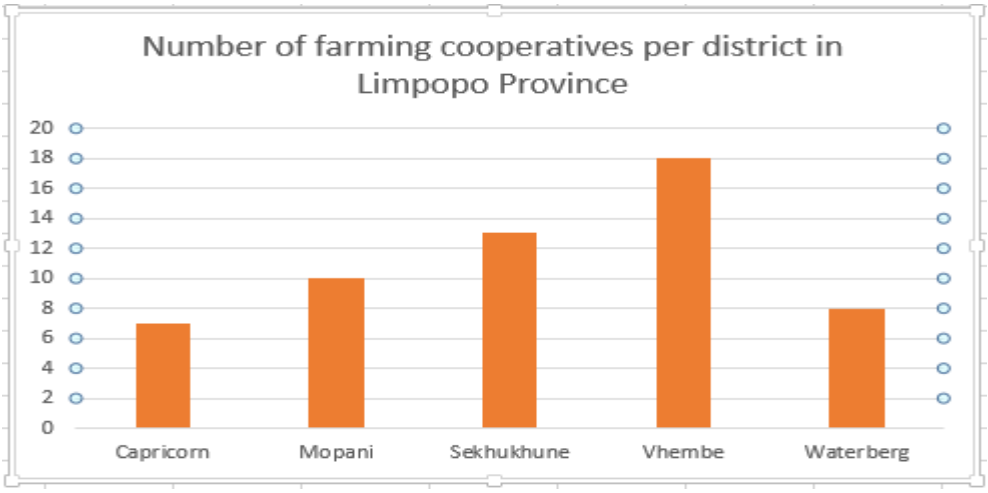


Figure 28: Graphic representation of the number of farming cooperatives per district in Limpopo Province

Source: Limpopo Economic Development Agency (LEDA) (2018)

The above table contains the names of the five districts in Limpopo Province with the available number of the incubated farming cooperatives. The table indicates a total number of 56 incubated farming cooperatives which the study used to obtain the sampling for data collection purposes. Each cooperative is comprised of a minimum of five members represented by males, females and youth totalling 541 members shown as follows:

Table 12: Gender and youth representation of the total population of the study

Gender	**Number**	**%**
Males	127	23,5%
Females	241	44,5%
Youth	173	32,0%
Total	541 people	100%

Source: Limpopo Economic Development Agency (LEDA) (2018)

Figure 29: Composition of the incubated farming cooperative membership
Source: Limpopo Economic Development Agency (LEDA) (2018)

The above graphic representation of the composition of the incubated farming cooperative membership indicates that female members are in the majority, with 44,5%, followed by youth with 32,0%, and lastly males with 23,5%.

3.6.2 Sampling

> For studying a social problem, it is difficult to study the whole universe of the problem under study. It is because it is both costly, time consuming and complex as well as financially not viable (Singh et al., 2015).

Sampling is defined as the selection of the research participants from the population (Taherdoost, 2016). It is the subset of the population from where the participants were obtained. The rationale behind the selection of the participants from the population is that in most cases it is not feasible to obtain data from the entire population. Population from which samples are selected is mostly huge to handle for data collection purposes; hence, sampling becomes necessary. It is time consuming and expensive to study the whole population (Pirzadeh et al., 2011). Research studies require a lot a time and sampling is meant to reduce time by obtaining information from the participants who are representative of the population (Turner, 2020). Turner (2020) further asserts that sampling provides benefits to the researcher, in the sense that the costs to obtain data are lower than focusing on the entire population.

Sampling is one of the critical components of the research, as it determines the credibility of the work being conducted. Showkat and Parveen (2017) assert that a sample should represent the population in all respects as any underrepresentation or imbalance of the samples may compromise the quality of the research findings and ultimately the study itself. Datta (2018) asserts that the selection of the sample has bearing on the quality of work to be produced. The goal of sampling is to have an adequate representation of the population (Pirzadeh et al., 2011). During the sampling process, errors can occur. Two types of errors have been identified:

The selection error: This type of error happens when there is high possibility of having one or some participants dominating the sample. A selection error takes place in the event where more time is maybe spent on a particular interviewee(s) than on others (Barreiro & Albandoz, 2001). A sample should strive to create a balance, with all involved afforded equal opportunity of participation. One way of avoiding this error is by ensuring good time management.

The non-answer error: This type of error occurs when the selected participants do not want to answer the questions posed to them by the investigator (Barreiro & Albandoz, 2001). Perhaps some reasons for the participants to avoid answering the interview questions may be as a result of the personal questions posed to them. In these instances, the respondents may choose to keep quiet and provide no answers or not answer honestly. The ethical considerations of every research study explicitly allows for participants to excuse themselves from the interview sessions at any given moment without asking permission from the researcher. Any form of forcing the participants to answer questions that they feel uncomfortable with may be against the ethics of research. It is therefore imperative for the investigator to ascertain that the prepared questions are free from such personal information, or rather inform the participants prior to the interview session. Ethical considerations discussed in the last part of this section emphasise the need to be honest and transparent with each other (both investigator and participant). However, these types of errors are generally unavoidable and require a skilful researcher (Barreiro & Albandoz, 2001).

According to Majid (2018), many studies are silent on how the sample size should be determined, as most of these studies determine the sampling through speculations.

> The sample size of a research study should have adequate power and significance, allowing the investigators to be confident that the study findings cannot be attributed to random variations in the population of interest (Majid, 2018).

Elevation factor: it is the quotient between the size of the population and the size of the sample, $\frac{N}{n}$. It represents the number of elements existing in the population for each element of the sample.

Sampling factor: it is the quotient between the size of the sample and the size of the population, $\frac{n}{N}$. If this quotient is multiplied by 100, we get the percentage of the population represented in the sample.

In this study, the sample was obtained from the total population of 541 people using stratified random sampling. The entire population of the study has been classified into various strata or groups of females, males and youth. Each member of the group was allocated a number, which the researcher used to select the participants randomly. For instance, a member belonging to the respective groups will be indicated as follows: F1 (female), M1 (male) and Y1 (youth). This classification assisted the researcher to differentiate between the various group members.

According to Duesbery and Twyman (2020), stratified random sampling is very important especially in studies where there are small groups of people with unique interests. In the case of a group having one only member, that member was automatically considered for participation. In such instances, the researcher noted that as one of the limitations to be reflected in the study.

3.6.2.1 Stratified random sampling

Although this research has wholly opted for qualitative methods, the researcher deviated a bit and employed the stratified random sampling technique from quantitative research methods to ascertain a fair spread of possible respondents. Stratified random sampling technique is a probability sampling technique. The stratified random sampling is found to be a fair procedure that will embrace all without bias. Non-probability sampling techniques have been found to be subjective and the results are mostly questionable. This deviation undoubtedly filled the void or addressed the weaknesses, as alluded to above.

Stratified random sampling is the method that uses strata for the selection of participants. Strata are defined by Pirzadeh et al. (2011) as the partitions or the subpopulation, from heterogeneous into homogeneous. For example, the subpopulation or strata may be divided according to gender, male or female, academic qualifications, etc. Showkat and Parveen (2017) regard the stratified random sampling method as the improved version of the systematic sampling method. The selection of participants are divided according to the desired homogeneous characteristics.

The stratified random sampling method has two types, namely proportionate and disproportionate. Proportionate stratified random sampling is obtained when the size of the sample is harmonious or balanced and disproportionate strata are not proportionate or balanced.

Table 13: Incubation sampling frame depicted per district

Districts	Males	Females	Youth	Total	%
Capricorn	29	23	18	70	12,9%
Mopani	16	30	27	73	13,5%
Sekhukhune	29	49	33	111	20,5%
Vhembe	37	95	69	201	37,2%
Waterberg	18	42	26	86	15,9%
	129	**239**	**173**	**541**	**100%**

Source: Limpopo Economic Development Agency (LEDA) (2018)

The above table of the incubation samples per district has been graphically represented as follows:

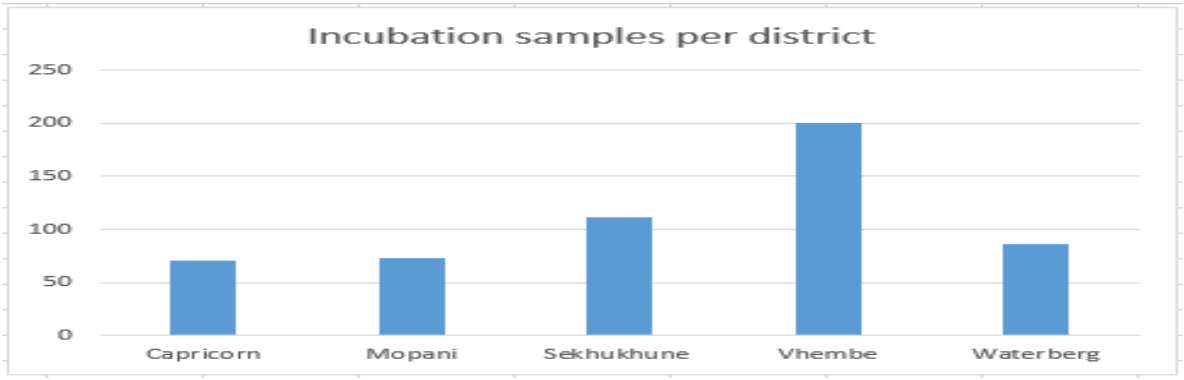


Figure 30: Graphic representation of the incubation samples per district
Source: LEDA (2018)

The incubation samples frame per district as shown in Figure 50 above indicates that Vhembe has the highest number (37,2%), followed by Sekhukhune (20,5%), Waterberg (15,9%), Mopani (13,5%), and Capricorn (12,9%).

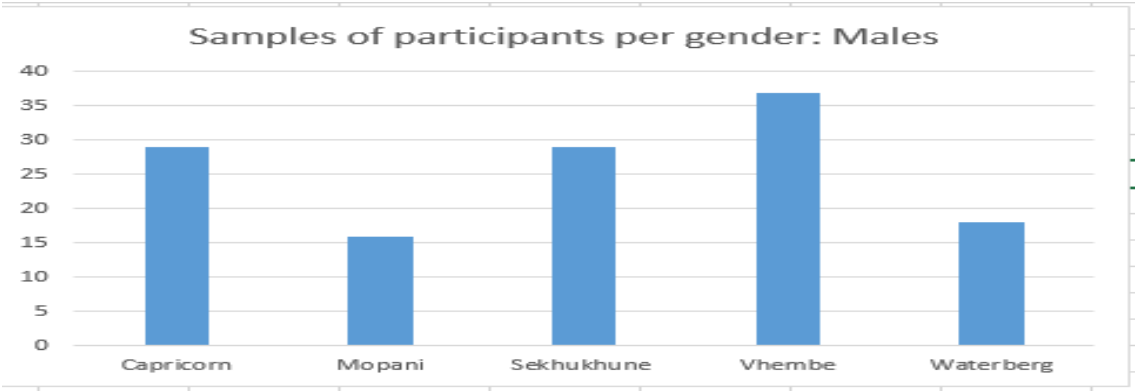


Figure 31: Graphic representation of the incubation samples per gender (Males)
Source: LEDA (2018)

From Figure 51 above, it can be seen that Vhembe District has the highest number of males (37) in the rural incubated farming cooperatives, with Capricorn and Sekhukhune both at 29, Waterberg at 18, and last Mopani at 16.

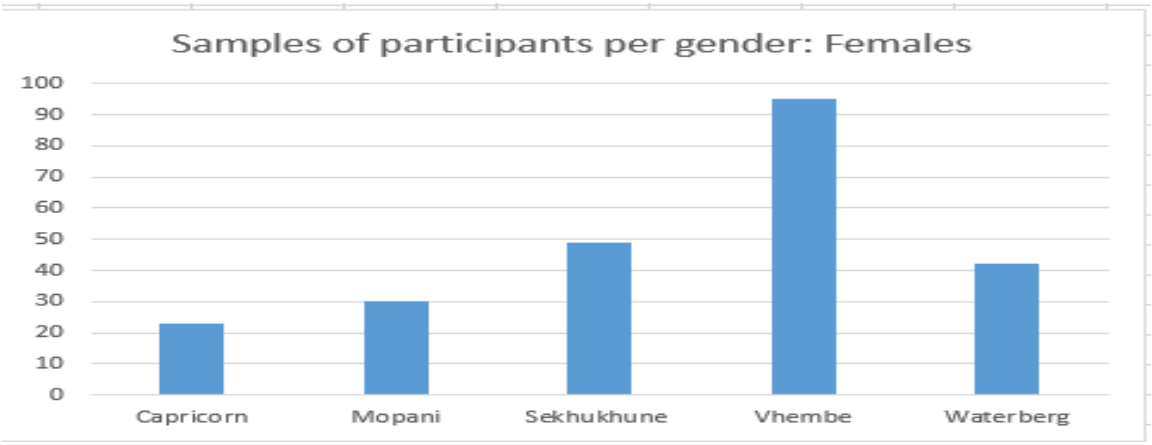


Figure 32: Graphic representation of the districts population per gender (Females)
Source: LEDA (2018)

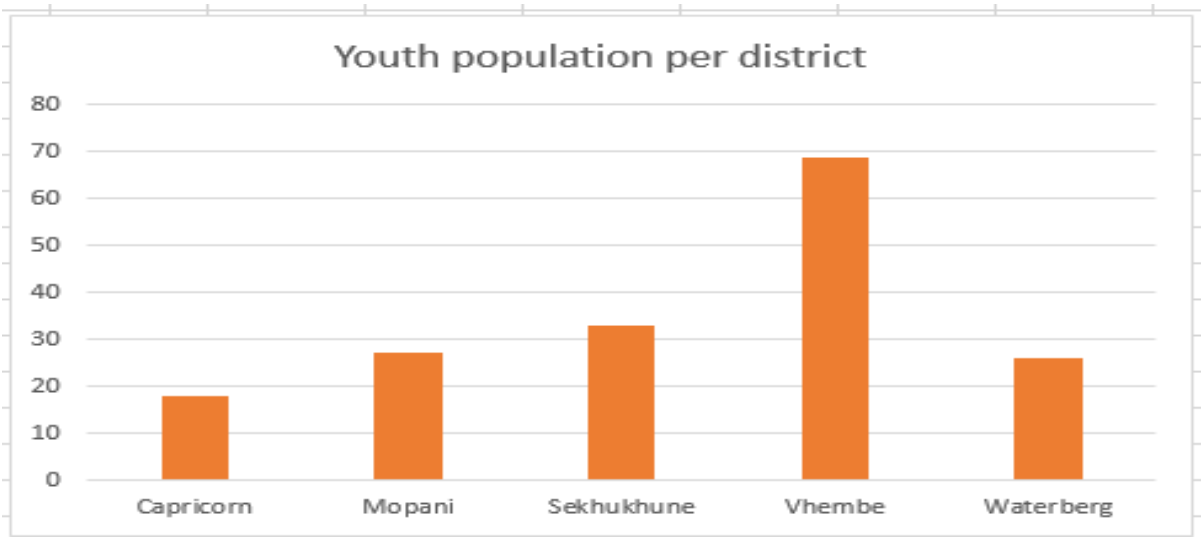


Figure 33: Youth graphic representation of district
Source: LEDA (2018)

On average, most incubated farming cooperatives of this study consist of five members as per the *Cooperative Act 6 of 2013* (RSA, 2013). In order to maintain a proportionate stratified random sampling, the research opted to take three members from each cooperative. The participants comprised a male, female and youth. However one of the three would be either a chairperson, secretary or treasurer of the cooperative. From the population of 541, the sampled participants were therefore 168 participants, as shown in the following table:

Table 14: Number of proportionate sampled participants

District	**Number of farming cooperatives per district**	**Number of proportionate sampled participants**
Capricorn	07	21
Mopani	10	30
Sekhukhune	13	39
Vhembe	18	54
Waterberg	08	24
Total	**56**	**168**

Source: LEDA (2018)

The above table can graphically be represented as follows:

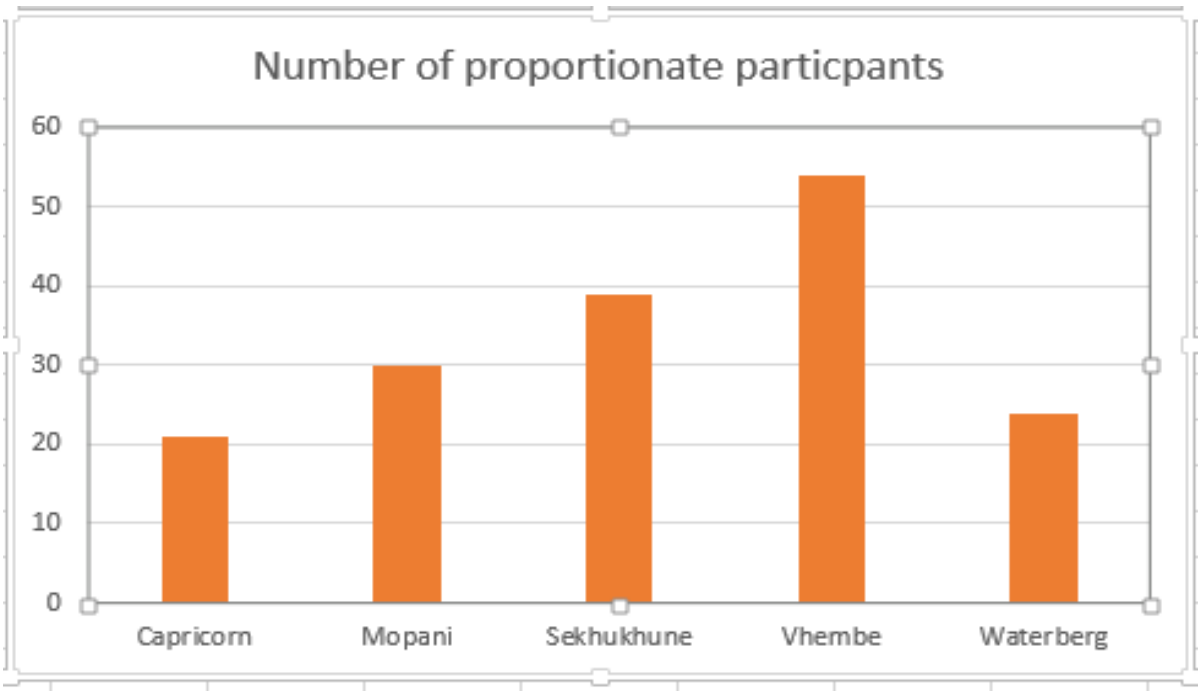


Figure 34: Graphic proportionate of participants
Source: LEDA (2018)

The above graphic representation of the proportionate participants maintained a fair participation of each cooperative. For example, the district with the highest number of cooperatives (Vhembe District) had a high number of participants and the district with the lowest number (Capricorn District) had the lowest participation.

Due to the challenges brought about by the coronavirus, one-on-one telephonic interviews were conducted using semi-structured interviews. Participants decided on a suitable date and time to be interviewed. Ethical considerations and purpose of the study were clearly articulated to the participants.

3.7 DATA ANALYSIS

The researcher employed a thematic analysis procedure. However, given the number of participants whom data were collected from, a high volume of data (from documents and recordings) were anticipated. It may sometimes be a loss of valuable information if the collected data are not properly managed. It is against this backdrop that the researcher employed the Atlas.Ti qualitative software programme to analyse the collected data. The

system was helpful in creating themes for further discussion of the findings. The Atlas.Ti has five steps, depicted as follows:

Figure 35: The five steps of the Atlas.Ti data management system
Source: Lewis (2015)

The above figure depicts the five steps of the Atlas.Ti, i.e. documenting, quoting, coding, creation of themes, and networks or links. It is the process that assisted in simplifying the discussion section of the study. Themes and networks or linkages are critical, as they show the similarities and differences of various themes.

3.8 CONCLUSION

This chapter gave an exposition of the critical concepts relevant for the study with a view to highlight the research tools employed. A comprehensive discussion of the specific research paradigms were captured, including why they were relevant in this research project. The qualitative research methodology and approach have been discussed as well as justification thereof.

The primary data collection techniques of interviews, questionnaires and observations were covered. Most importantly, a detailed and narrative discussion of the application of these techniques to this study was presented.

Lastly, a comprehensive discussion of the research design pertaining to sampling and sampling type was discussed. The implications of the population sampling was also depicted in a few relevant tables, figures and maps. A thematic analysis of data to be used by means of an Atlas.Ti software management system has been shared.

CHAPTER 4
PRESENTATION OF THE RESEARCH FINDINGS

4.1 INTRODUCTION

Chapter 3 presented the roadmap on how data was obtained from the research participants. The section broadly discussed the research design which clearly unpacked the setting, population and sampling procedures to be followed. A semi-structured interview guide was developed and implemented in the five districts of Limpopo Province, namely Capricorn, Mopani, Sekhukhune, Vhembe and Waterberg.

In this chapter, more focus will be on what has been uncovered during the telephonic interviews, with particular attention to the key research objectives, namely the extent of ICT adoption for development of the incubated rural farming cooperatives in Limpopo Province; the challenges associated with ICT adoption; the perceptions of the incubated rural farming cooperatives on ICT adoption; and the critical success factors towards ICT adoption for development of the incubated rural farming cooperatives in Limpopo Province.

Most people in rural areas are illiterate and the present research participants are not immune (Myeni, 2022). The semi-structured interview guide was translated from English into Sepedi to accommodate the literacy levels of the participants, especially those who are not comfortable in English. The responses were captured by using an audio recorder and later translated into English.

The findings of the study were obtained from 31 participants of the 56 cooperatives, with the response rate as shown in the graph below:

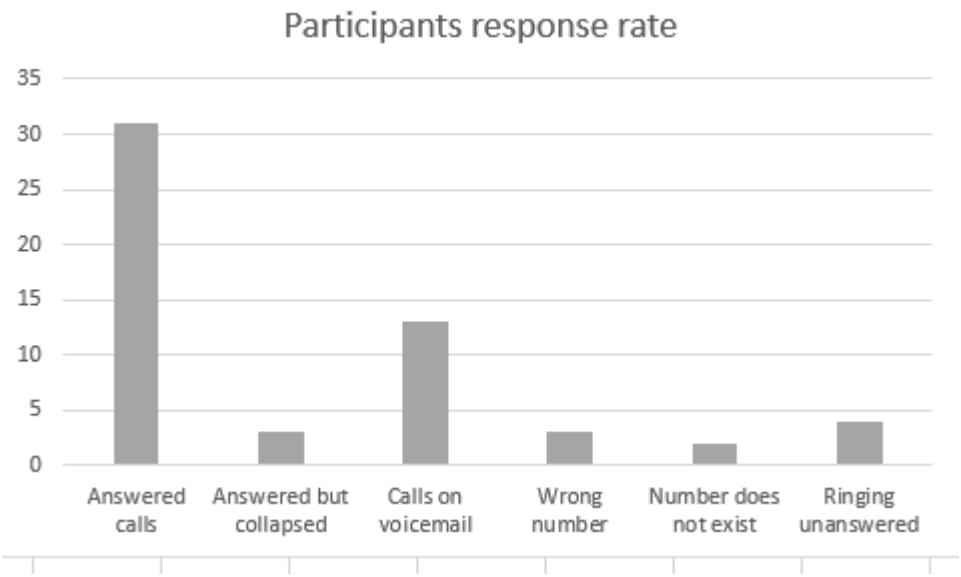


Figure 36: Participation rate
Source: Own

The response shows that 55,4% were answered, but collapsed cooperatives at 5,4%; calls on voicemail at 23,2% with no calls returned; wrong numbers at 5,4%; number does not exist at 3,6%; and ringing unanswered at 7,2%.

The following graph is an indication of the participation rate per district:

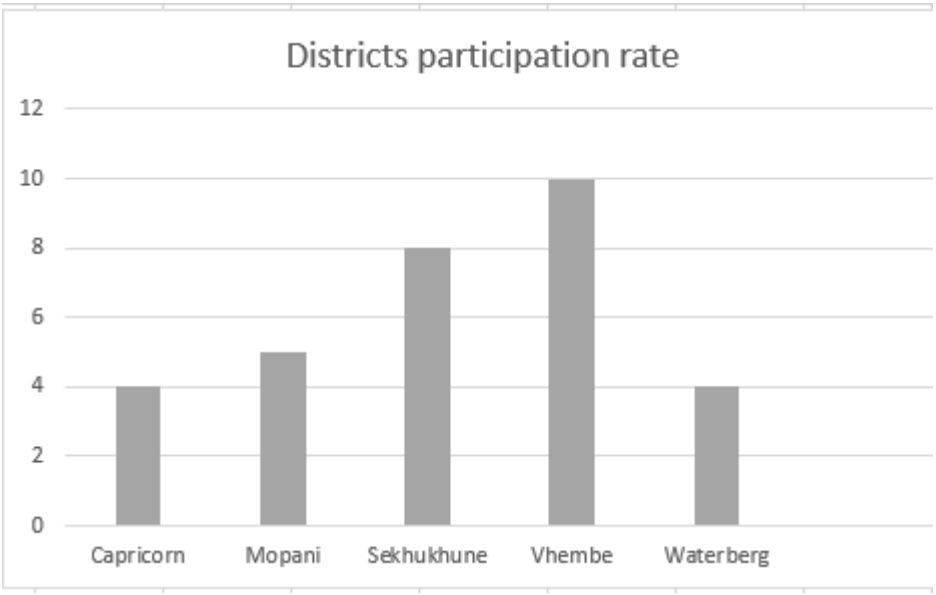


Figure 37: Districts participation rate
Source: Own

Vhembe District led the participation rate with 10 participants (32,3%); Sekhukhune with 8 participants (25,8%); Mopani with 5 participants (16,1%); Capricorn with 4 participants (12,9%) and Waterberg with 4 participants (12,9%).

The following graph is a reflection of the participation in terms of age:

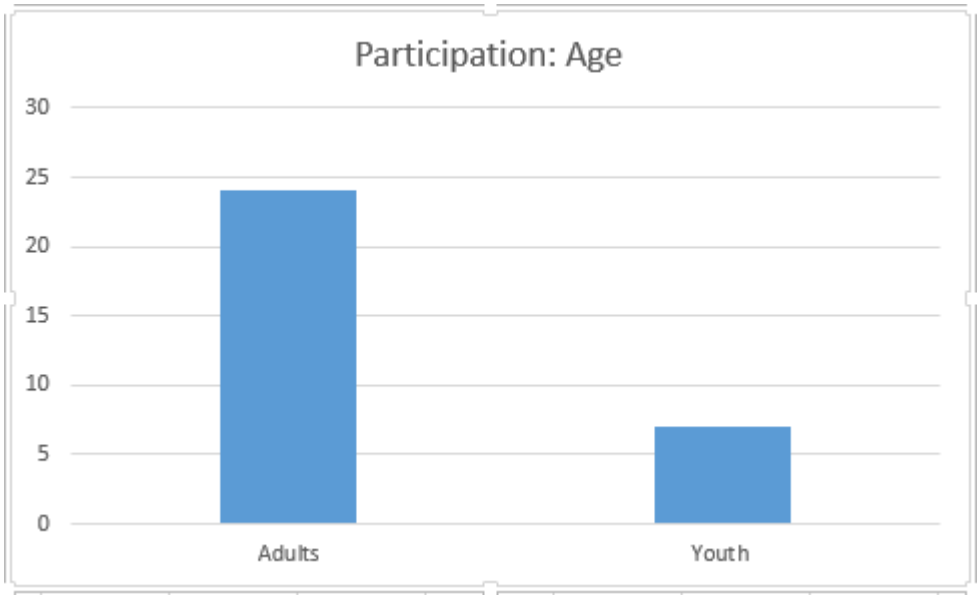


Figure 38: Age participation
Source: Own

Adult participants were in the majority with 24 participants (77,4%), compared to the youth with 7 participants (22,6%).

From the 31 participants, 19 were females and 12 males, as represented in the following bar graph:

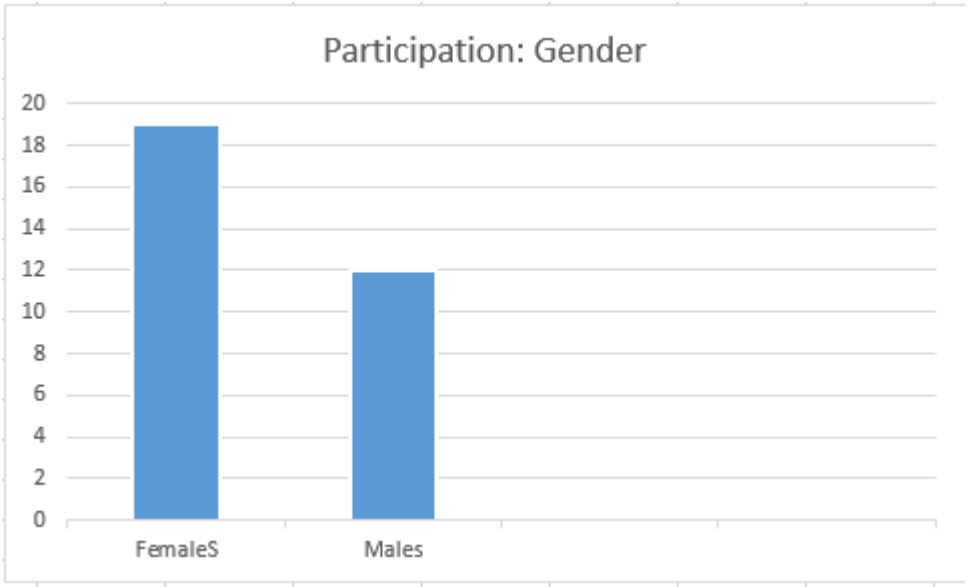


Figure 39: Participation per gender
Source: Own

More females than males participated in the study. The number of female participants constituted 61,3% of the 31 participants and males 38,7%. There are more female farmers than males in the sector.

The key themes of the study are mainly derived from the research objectives, namely:

- The extent of ICT adoption
- Perceptions of incubated rural farmers towards ICT adoption
- Challenges of ICT adoption
- Critical success factors towards ICT adoption

The above themes further yielded subthemes, which will be described in this section of the study.

Conducting interviews require an approach that will bring comfort and eradicate anxiety in both the interviewer and the interviewee. For that reason, the main research questions were preceded by general questions about the cooperatives in order to put the participants at ease for the process. This included asking the participants about the profiles of the cooperatives, for instance, the establishment of the cooperative; number of members in a cooperative; type of crops or livestock; and size of the land in case of crop farming. These introductory questions

served as ‘ice breakers’ and the participants were more than relaxed to respond to the main research questions. These questions are closely relevant to the project, as some of the findings form part of the critical variables that will be covered in this part and the subsequent chapter.

For purposes of maintaining research ethics, names in this findings are not real names, but pseudonyms, in order not to compromise the quality of information received from the participants.

The following is a schematic representation of the key themes that form the core of the study findings:

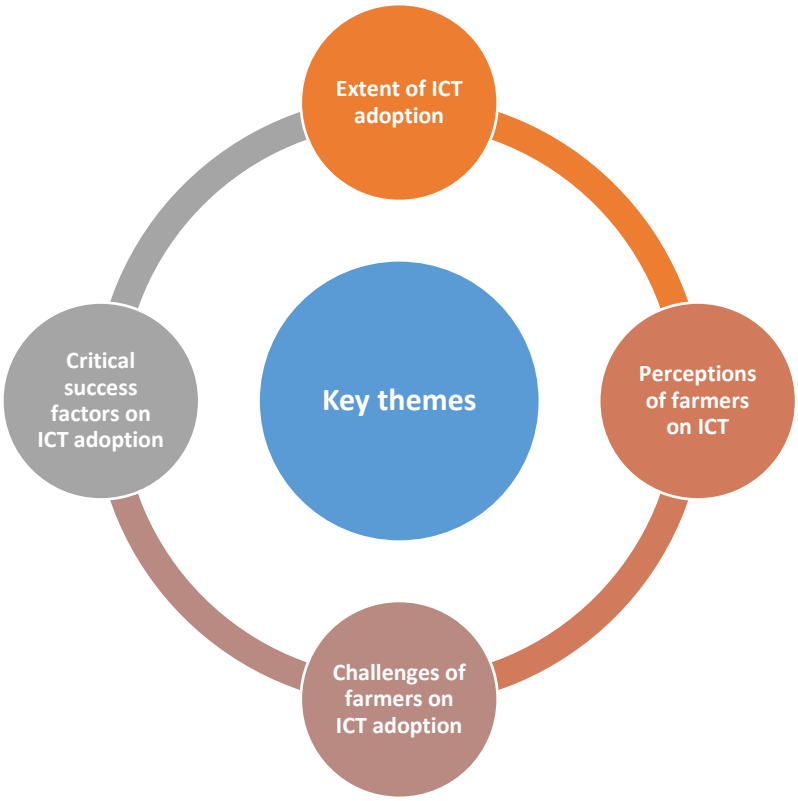


Figure 40: Key themes
Source: Own

4.2 THEMES

4.2.1 Theme 1: The extent of ICT adoption in farming

Theme 1 is about the extent of ICT adoption in farming emerged from the following research question:

To what extent do the incubated rural farming cooperatives in Limpopo Province adopt ICT for development?

In responding to the above question, the participants provided different views which yielded four main subthemes, which can schematically be summarised as follows:

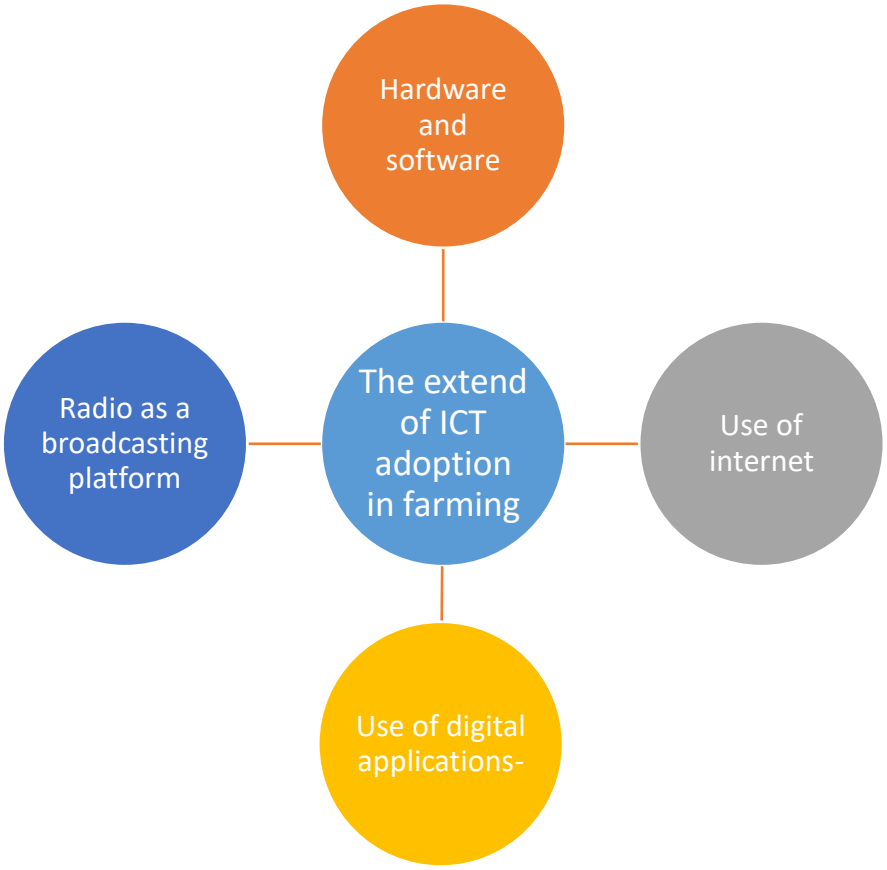


Figure 41: The extent of ICT adoption theme
Source: Own

4.2.1.1 Sub-theme: Hardware and software

There are cooperatives that have only basic technological devices like mobile phones to run the business. Some of these mobile phones are not smartphones and they are primarily used for making calls, and sending short message services (SMSs) and 'please call me' messages.

Mabele said: *"*... you know a fancy... *gape cell phone ya matsaka e a turwa, re itheketše tšona tše"*, in English translated as "cell phone is expensive, we bought these affordable ones".

The use of low-cost mobile phones, especially among older and some pockets of younger farmers was found. Apart from the expensive nature of these devices, one **Billy** said:

> (*O a sega), matsogo a rena a phela a tlotse ditšhila, re šoma ka meetse le mabu bjale gantšhi cell phone ge e lla, e hwetša ka nako e nngwe o le gare o nošetša ka dipipe goba o lokisha leotwana la trekker. Bjale SASSA e wa gantshi mo letšatšing e bile e a kgotlelela translated in English as*
>
> ... (laughing), our hands are ever dirty, we work with water and soil and sometimes a cell phone rings while you are changing irrigation pipes or fixing a flat tyre of the tractor. These 'SASSA phones' (referring to the low cost phones) fall many times during the day and they are durable.

There are farmers who have technological tools like laptops and printers. These are mostly the youth who have basic ICT skills. Some e-mail to receive correspondence from their extension officers. However, WhatsApp is the most widely used platform to communicate. Apparently, this application is seen to be cheaper and more convenient, compared to airtime. The participants frequently mentioned frequently that WhatsApp was one of the communication modes used by some extension officers to assist farmers in cases like providing solutions to farming challenges.

In most cases, mobile phones are used to invite potential clientele, especially when the produce is ready. One participant producing broilers said:

> We have customers all over and we make telephone calls to inform them of the readiness of the broilers". We also call the locals so that they do not feel excluded.

The use of mobile phones has emerged to be an important tool used to check the market prices. Some participants whose businesses have reached the commercial level use mobile phones to enquire about market prices.

> … I buy airtime myself and make calls to various markets like Cape Town, Durban, Krugersdorp, Pretoria and Johannesburg (City Deep) to compare prices. I then take my produce to Tzaneen for Premier Trucking to transport them to where there is better price.

Some features of the mobile phone like the camera are very critical when it comes to taking pictures of crops and animals and forward them either to the extension officers in cases of

diseases or put such pictures on platforms like WhatsApp, Facebook and Instagram as a way of marketing they produce.

The levels of cooperative advancement are different. Some farming cooperatives use advanced levels of technology. For instance, one participant mentioned that he used technology to provide heat to the broilers. He further stated that he used a laptop to keep a record of the stock including mortalities.

The use of a universal serial bus, commonly known as a USB, has been mentioned as a good storage for information. It is seen as a portable device that can store a lot of business information.

4.2.1.2 Subtheme: Use of internet cafés

The use of internet cafés in most farming cooperatives has surfaced as an alternative means of communication, especially those businesses without resources like computers and printers. The farmers pay visits to these businesses to download documents and respond to e-mails.

These businesses (internet cafés) are also useful for the farmers to browse the internet searching for relevant solutions for their produce as one participant said:

> … tomatoes have numerous challenges and we search on the internet for solutions. We should have closed this cooperative in 2009 if it was not because of the internet café"

4.2.1.3 Subtheme: Use of digital application

It has emerged at some few cooperatives that ICT had been adopted up to the point of using some applications like banking applications to effect payments to the members as well as paying for their needs required by the business.

> Uhmm, what can say? (sigh …), technology has many benefits. We stay very far from the Musina Town and transport is expensive. We are using a banking app to pay for whatever….

Apparently the users have begun to reap the fruits of using technology.

4.2.1.4 Subtheme: Radio as a broadcasting platform

Radio is one of the available platforms for information sharing. Most mobile phones, especially low-cost phones, have radios in different languages like Sepedi, TshiVhenda and Xitsonga.

> … if I don't have data for internet, I switch on Phala Phala FM as it provides different national market prices of various produce on Tuesday morning at 5h00.

4.2.2 Theme 2: Perceptions of farmers on ICT

The above theme emerged from the following research question:

> What are the perceptions of the incubated rural farming cooperatives towards ICT adoption in Limpopo Province?

The above English version was translated into Sepedi as follows:

> *Naa e ka ba bjalo ka temo ya kalamelo ya mohlakanelwa, mmono wa lena o reng ka ga tšhomišo ya mafarahlahla a thekonolotši go godišeng ga kgwebo ya lena?*

This is the smallest theme of the four themes in this section of the study, yet the most critical section not to be ignored. It is more concerned about the participants' confirmation or denial of ICT adoption. It is more focused on the participants' views and perceptions about technology. Responding to these questions on perceptions undoubtedly served as a gauge or an indication of the future of ICT adoption in farming. Most participants provided their different versions on this aspect and of course not all participants spoke with one voice.

There are some participants who are for technology embracement in their businesses, while some prefer using the blended approach and those who still want to go the traditional way of farming.

The results of the study will therefore reflect on the three tiers of ICT perceptions alluded to above, as shown in this diagram below:

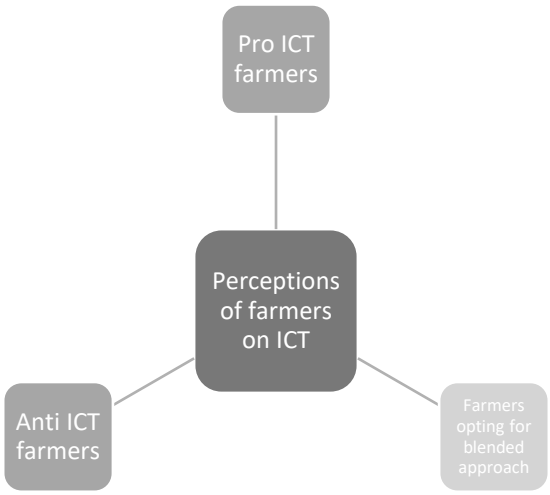


Figure 42: Perceptions of farmers on ICT theme
Source: Own

4.2.2.1 Subtheme: Pro ICT farmers

The majority of the participants (19 = 61,3%) interviewed had a positive perception towards the embracement of ICT in their farming. Some have apportioned the success of their cooperatives coming from the infusion of technology as **Maestro** said:

> … I have realised the benefits of technology. Because today I talk to my marketing agent in City Deep, Johannesburg without driving there. Imagine if there was no telephone to constantly communicate with this person on what is happening in the markets. No farmer especially those living far from these markets will thrive. It is a costs cutting measure in our businesses.

Sehlabeng said:

> Eish! … I'm lacking words to express exactly what I want to tell you but *bophelo bja* today is technology translated in English to mean technology is the bedrock of today's life.

Technology has been confirmed by some participants as the tool for information sharing and the globe is now connected through it. It is further perceived as the tool that provides network with the outside world. He further stated that technology was the way to go and that one could not run away from it. **Neven,** one of the participants, view technology as very instrumental in the present economy

> … there is no progress in farming without using technology …

4.2.2.2 Subtheme: Farmers opting for blended mode

Some farmers use a blended approach of both technology and non-technology. Although the benefits of technology have been realised, the traditional approach is still in place. One participant said (taking time to respond):

> …our business market depends solely on the locals and we mostly conduct door-to-door visits to sell our produce. We sometimes call old clients informing them of the readiness of our crop but door-to-door *e a re berekela, shem*, meaning "it is working for them".

One of the participants indicated that face-to-face discussions helps a lot, as they are able to convince their clients using effective marketing strategy. He even said "*ditaba di tšwa mahlong"* in Sepedi meaning "face-to-face talk is fruitful".

Mmahlaole actually shared a comparison of using both technology and the conventional approach. She concluded that she used her mobile phone to make appointments but preferred to physically pay visits to the clients.:

> … technology is good sometimes but …*eish e staraga* (it is slow to generate profit as compared to physical visiting of clients).

4.2.2.3 Subtheme: Anti-ICT farmers

Besides the pro-ICT and blended approaches of ICT adoption discussed above, there are those who are against ICT adoption.

4.2.2.3.1 Self-sufficient

Most farmers, especially those against the use of technology in their farming business, believe in the knowledge that have accumulated over time.

> *... ke godišitšwe ke temo ye and ke tseba kudu ka yona, meaning he grew up in farming and he has vast knowledge about it. Ke rutile batho ba kgole le kgauswi gore tamati e nyakang, le balemi ba tla mo go botšiša ka malwetši le kalafo ya tamati,*

translated into English as

> I taught many aspiring tomatoes growers including other extension officers consult to know about the different tomato diseases and treatments thereof.

4.2.2.3.2 Resistance to change

Most adult farmers are not ready to embrace technology in their farming. They associate technology with the western culture and they find it difficult to adjust.

> *…go thušang gore o bolela ditaba, yaba mongwe o go thaeditše? Gape dilo tše ga di na sephiri (O a sega)* (it is of no help to talk with someone while there is someone on the other side listening? Technology has no privacy or secret (laughing).

He further said:

> *… e no ba bo thopa dimolaleng* (technology is the secret exposer and intercepted).

Leeto said:

> *…ke goletše ka mo polaseng, ke tseba potato ka ntle le ka gare. Re rutilwe ke molemi wa leburu ka 1956 go bjala potato. Batho ba tla mo dikoloi ba reka ka mapokisi ba tlatša dibene le di truck* (he grew up in the farm with vast knowledge on how to produce sweet potatoes. He has been taught by white farmers in 1956 to farm sweet potatoes and customers come to fill their small and big vehicles).

Hunadi said:

> I walked to Goseame Fruit and Vegetable market here in Polokwane to market my spinach and after showing them my samples, they were happy with the quality of my produce and I started supplying them till today. I need no technology to do my business.

She further went on and said that maintaining a mobile phone was expensive and would consume the meagre profit generated by the business.

Most cooperatives without youth conduct business using the traditional way of farming. They rely mostly on their experiences with due neglect of technology. One of the participants said:

> *…thekinilotši ke selo mang* (what is technology)?

The statement shows the participant having a negative attitude with little or no interest in technology. In Sepedi when one says, *… ke selo mang sona seo …* (what is that), two meanings that can be deducted from that. The speaker may literally be asking for definition or description of something or having no interest in that object at all. It also depends on the tone of the speaker. In this case, **Mr D**, the participant, sounded very annoyed and completely not interested in

what technology is about. The tone expressed by the participant was that of not being interested and with a negative attitude towards technology.

4.3 THEME: CHALLENGES OF ICT ADOPTION

Theme 3 of the study focused on the following research question:

> What are the challenges of ICT adoption faced by the rural farming cooperatives in Limpopo Province?

The research question was further translated into Sepedi as follows**:**

> *Naa e ka ba ditlhohlo goba ditšhitišo ke di fe tšeo le lebanego le tšona go ka akaretša tšhomišo ya mafarahlahla a thekinolotši kgodišong ya kgwebo ya lena ya temo ya mohlakanelwa?*

The adoption of ICT in farming is not without challenges. Some of these challenges include network coverage; low youth participation; technological language; low ICT skills; the expensive nature of technology devices and maintenance; and illiteracy. These challenges can schematically be represented as follows:

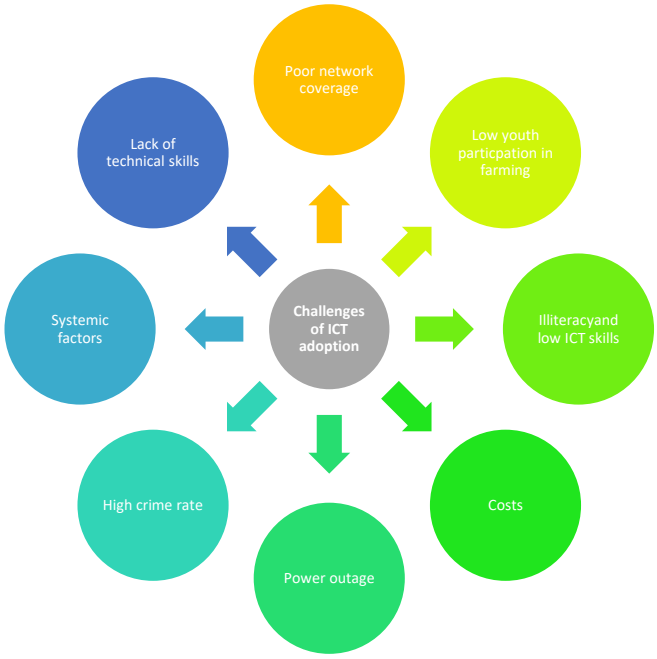


Figure 43: Challenges of ICT adoption theme
Source: Own

4.3.1 Subtheme: Poor network coverage

Some of the participants frequently cited poor network coverage as a setback for effective usage of technology in their businesses.

Uncle J said:

> … I leave my cell phone at home because there is no coverage on my farm. We have long reported this to the municipal council but nothing so far. There are some few spots around the farm where there is little coverage for MTN but Vodacom is zero coverage.

Some indicated that network coverage was worse these days.

4.3.2 Subtheme: Low youth participation

It has since emerged that youth are very instrumental when it comes to ICT adoption. They are mostly associated with high technology usage, compared to adults. Farming is one of the economic sectors dominated by adults. It has fewer youth who also stay long as members of the business.

Molokwane said:

> … youth want money but they don't want to dirty themselves with soil … *bana ba rena ke dibodu, ga ba nyake go bereka, e bile o ka se ba bone le mo …eupša re tshephile bona ka mo go tša tekinolotši* (… our children are lazy, they don't want to work, you will not even see them closer to the farm … however, we rely on them for these new technological things).

The exodus of youth from farming cripples the agricultural sector. Particularly since young people are very instrumental when it comes to ICT adoption. The youth seem to be the pillar of strength when it comes to technology. However, they do not stay long in cooperatives,

Vaseline said:

> *… re be re na le moswa wa mogolofadi bjale o a tseba gore baswa ke batho ba mohuta mang, ba a emaema, o hweditse dikoropsana mola Tibane* (we had one youth with disability and you know the type of people I am talking about, they do not stay in one place, she got some work at Tibane Mall).

As most adult farmers possess limited basic ICT skills, the vacuum left by the youth mentioned above has bearing on technology in the business. Most youth do not see farming as employment but just as a form of survival.

4.3.3 Subtheme: Illiteracy and low ICT skills

Most rural people are illiterate and this has bearing when it comes to the use of technology. Technology has a specific language that requires following specific instructions.

Matipa said:

> *(A gohlola) ... gape rena re tšwele ka lefasetere ka sekolong, re duletše go thuntha ka Majabatho meaning "(coughing) he absconded and spent most time swimming in the Majabatho river". ...ga re tsebe go thwatlathwatla dilo tše tša makgowa. Ke emela bana ge ba etšwa sekolong gore ke kgone go founa ka gore o tla re o a kgotlakgotla wa senya* (… we are unable to operate these western devices, I wait for my children to come back from school to make a call and attempting to operate these devices can result in messing it up).

Nkareng said:

> *...gape rena re tšhabile sekolo ka morago ga go bowa komeng, ra tšhabela diborong go la Gauteng* (he left school in his early ages after initiation and seek employment in Gauteng Province) … *ke mahlale a sebjalebjale,* referring to "technology as something associated with modern life".

4.3.4 Subtheme: Cost of devices, airtime, data bundles, maintenance and repairs

4.3.4.1 Cost of devices

The embracing of ICT in farming is not only limited to the dialling of calls from the low-cost mobile phones. There is a lot that the farmers miss, like using the numerous applications and platforms like the internet. Most participants interviewed indicated that they used their personal devices because the business was still growing to afford smart phones to access internet, social media like WhatsApp; Facebook and Instagram. "… data are expensive…" said **RR**. She further stated: "… the business is straining our coffers and we are using personal devices".

Tascan said:

> Our printer has since broken and we are unable to fix or buy a new one, we can't afford a mere toner even if it is working.

4.3.4.2 Airtime

Mobile phones need airtime for the user to be able to communicate. Without airtime, communication using a cell phone is impossible. The majority of the participants mentioned the high cost of airtime as one of the challenges. Some opted to use the so-called 'power hour' as a way of saving money and being able to talk much. This is a business strategy from the network companies allocating consumers a particular duration for a fee. For instance, Vodacom has various power-hour options, like buying 10 minutes airtime for R2; 30 minutes for R4; and 60 minutes for R8. These network companies have specials and promotions which some consumers are able to take advantage of.

Rams said: "… airtime is high and *nna ke phela ka* 'power hour' (I use the power hour most frequently to save)".

One **JJ** said: "… Cell C airtime is cheaper, but the problem is the network coverage in our area. This place is mountainous and network is a big challenge".

4.3.4.3 Data bundles

The majority of the participants mentioned the cost of data as one of the impediments for them to use technological tools like a mobile cell phone. This is among the reasons that some opted to leave their devices at home, especially if they had no data.

Mpedi said:

> … it is of no use to have your cell phone without data. Data are killing us. I buy data almost every day. It is more like a grocery these days (Laughing) … Telkom data are better as compared to the MTN and Vodacom, at least it lasts.

The following is an example of the cost of one gigabyte per mobile network provider:

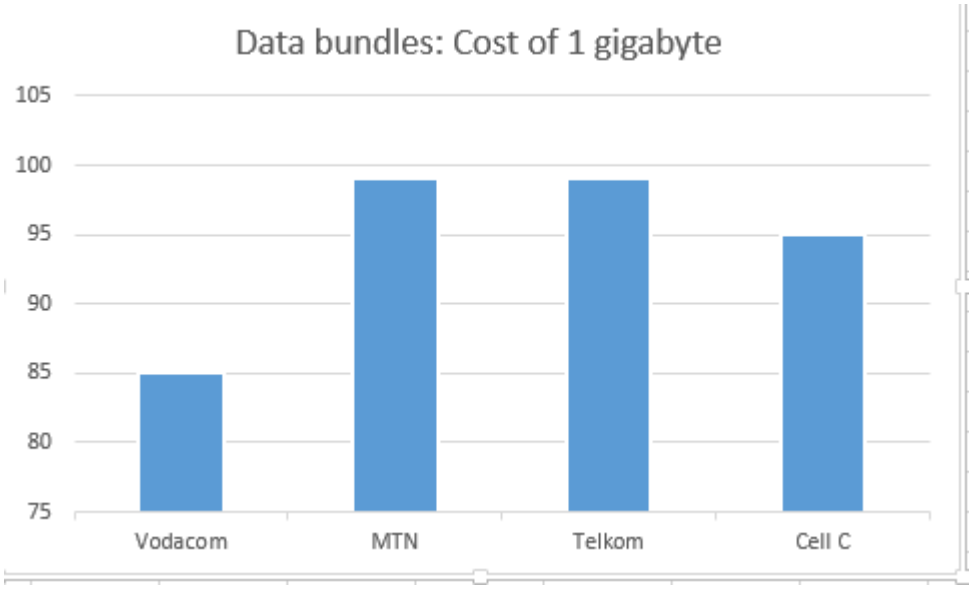


Figure 44: Data bundles costs per network provider (obtained by the researcher in February 2022)
Source: Own

The above bar graph illustrates the cost of one gigabyte from Vodacom, MTN, Telkom and Cell C. Comparatively, Vodacom is the lowest, followed by Cell C and MTN, with Telkom the highest. The lowest price does not mean the data bundles are affordable.

4.3.4.4 Maintenance and repairs

ICT tools need maintenance and repairs, which most participants said were unaffordable. The replacement of a mobile phone battery has frequently been cited as one of the expensive components of these devices. Some indicated that they spent more than R600 to replace a smartphone battery. There are those who resorted to buying cheap batteries from Chinese stores, but the lifespan was less than the original component. They also indicated that some cheap batteries caused them to lose the warranties of their devices.

> "…you know how much is the screen of some smart phones? Some can even cost approximately R1500 to replace. *Eish!, di a re bolaya straight* (they are expensive). … *kgwedi yeo o lokišitšego screen, bana ba nya meetse thwii!* (the month that one has fixed or replaced the screen, children will be starving).

The participants used an idiom, "*go nya meetse*", literally meaning water coming from the back instead of faeces, emphasising the expensive nature of maintaining a mobile phone, especially a smartphone.

4.3.5 Subtheme: Power outage

The frequent power losses, commonly known as loadshedding, is a matter of grave concern to most participants**.** In recent years, the country has encountered a chronic loss of electricity. This is a problem that is also felt by the farming fraternity. Some of the interviewed participants complained about loadshedding as one factor that kept their morale down when it came to the use of technology in farming. "… this electricity thing comes and goes … There is even a schedule of power cuts that is now official," **Ketikani** said.

Phandelani said:

> "I lost an expensive cell phone given to me by my boyfriend as a birthday present because of load shedding. I left it on charger unaware that there was going to be electricity outage. It is completely dead as we speak. The charging point is damaged when the power was restored. …the cost of repairing that phone is just as buying a new one (Very disappointed) and I have no insurance to make a claim".

4.3.6 Subtheme: High crime rate

(Taking long to speak) "Uhhhm,..we got a computer and printer donation from…and all stolen within two months," **Mmathoto** said. She went on to say that the case was opened with the local police station and she had not heard anything since then.

The country has a plethora of cable theft and this has a negative impact on the supply of electricity to the consumers, including the farmers.

> … *re dutše le mahodu, izinyoka, ga re sa na mohlagase, ba utswitše di cable ngwagola* (thieves called *izinyoka* have stolen the electric cables last year).

It is indeed true that ICT connectivity cannot happen without the electricity supply. Any theft of electricity brings the functionality of the devices to a halt. For instance, devices need electricity for charging and network supply.

4.3.7 Subtheme: Systemic factors

The findings revealed that low levels of ICT adoption can also be associated with the system itself. like the departmental officials. For instance, most extension officers who are in the system say little about the use of technology in farming except to send information to the

farmers through social media like WhatsApp and receiving calls from farmers requesting assistance or information pertaining to their challenges.

Rams said:

> … they are very old and they still use the old farming methods (laughing loudly) … I don't know if they know anything about technology…they are the 'old mutual', nickname for old age people. Some of them are just waiting for *mudende* (pension) … *bana ba a gola*, that's all (laughing again but his time showing signs of loss of hope) (meaning the extension officers are there to support their families with less effort on developing the sector). No, I will be lying if I can say they are doing something in that field except the training on how to take care of the chicks. We now know that after receipt of the day-old chicks, we have to give them stress relievers.

It is only not doom and gloom about the extension officers and ICT adoption. There are those who have programmes on technology usage, but the number is extremely low, as depicted in the following bar graph in Figure 65:

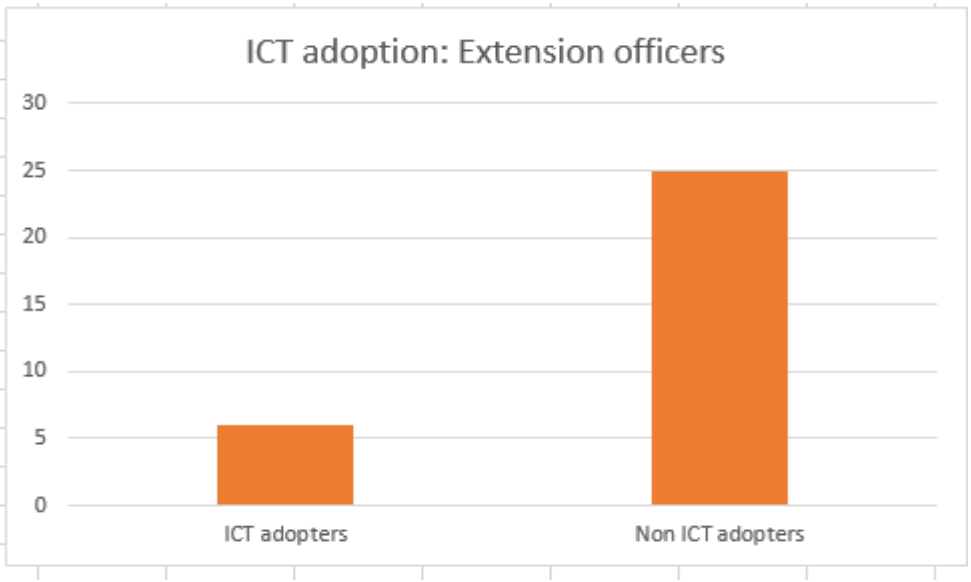


Figure 45: ICT adoption per extension officers
Source: Own

The above graph reflects the adoption and non-adoption of ICT among the extension officers. From the 31 participants interviewed, 6 extension officers (19,4%) have made some strides in using ICT in support of the farmers. They have advised the farmers to use e-mails and

WhatsApps. The remaining 80,6% of the extension officers have been reported not to say anything, let alone encourage the farmers to infuse basic ICT into the business.

4.3.8 Subtheme: Lack of technical skills

The use of ICT involves a lot of technical skills like replacement of drums or toners for printers. It also requires other skills like dealing with viruses. **Fholufhelo** said:

> We have bought a new toner for our printer but we do not know how to replace it. We have to wait for someone with that knowledge to come and assist us.

One **Makgo** said:

> ... people with knowledge of technology charge too much to do a small work of fixing our computer and printer. He sometimes charge us R900–R1250 to replace antivirus. It is worse when it comes to a breakdown.

He further mentioned that the technicians took advantage of them for not having the technical know-how. “We don’t have complete skills on how to use these modern things,” he said.

4.4 THEME 4: CRITICAL SUCCESS FACTORS TOWARDS ICT ADOPTION

The theme on the critical success factors towards ICT adoption emerged after posing the following question:

> To what extent is ICT adoption a critical success factor for rural farming cooperatives in Limpopo Province?, translated into Sepedi as:
>
> *Le ka re nyetlela gore le bona le kgontšwa ke eng go akaretša mafarahlahla a tšhomišo ya thekinolotši kgodišong ya kgwebo ya temo ya lena ya mohlakanelwa?*

The responses from the participants yielded numerous subthemes, as presented in the following figure:

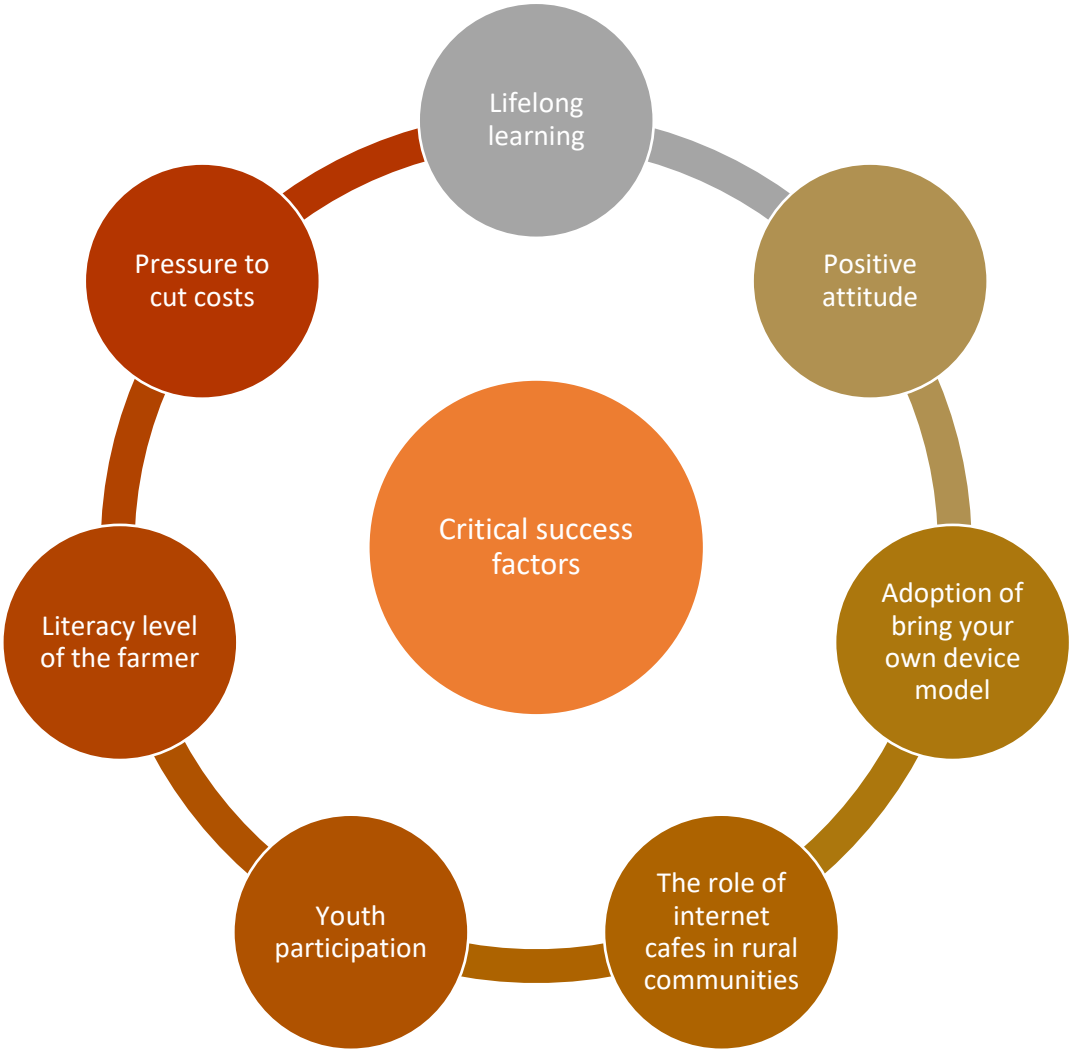


Figure 46: Critical success factors
Source: Own

4.4.1 Subtheme: Lifelong learning (LLL)

Most participants that use ICT in their farming businesses indicated that they had not received any formal education to use technology. For instance, a mobile phone is one of the devices they taught themselves to operate. They accepted that it was not easy, as there has been some trial and error until they succeeded. **Azwi** said:

> (Laughing hysterically), I only asked my grandchildren to teach me how to operate it … and so I learn it to make calls … *nna ke be ke nyaka go dira feela 'pre-school'* instead of 'please call me' (she wanted to know how to make a please call me).

4.4.2 Subtheme: Positive attitude

Adoption of ICT into farming cannot happen without a positive attitude. Attitude plays a critical role in business sustainability. Most of the participants interviewed were very vocal on attitude as the main factor for their success. The use of personal devices to run the cooperative is one indication of the attitude members possess. **Antony** said:

> … to have this business where it is today, we struggled but good attitude kept us going. (Thinking for a while, still breathing in the microphone) … Oooh, I am the one who trained these other members on how to use the donated laptops and today they are all able to use the devices because of their positive attitude … it also goes hand in hand with willing to learn.

4.4.3 Subtheme: Adoption of 'bring-your-own-device' approach

The adoption of ICT in some of the cooperatives was a result of using personal devices like mobile phones, printers and laptops. Almost all the participants interviewed mentioned that the businesses had no assets and they opted to use their own in the meantime. "… we are not making enough from the business and some of us decided to assist with our gadgets", **Zinhle** said. She went on say:

> We rely on those with connectivity like WiFi at home to print business e-mails and internet to download information on diseases and treatments for their produce … so far people agree to use what they have …

4.4.4 Subtheme: The role of internet cafes in rural communities

Internet cafes play a critical role in rural communities with and most participants interviewed have also tapped from that. Some participants like **Avho** said:

> … we survive because of our local internet café business. It is a bit far and expensive but it is very helpful. We do our calls in cases we are running short of airtime.

The significance of this business has also been mentioned by several other participants.

> … I do everything at the internet café. I print, use computers to write business letters and google.

4.4.5 Subtheme: Youth participation

Youth participation in farming is the bedrock that keeps the business going on daily basis. During the interviews, most adult farmers referred the researcher to their youth members to respond to the questions. It was very difficult to have a longer session with adult participants, compared to those led by younger generation, *... o tla bolela le Multi ka gore ke moswa ba tseba dilo tše o di nyakago*, referring me to someone younger in the cooperation as he would be able to respond to the research question. In cases where the cooperative members are mostly adults, the interview sessions took less time, about 8 minutes on average and approximately 31 minutes with the younger generation. Responses from most adult participants were not linked to the research questions, but something about the general challenges of the business. For instance, one old farmer requested me to follow up with Deputy President David Mabusa on the case of his farming which he had reported to him while in Polokwane for ANC campaigns. This kind of response was not linked to any of the research questions.

4.4.6 Subtheme: Literacy levels

Level of education has also been associated with a high level of ICT adoption. The literate participants were found to be using technology the most in their farming cooperatives. Some of those interviewed mentioned the level of education as their 'winning card' in ICT adoption and business sustainability. One **Fholufhelo said**:

> I have a qualification in information technology (IT) and obviously I understand the role that technology can play in this business. I put the most classified information in the cloud.

He further stated that he was pretty much aware of the benefits of technology as most of his customers are all over the country and the use of social media like Facebook is key. It is the same literacy level that assists a lot in joining other farmers across the globe.

Some of the participants joined farming clubs on the continent. Social media like Facebook and Instagram allowed them to be abreast of the farming issues that are shared on such platforms.

Farming also has members who are academically advanced. There are people in this sector who are already conducting some research. Some already use the findings of their studies to address some of the challenges and ICT adoption. "I have a PhD qualification from the University of

KwaZulu-Natal (UKZN) and specialised in animal production. Technology use is key in this farming business," said Dr **Mnisi**.

4.4.7 Subtheme: Pressure to cut costs

Pressure may be viewed as something negative, but it has played a role in some of the participants. "… everything is expensive, petrol is high, and diesel is high …," said **Roos.** He indicated that the costs of running a farming business were very expensive and technology made things a little better, especially in cutting travelling and transportation costs:

> … *ke be ke sa itire ge ke reka smart phone… mara lehono ke a iteboga* (he was under extreme pressure to have a smart phone but today he is thanking himself).

4.5 GENERAL FINDINGS

About the incubated rural farming cooperatives:

LEDA as the gatekeeper provided the researcher with a list of 56 incubated rural farming cooperatives comprising 541 members, from which a total of 168 participants were sampled. However, the revelations provided a completely different picture at the very beginning when the researcher was in the process of setting appointments to conduct face-to-face interviews with participants:

- More than 93% of the 56 farming cooperatives are actually closed corporations (CCs) run by individuals who use their siblings; identity documents (IDs) to register as cooperatives in order to qualify for government and non-governmental organisations benefits, including applying for banking finances. These individuals will do everything in the cooperative, from attending workshops, training and other business engagements.
- Some individual farmers registered more than one farming cooperative to have more than one application, which provides greater opportunity for selection in case of government-funding opportunities.
- A concern of misrepresentation was unofficially raised by some LEDA officials when searching for more particulars of participants alleging that most cooperatives belong to government officials who fronted community members to benefit from government and NGO funding support initiatives hence many collapsed.

- A sizeable number of the cooperatives collapsed immediately after the incubation programme, as expectations were not met. The number of calls on voicemail and those whose numbers no longer exist was evidence of this.

The above findings affected the participation rate badly, as the participation numbers plummeted profoundly.

4.6 CONCLUSION

In this section of the study, the findings from interviews with 31 of the 56 participants have been presented. Findings that have been presented in Sepedi were translated into English and provided a full meaning to reduce ambiguity. The findings are primarily premised on the research objectives, which yielded the primary themes and subthemes. Themes and subthemes were further illustrated by making use of diagrams and bar graphs to provide more insight. Some numbers have been converted to percentages to provide a more elaborative meaning and value of the findings.

CHAPTER 5:
DISCUSSION OF THE RESEARCH FINDINGS

5.1 INTRODUCTION

The previous chapter presented the findings from the semi-structured interviews. The focus was mainly on four objectives, namely the extent of ICT adoption of incubated rural farming cooperatives; perceptions of the incubated rural farmers on ICT; challenges of the incubated rural faming cooperatives on ICT; and the critical success factors of the rural farmer on ICT. The findings yielded four key themes and subthemes related to the objectives.

In this section, more focus will be on the discussion of these findings in relation to the research objectives alluded to above, as well as the problem statement of this research project. The process of discussing the findings will mainly be guided by the themes and subthemes uncovered during the presentation of the results.

5.2.1 The use of technological devices

5.2.1.1 Cell phones

The results of this study have shown that the use of technology is gradually gaining momentum and that the mobile phone has emerged stronger, compared to other devices. Most farmers who participated in the study use low-cost (affordable) mobile phones, compared to the smartphone. The use of low-cost mobile phones has in some way exposed the poverty levels of these farmers. It has also become apparent that the expensive nature of the smartphone has created a gap between the poor and the affluent. A smartphone is defined by Whyte (2019) as a mobile phone that performs many of the functions of a computer, typically having more features like touchscreen interface, internet access, and an operating system capable of running downloaded applications. Unlike the smartphone, the low-cost phone comprises basic features that allow the user to make calls, send messages and conduct ‘please call me’ messages. Some low-cost mobile phones do have extra features like a torch and a radio. These features are inadequate, particularly when it comes to provision of information. Most farmers in rural areas miss quite a lot of information that a smartphone can offer, such as information on climate change, market performances, and solutions to various diseases, which can be obtained from the internet. The

difference between a smartphone and a low-cost phone shows the disparity between rich and poor and commercial vs. small-holder farmers.

Besides the challenges that are associated with the difference between the low-cost mobile phone and smartphone, some participants have begun to realise the usefulness of using technology. The usefulness of ICT in the technology access model [TAM] is beginning to attract more researchers focusing on ICT adoption. This has been cited in the study conducted by Hattingh (2021). It is a model that focuses on two principles, namely perceived usefulness (PU) and perceived ease of use (PEU). He, Chen and Kitkuakul (2018) simplified these two ICT adoption principles in their public interest statement by stating that perceived ease of use is when people see technology as easy to use. The more confident and competent people are using technology, the greater their chances of adopting it. This statement can also imply that people may not have an interest in using technology if it is perceived to be difficult to use. There is a bit of complexity in the above statement, as the principle is relative; what one perceives as easy may not necessarily be for another person. This also reveals the weakness of this principle. He et al. (2018) further state that when people view technology as useful (perceived usefulness), it has greater opportunities to be embraced.

The technology acceptance model has been widely tested to establish the strength between the two principles. The perceived usefulness has in many instances been found to be strong in terms of correlation with ICT adoption, while the perceived ease of use performed weakly (Ma & Liu, 2005). However, given the time that has already lapsed, these findings might have proven otherwise.

5.2.1.2 Internet cafés

The adoption of ICT in farming cannot be successful without the inclusion of internet access. Most people living in rural areas have now resorted to using internet cafés as an alternative move to access the internet. It is for this reason that most rural areas have been flooded by internet cafés. Internet cafés, commonly known as cybercafés, are a business that aims to provide internet to the public. The findings of Sife (2013) on internet use behaviour of cybercafé users in Morogoro Municipality, Tanzania indicates that most internet café users mostly use search engines like Google and Yahoo. The value that internet cafés brings to rural areas have been noticed. Rural people have now started to form part of the global village.

However, it is necessary to indicate that internet cafés are mostly private businesses that take unilateral decisions on how much to charge to access the internet. In the same study by Sife (2013), 62,3% of the respondents mentioned high costs as a factor towards using internet cafés. The problem of limited services like internet in rural settings means that those areas are "left behind in the digitisation process" (Trendvoc, Varas & Zeng, 2019).

5.2.1.3 Digital applications (Apps)

The usefulness of digital applications like banking apps is beginning to emerge as one of the benefits that come with technology. For example, encouraging farmers to use such digital applications will undoubtedly benefit them in many areas like having to travel long distances to make fewer banking transactions. This confirms the benefits that come with the technology acceptance model (TAM) (Hattingh, 2021). The importance of digital applications has been well documented, as cited by Trendvoc et al. (2019). The benefits that come with digital applications cannot be overemphasised. For example, the use of the EMA-i app has been seen to be very instrumental as a warning system that provides quality data on livestock diseases.

5.2.1.4 Radio as a broadcasting platform

The radio is one of the oldest technological platforms and still continues to provide valuable information. It has been found to be one of the accessible tools that even the poorest in particularly rural communities has. Unfortunately, the emergence of other media like television has since affected the use of this medium badly. The importance of the radio still remains in certain economic sectors and agriculture involved. The use of the radio as the medium for dissemination of agricultural information, especially in rural areas, is affirmed by Ayim et al. (2020). Radio, unlike other media, presents content in the language suitable for a particular setting. For instance, the South African Broadcasting Corporation [SABC[has three radio stations exclusively for people of Limpopo Province, namely Munghana Lonene FM; Phala Phala FM; and Thobela FM. These three radio stations serve the three primary languages (XiTsonga, TshiVhenda and Sepedi) spoken in Limpopo Province. What is even more important about this medium is that it caters for the illiterate in the rural areas of Limpopo Province. For instance, Thobela FM used to have a 30-minute agricultural programme called **Lehumo le tšwa tšhemong,** changed to **Go sa galetše** in 2012. The programme is very helpful in disseminating valuable farming information to the Sepedi-speaking people. It is a platform

preferred mostly by the elderly and the poor. It is able to ascertain that information is disseminated to the deep rural settings. It is more embracing and addresses the divide between the different community members. The radio has emerged to be one of the technological platforms that provide valuable agricultural information, as it has been detected during the data collection process. The findings of the study conducted by Mtega (2018) on the use of radio and television as agricultural knowledge sources in the Morogoro region of Tanzania reveal that radio is the second (61,5%) source of agricultural information after fellow farmers. Musa et al. (2014) also confirm the contribution of radio in the dissemination of farming information.

5.3 PERCEPTIONS OF FARMERS ON ICT

The perceptions of farmers on ICT emerged in various ways. There are basically three groups of ICT adoption, namely pro-ICT, blended ICT adoption, and anti-ICT.

5.3.1 Pro-ICT

The findings of this study confirm that there are indeed farmers who have started embracing ICT in their farming activities. These farmers are reaping the fruits that come with technology. Rabbi et al. (2020) assert that farmers who perceive the usefulness of ICT are more likely to adopt technology. They further contend that the usefulness of ICT has a huge influence on farmers to embrace it. ICT influences farmers to change the traditional methods of farming and thereby penetrate the markets. The findings in this study reveal that the pro-ICT farmers are convinced of the benefits and value that technology makes to their farming.

5.3.2 Blended ICT adoption

The results of this study show that there are some farmers who use a mixture of both the traditional and modern farming methods. This approach suggests that there are some farmers who have seen the results of a blended approach of farming, thereby fusing ICT with traditional methods. These are mostly the farmers who see the adoption of ICT as a process rather than an event. To these types of farmers, the approach of migrating into ICT adoption is slowly taking place. Using the 20-60-20 rule by Jaworski and Pitera (2015), one can place these farmers in the middle 60%, as they require adequate conviction to adopt. The farmers in this group are neutral and unsure whether to stick to the old traditional methods of farming or abandon and

switch over to something they are not sure of. The results of this study confirmed the rule, as many farmers are in the middle bracket. The study revealed that most farmers are still undecided about embracing technology, as confirmed by the snail pace of adoption.

5.3.3 Anti-ICT

Using the same Jaworski and Pitera (2015), 20-60-20 rule above, the anti-ICT farmers are those belonging to the bottom 20%. These are the farmers who are negative about the use of ICT in their farming and they mostly rely on their experience and knowledge acquired to run their business.

5.3.3.1 Self-reliance

The farmers who belong to this category were found to remain negative about ICT as they depend on their experience and knowledge. Some of these traits are the ones that they acquired through their own efforts. Most farmers still depend on what they have learned throughout their entire life and they find it difficult to trade off their experience they have accumulated so hard. The self-reliant farmers are those who perhaps learned particular skills from others, from research and through trial and error.

5.4 RESISTANCE TO CHANGE

The adoption of ICT in farming is not without challenges (Satveer, 2017) and resistance to embrace ICT has been observed as another barrier towards moving traditional farming to modern farming through the infusion of technology. Resistance is the refusal to do something that may be associated a with person's attitude. The study by Bucci, Bentivollio and Fino (2019) on the factors affecting ICT adoption in agriculture in Italy confirms resistance as one of the causes of low adoption of precision agriculture [PA]. Bucci et al. (2019) argue that it is strange why resistance among the farmers persists next to the effective nature of technological systems like precision agricultural technology [PAT], which has proven to bring win-win results to the sector.

5.4.1 Political factors

The scars of colonialism and apartheid in South Africa are still prevalent, as evidenced by some participant farmers in rural areas. Some of the participants in this study reflected the unwillingness to adopt ICT in their farming. Political infiltration emerged central to farmers not ready to adopt ICT. Technology is seen to be something that cannot be trusted. It has emerged during the interviews that ICT is associated with western culture, which may give rise to such resistance. Most Africans still recall what apartheid has caused and anything from the west is not welcomed, irrespective of the benefits that come with it.

5.4.2 Cultural practices

Culture is among the factors that has bearing on ICT adoption. Musa et al. (2014) cite culture inertia as one factor that has bearing on the rate of ICT adoption among farmers. The study participants comprised Pedis, Tsongas and Vendas, who have specific cultures that distinguish themselves from one another. For instance, Pedis have a traditional way of treating the harvested sorghum. The variegated aloe is burned and its dust applied to protect the grain and repeal damage by the insects called ***tšhupa*** (granary weevil), as illustrated below:

Figure 47: Granary weevil
Source: Own

5.4.3 Indigenous knowledge systems (IKS)

In a study by Akullo and Kanzikwera (2007), they confirm the attachment that certain cultures have to their cultural knowledge. The indigenous knowledge systems [IKS], including the use of natural resources like trees, shrubs and animals are considered a matter of survival, especially by the people who made the effort to generate the systems. Farmers using indigenous knowledge systems seem to have a genuine reason not to embrace technology in operations, as the usefulness has been realised. Some farmers using IKS have natural resources in abundance in the locality, which do not demand any money to acquire them, compared to the high costs that are associated with using technological platforms like internet.

5.4.4 The wavering trust of ICT

5.4.4.1 Infringement of communication

The mistrust for ICT has surfaced during the interviews as a factor that is associated with the resistance of technology among some farmers. Chapter 2 (Section 14 (d)) of the *South African Constitution, Act 108 of 1996* (RSA, 1996) clearly stipulates that everyone has the right not to have the privacy of their communication infringed. It is widely known that mobile phone calls may be intercepted and communication be listened to. This was one factor mentioned during the interviews that contributed towards the resistance for ICT adoption.

5.4.4.2 Reliable farming information

Television channels and radios providing weather forecasts have sparked some doubts on the reliability of information disseminated by these mediums. Some of the farmers complained about the reliability of the information provided on these ICT platforms. Rural farmers across the African continent are desperately in need of pertinent farming information (Wyche & Steinfield, 2015).

Farmers rely heavily on climate information for planning the activities and information uploaded should therefore be reliable. Due to the limited knowledge of climate change fluctuations, some farmers, especially those with low literacy levels, literally expect climate information to happen as announced. Borrelli et al. (2018) concur with farmers who believe that information should be reliable, as this will strengthen the planning process. It should be

stated that some farmers use information sites for different reasons. This is confirmed by Csótó (2010), who states that farmers have preferences when it comes to information selection. The argument is that farmers use information sources for different reasons, which may not be related to the sector.

5.4.4.5 Theft of devices

Theft of devices is rampant and it is considered one of the factors towards resistance, including in the farming sector. The 2019–2020 Crime Statistics in South Africa indicate that 51 825 cases of common robbery were reported (South African Police Services [SAPS], 2019/20).

In the same period, theft from motor vehicles recorded 118 213. Some of the targeted items during these robberies included devices like mobile phones, laptops and any other valuables. These are the most wanted items because of the quick cash that they can generate when sold on the informal markets. In the study conducted by Anjum (2015), robbery of valuable items like mobile phones among the farmers is rife. It is even worse when the victims are fatally wounded and sometimes killed during the incidents.

5.5 THEME: CHALLENGES OF ICT ADOPTION

The theme on the challenges of ICT adoption revealed a myriad of subthemes, namely poor network coverage; low youth participation in farming; illiteracy and low ICT skills; costs of devices, airtime, data bundles, maintenance and repairs; power outages; high crime rate; age of extension officers (systemic challenges); and lack of technical skills.

5.5.1 Poor network coverage

The need for smart farming, especially in the 21st century, is the right thing to do. The use of technology has proven to be the one that can make a remarkable contribution in the agricultural sector. In the study conducted by Thangarasu and Anandamurugan (2019), they compared traditional farming with smart farming and the results revealed high advantages when using smart farming, as shown below:

Table 15: Comparison of Traditional farming with Smart farming

Agricultural requirements	Traditional farming	Smart farming
Need of staffing	Yes	No
Water utilization	High	Low
Field monitoring	High	Low
Data acquisition	Low	High
Cost	High	Low
Yield	Low	High
Time	More	Less

Source: Thangarasu and Anandamurugan (2019)

While the benefits of using technology are appreciated in the farming sector, connectivity remains a barrier, especially in the rural areas. Ayim et al. (2020) confirm that the African continent is still experiencing poor technological infrastructure. Lately, the problem of poor network coverage is ubiquitous in many parts of South Africa. The effective use of ICT, particularly in farming, is not feasible without connectivity. There are about 3,8 billion people worldwide who remain offline and most are found in remote areas (Trendvoc et al., 2019). Rural settings are mostly those in low-lying areas with mountains that also impact connectivity negatively. In a study by Russell (2019) on connectivity in Central Asia, mountains are cited as physical barriers that can lead to poor connectivity.

5.5.2 Low youth participation in farming

There is greater affirmation that youth are the future in Sub-Saharan Africa [SSA] (Chipfupa & Tagwani, 2021). The findings of this study reveal that there are more adult farmers than youth in the sector. The results further show that the level of youth interest in farming is low, as is evidenced by the exodus of those who joined farming earlier but opted for greener pastures. However, the study conducted by Chipfupa and Tagwani (2021) casts some doubt on youth participation in farming by taking a neutral stance. They argue that the participation of youth in farming should not be painted with one brush, as there are some youth in farming, though the number is not pleasing. They accept that getting youth into farming is surmountable but elusive. Most youth consider farming as the last resort when it comes to employment. Some are in farming due to the frustrations that come with a high unemployment rate, especially among the youth. The perceptions of low youth participation in farming is well documented. Geza et al. (2021) confirm that the youth are pessimistic about farming when it comes to their

capability to improve their living standards. The same study by Geza et al. (2021) contends that agricultural development programme policies reflect a deficiency to address structural issues for effective youth participation in this area.

5.5.3 Illiteracy and low ICT skills

The study conducted by Nwokoye et al. (2019) on rice farming reveals that level of education has an impact on ICT adoption. This is confirmed by Pillay (2016) in the study on barriers to ICT adoption use amongst SMEs in the manufacturing sector. The average adult illiteracy levels in South Africa stand at 12% (Khuluvhe, 2021). This is the number of adults who are 20 years and older. The same report conducted by Khuluvhe (2021) indicates that the illiteracy level in Limpopo Province, where the study took place, stands at 17,6%. In this study, most adult participants preferred semi-structured interview questions to be asked in their language of birth. This reflected the level of discomfort when asked in another language like English. English is the most widely used language in technology, including mobile phones. At least there is development in the banking services, as some automatic teller machines [ATMs] have begun to use African languages like Setswana to accommodate different literacy levels.

The literacy levels among the rural farmers has bearing on low ICT skills. English is the language of business, more precisely for communication, commonly known as the lingua franca (Kuiper, 2007). Technology uses English to describe the instructions that should be understood in order for the user to benefit effectively from the devices. It is the language commonly used by devices like mobile phones and computers. However, the study conducted by Nwokoye et al. (2019) determining the socioeconomic determinants of ICT adoption among the rice farmers in Nigeria, shows that language is a hindrance to mobile phone and internet users, especially in rural areas.

Most study participants have reflected low ICT skills as evidenced by relying on youth for assistance. This has created anxiety regarding the use of these devices, commonly referred to as technophobia. Low CT skills have been confirmed by Kusumaningtyasa and Suwartob (2014) as factors impeding ICT adoption. Apparently, the level of literacy is a precursor to be able to follow the technological language (instructions). The results of the study conducted by MacCullum and Jeffrey (2013) on the influence of students' ICT skills and their adoption of

mobile learning indicate that ICT skills determine the adoption. The same study revealed that perceived ease of use [PEU] is one of the TAM principles that influence ICT adoption.

5.5.4 Cost of devices, airtime, data bundles, maintenance and repairs

5.5.4.1 Cost of devices

The study revealed that all participants have mobile phones, though the difference comes in the quality of the device one possesses. This is confirmed by the study conducted by Manku (2020) on community-based farming projects, whereby the study revealed that mobile phones dominate the sector more than other devices. In most cases, these mobile phones are used for communication. Some of the respondents in this study indicated that technological devices like mobile phones, computers and printers are expensive and unaffordable. This gave rise to the use of low-cost devices with fewer application features. It should be noted that these same features have created a digital divide between the affluent and those living in abject poverty. Most participants in this study rely on their own devices and sometimes those of others to run the cooperative, which is an indication of the level of poverty rife among the rural farmers. The cost of ICT infrastructures like computers and mobile phones among the smallholder farmers has also been highlighted by Shemfe (2018) as one of the impediments to ICT adoption. Manku (2020) concurs that the cost of ICT infrastructure is one of the causes that limited access.

5.5.4.2 Cost of airtime

Besides the cost of devices as discussed above, the cost of airtime emerged as another subtheme to give attention to for discussion. The use of a device like a mobile phone requires airtime, which is the minutes available on the phone. The cost of airtime varies, depending on how much one wants to buy. For instance, Vodacom airtime starts from R5 to R1 000. This is meant to accommodate poverty levels. However, people who can afford the R5 airtime have limited talking time, compared to one with R1 000 airtime. The limited talking time that gets depleted while talking serious business is in itself a setback. Farmers need to communicate frequently for various reasons like checking the market prices with agents and responding to clientele on business-related matters. In the study conducted by Wyche and Steinfield (2015) on why farmers do not use mobile phones, it is revealed that the use of mobile phones depends on how much airtime one has on the phone. Bluntly put, airtime is one of the primary determinants for

mobile phone use by the farmers. Lack of airtime turns farmers into liabilities, thereby using 'please call me', which does not give the farmer a guarantee that the person requested to call back has airtime as well. This also causes a delay, as the person requested may not necessarily respond there and then. It should be noted that the 'please call me' features are only applicable to mobile phone providers and not to landlines, meaning a desperate farmer cannot make such a plea to the extension officers and other farmers using landlines.

5.5.4.3 Cost of data bundles

The cost of data is another worrying factor for rural farmers to embrace technology. Data provide users of technology with access to the internet. Connecting to such search engines needs adequate data, depending on the sites and time spent visiting those sites. The speed at which sites open determines the amount of data to be used. The majority of the study respondents, especially the youth, are aware of the benefits of using the internet, but they mentioned the exorbitant cost of mobile data as one impediment for internet access. South African youth, especially those at institutions of higher learning like universities once launched a **#datamustfall** campaign, as illustrated below:

Figure 48: #DATAMUSTFALL campaign
Source: Own

Some of the respondents with available devices to access the internet, WhatsApp and Facebook were very vocal about the price of mobile data and supported the call to have data slashed.

Mobile data are no longer a want but a must for the development of any economic sector, including farming. It is a pressing matter that may attract youth to the farming sector. Lately, the use of data is not only confined browsing the internet. The global outbreak of the corona virus (Covid-19) has reduced the face-to-face gatherings to be replaced by virtual meetings like Teams and Zoom. One cannot be a participant of such meetings without adequate data.

5.5.4.4 Cost of maintenance and repairs

Maintenance and repair of technological devices are a 'must do' in order to sustain the lifespan of any infrastructure. However, this exercise has serious financial implications for the user. It is among the factors that limit the farmers, more particularly, those in rural settings, to turn a blind eye towards the adoption of technology. Some of the study respondents indicated that they did have devices, but which were long abandoned due to breakdown. For instance, one respondent indicated that they had a printer which required a replacement of the drum, but the cooperative was unable to procure a new one due to a lack of funds. This is one factor that leave farmers out in the cold, and ultimately not being able to reap the fruits of technology. Having new computers requires of the user to insert drivers like Microsoft packages (Word, Excel, PowerPoint, and Outlook), which do not come cheap. The cost of maintenance and repair of farming equipment are confirmed by Lips and Burose (2012) in their study on the repair and maintenance costs for agricultural machines. The cost of maintenance and repair of infrastructure are also a major constraint for rural farmers to access the value chain (Baloyi, 2010).

5.5.5 Power outage

The successful adoption of ICT cannot happen without the provision of adequate electricity. Some equipment like mobile phones and computers need to be charged for maximum functionality. Up to now, most of the technological devices need electricity to work. In the study conducted by Nowakowska and Tubis (2015), the supply of electricity in South Africa covers approximately 95%. Lately, the South African economy is experiencing a plethora of challenges caused primarily by a series of power outages, commonly known as loadshedding. This is like a pandemic that affects the entire country. A paper by Schoeman and Saunders (2018) confirms that load shedding damages equipment. In the same presentation, Schoeman

and Saunders (2018) provide the frequency of power outages, as depicted in the following graph:

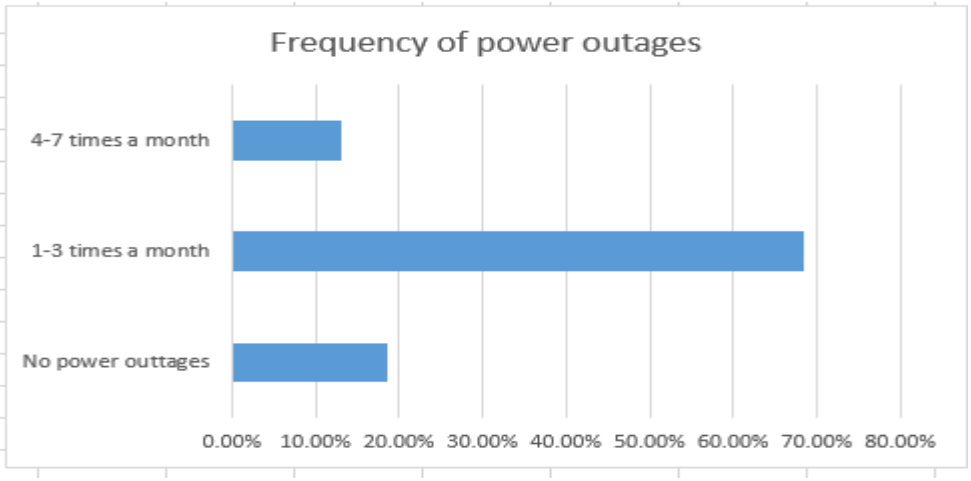


Figure 49: Frequency of power outages in Johannesburg
Source: Schoeman and Saunders (2018)

One of the respondents in this study indicated how electricity damaged her smartphone after load shedding. The farming sector is no exclusion, as the adoption of technology, which is the main subject of this study, depends primarily on the availability of power to function. Power is no longer a luxury as it was in the past, but a need for effective human function. The shortage of electricity in South Africa has caused severe damage in the farming fraternity, resulting in food prices sky rocketing. Many rural areas have resorted to the traditional way of using firewood as a source of energy to make ends meet, instead of using electricity, as illustrated below:

Figure 50: Woman carrying firewood
Source: Own

Electricity supply is one of the factors that contribute towards the human development index [HDI]). However, failure of the South African government to provide adequate power to its citizens also has an indirect bearing on life expectancy, as it contributes to a high mortality rate (Conceição, 2019). Carrying firewood on the head may have unpalatable repercussions as the person may carry an unbearable load that consequently affects his/her health. The smoke from firewood has serious health hazards, as it may result in respiratory diseases like asthma. The process of collecting firewood in the veld puts such people at high risk of being attacked by snakes and wild animals.

5.5.6 Ineffective extension officers

Extension officers are very instrumental in farming. They often provide valuable information and mentorship to inexperienced emerging farmers. The findings of this study revealed that very little is done by the extension officers, especially when it comes to ICT adoption, except to provide farming information through social media like WhatsApp. One wonders as to whether these critical farming stakeholders do possess other ICT skills that can be cascaded to the sector than using social media. Some of the respondents indirectly rendered their area extension obsolete and ineffective. There are numerous damning allegations levelled against these officials, which suggest that farmers in some areas are on their own. A presentation by Patil et al. (2008) at a world conference using an Indian case study reveals that extension

officers lack ICT experience and skills. Do the rural extension officers in the five districts have development programmes that include ICT as part of their performance contracts? The study conducted by Patil et al. (2008) states that most extension officers have unsuitable and incompatible ICT programmes.

Aging extension officers was another remark made about these officials in some parts of the districts. A number of studies associate low adoption of technology with age. This has resulted in numerous nicknames like 'born before technologies' or BBTs, when referring to older persons who cannot use technology. In this study, extension officers are also referred to as "old mutual", still referring to their old age. Most of the older respondents referred the researcher to younger respondents immediately after being informed of the purpose of the interviews. Some completely distanced themselves from the topic, assigning younger members of the cooperatives to respond on their behalf. The study conducted by Kinuthia and Mabaya (2017) in both Tanzania and Uganda indicates that ICT adopters are relatively younger in terms of age, compared to the non-adopters. They further suggest that the older the farmer, the less adoption of technology.

Hopelessness also emerged from some respondents when asked about the role of the extension officers in their district, up to a point where they are referred to as "cheque collectors", meaning that their impact on supporting the farmers is not visible, except to receive salaries. This may be a sign of despair on the side of the farmers who desperately need the support of the extension officers. It becomes apparent from the findings of this study that most rural farmers do not receive the support from their extension officers they are supposed to get.

5.5.7 Lack of technical skills

The effective use of technological devices like computers include the possession of certain specific technical skills. This may include basic skills like replacing an old cartridge or toner, cleaning viruses and connecting the computer to the projector, which in some instances fail to communicate. This looks like a simple thing, but it requires some form of technical skill. It has been found that some participants could not use a printer due to a lack of technical skills. Sometimes lack of technical skills can also be the barrier to ICT adoption. A critical analysis of challenges in adoption of technology in agricultural education by Vinayagam et al. (2020)

reveals that 83,3% of the farming respondents lack the technical know-how to operate the technological tools.

5.6 CRITICAL SUCCESS FACTORS [CSFS]

The adoption of ICT, particularly for rural famers, is not all doom and gloom, as depicted in the previous section of this chapter. There are farmers in the same setting that are pushing extremely hard to embrace technology besides the numerous hindrances they encounter in the process.

The following section of this chapter presents some of the critical success factors revealed during the data collection process. These critical success factors will be presented in subthemes as follows:

5.6.1 Subtheme: Lifelong learning

Most farmers who embraced technology in their businesses reported to have been self-taught on how to use the devices. Lifelong learning is defined by Desai, Vijayalakshmi and Joshi (2014) as the "ongoing, voluntary, and self-motivated pursuit of knowledge for either personal or professional reasons". Some reported that it was not easy, as the process was mainly characterised by trial and error. Embracing technology through trial and error is confirmed by the study of Morgan and Kennewell (2005). They indicate that learning technology is a complex process that takes place through various means, including informal ways like trial and error, and asking friends and people with experience. Some even engaged children who enjoy laughing at their parents who are adverse to these devices. Children usually perceive this activity as another form of play rather than serious learning. It should be noted that some of these farmers are unable to read or simply understand the technological instructions demanded by some of these devices. They try very hard to learn all the instructions, some through the help of others. Some basic learning includes how to make calls, use 'please call me' and SMSs. Some did not receive any formal school or training to know the basic operations of these devices. They ultimately succeeded in making calls to enquire about the market prices using technology.

5.6.2 Subtheme: Positive attitude

Many studies concur that attitude plays a critical role in ICT adoption. The way one thinks about something determines success or failure. Many farmers who succeeded in embracing technology indicated that they remained positive throughout the journey by not allowing negativity to defocus them. A paper by O'Shea ab et al. (2018) on farmers' attitudes in Ireland confirms that attitude influences potential adopters to embrace technology. One respondent mentioned that good attitude was what kept the cooperative intact. Positive attitude led to some cooperative members training other members on basic ICT skills. The success of the training was premised on other members' willingness to be taught on how to use technology.

5.6.3 Subtheme: Adoption of 'bring your own device' approach

Although poverty is rife in most rural areas, the usefulness of technology has been realised by farmers, evidenced by study respondents' use of personal devices, particularly mobile phones, to run the cooperatives. Most of these farmers opted to what is termed 'bring your own device' [BYOD]. It is the strategy defined by Barlette, Jaouen and Barlette (2020) as the provision and use of personal devices for both private and business purposes. This is another way of sustaining a business, especially in times when it is still growing. This strategy requires generosity and willingness to share one's assets with others. In this study, most cooperative members use their own devices like mobile phones, printing machines and materials. They fully understand the business situation, thereby augmenting using their own assets. It is another way of not waiting for the business to blossom, as that may take a while. BYOD strategy in this study is not really a matter of policy, but a matter of volunteering to use own assets. Most members do not get any form of incentive for using their own devices. In other words, one decides when to use or withdraw one's own asset(s). No-one is blamed for withdrawing his/her device. Although BYOD seems to work in growing a business, it is definitely not sustainable and therefore not a strategy to rely on completely.

5.6.4 Subtheme: The role of internet cafés in rural communities

Most rural farmers are still without ICT resources like the internet, which is a challenge to access information. The problem of limited ICT resources in rural areas is confirmed by Huda et al. (2010), including access to information. Infrastructural challenges in rural areas is further

mentioned by Satveer (2017). The study participants use internet cafés as an alternative means to search for information relevant for their farming activities. The role that internet cafés play in the adoption of technology has been mentioned several times. The majority of the rural farmers in this study visit internet cafés to access information, e-mails, write and print documents, and access the internet. It was mentioned by some participants that internet cafés are generally expensive to use, but have contributed hugely to the adoption of ICT.

5.6.5 Subtheme: Youth participation

The findings revealed that most farming cooperatives with youth as members show great possibilities of ICT adoption. Youth participation in agriculture seems to anchor the embracing of technology. It was also detected that most ICT-related responsibilities in cooperatives have been relegated to the youth. This is evidenced by the many youth respondents during the interviews. It was further revealed that on average, adult participants took about 8 minutes during the interviews, while youth took approximately 31 minutes. Youth participants have shown great interest in the topic and more probing took place, unlike the adult respondents who gave very short answers. The status report provided by Lohento and Ajilore (2015) on youth participation in agriculture, with special focus in Sub-Saharan Africa, confirms that young people show greater zeal, zest and creativity when it comes to embracing technology in agriculture. A further revelation was that most adult participants were unable to provide relevant responses and this gave rise to information that was completely different from what was expected. Some adult farmers unintentionally defocused in order to present their own farming challenges.

5.6.6 Subtheme: High literacy levels

High literacy levels among the farmers have shown greater potential for ICT adoption. Most study participants indicated that their education level remained the pillar of strength. Some of these farmers possess university qualifications in technology and for them embracing ICT becomes simple. Such farmers are able to face any ICT-related challenge without hesitation, as they are also aware of the benefits or usefulness that technology can bring to their businesses. Having better literacy levels allows them to use the internet and social media to network with confidence with other farmers. Literacy as one of the critical success factors in various economic sectors, including agriculture, has been well documented. Alant and Bakare (2021)

assert that literacy levels among farmers has a significant impact on technology adoption. The findings of this study also confirm that some of the farmers with better literacy levels are able to save their records and other valuable information on the internet cloud. This is the most recent space that has shown to be reliable, as more attempts to steal and destroy valuable information are eminent. Some participants with higher education qualifications opted to pursue some specialty in areas like piggery to understand the numerous challenges, and technology is central to resolve some of the challenges.

5.6.7 Subtheme: Pressure to cut costs

The findings of this study revealed that there are instances where the farmers are compelled to adopt technology. These instances may be two-fold, namely external and internal. The external pressure may be caused by the cost of transport, as frequently mentioned by some of the participants. External pressure was frequently mentioned by the respondents as the reason for ICT adoption. Some respondents indicated that initially they were reluctant to use technological tools like mobile phones, but the need to know the market performances brought immense pressure to use technology in order to keep in touch with their agents who are based in the national markets across the country. It became very easy and convenient to touch base with them frequently to get the recent performances of the markets and how their produce is perceived by the potential buyers. These farmers have seen the usefulness of not travelling every time, but using technology to keep abreast of the latest market performance. Further pressure to adopt ICT may be exacerbated by the global competition, which has also exposed every business, including agriculture. The competitive pressure faced by the SMEs has been confirmed by Martin and Vasilciuc (2011) in their study on reducing international competitive pressures through ICT adoption in SMEs. The mere fact some farmers have started to take their produce to the national markets is an indication of wanting to compete with others. It will undoubtedly force these farmers to start searching for strategies for them to succeed. Participating in the markets is a game of "survival of the fittest". One becomes fit if one has the requisite skills, which may include the digital skills to compete with others. Searching information from other engines like the internet becomes paramount. External pressure is also cited by Ordaninin and Arbore (2008).

5.7 CONCLUSION

Chapter 5 comprehensively discussed the primary themes and subthemes, with the main focus on the extent of ICT adoption among the rural incubated farming cooperatives. The subthemes included the use of devices; access to the internet; digital applications; and the radio as an information medium. The perceptions associated with the adoption of ICT were also covered. Challenges that hamper the adoption of ICT were fully discussed. Finally, critical success factors were discussed. The discussion was further anchored by the review of literature as well as illustrations to provide an insightful understanding of issues. It was also interesting to note that some themes and subthemes served as both challenges and critical success factors, as in the case of mobile phones for ICT adoption. Some themes like internet cafés were discussed as indications of the extent of ICT adoption and also as critical success factors.

CHAPTER 6

SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.1 INTRODUCTION

The previous section of this study provided a detailed discussion of the findings with a view to provide further insight into what has been obtained from the research participants.

In this chapter, the focus will mainly be on the summary, conclusion and recommendations of the entire study project.

A summary of the study will preclude the conclusions and recommendation, thereby providing the main aspects of each chapter as follows:

6.2 SUMMARY OF THE MAIN FINDINGS

The study focused mainly on the adoption of ICT for development of the incubated rural farming cooperatives in Limpopo Province. This research undertaking was prompted by the low adoption of ICT among the rural farmers and the incubated rural farmers in Limpopo Province were identified as the main case under study.

The study employed a qualitative research method to establish the in-depth reasons behind the problem. An inductive approach was followed as the study had no hypothesis or preconceived ideas about the outcomes. Two theories, Roger's diffusion of innovation and Kurt Lewis's change theories, were found to be relevant for this study. The former is more about the adoption of ICT, and the latter assumes that if adoption takes place, change will take place there as well. A further technology acceptance model [TAM] was identified to assist in identifying the challenge of low adoption. This model is premised on two principles, i.e. usefulness and ease of use.

The list of the incubated farming cooperatives was provided by the Limpopo Economic Development Agency [LEDA]. A population was derived from the 56 incubated farming cooperatives with a total membership of 541 potential participants of the five districts (Capricorn, Mopani, Sekhukhune, Vhembe and Waterberg) of the Limpopo Province.

Capricorn had the least cooperatives (7) and Vhembe had the highest (54). A sample of 168 participants were identified through a stratified random sampling procedure. A semi-structured interview based on the four research objectives was conducted. Data were analysed using the Atlas.Ti qualitative programme to establish the themes.

The findings confirmed that there are fewer rural farmers using ICT than those who do not. Most of these farmers are youth using mobile phones for communication and local internet cafés for information searching. There are numerous challenges, such as low youth participation; high cost of data; airtime; power outage; technical skills; illiteracy; theft; and incompetent extension officers. However, some critical success factors stem from using own devices, literacy levels, life-long learning and experience.

6.3 CONCLUSION

The findings of the study confirmed that there are fewer rural farming cooperatives using ICT in the sector than those who do. Most of the ICT adopters are youth who are able to use the internet for various reasons, including crops and animals diseases. Mobile phones are the most widely used devices by both adult and youth farmers. The adoption of ICT in the sector, particularly in rural areas, is clouded by numerous socio-economic challenges, ranging from illiteracy, age, or poverty to lack of infrastructure, to name but a few.

However, not all is doom and gloom, as the situation can improve for the better if the recommendations below are put in place, particularly issues of government policies and advocacies to attract more youth to the farming sector. Due to the expensive nature of data and lack of connectivity, using basic platforms like the radio that is mostly available in rural households can still provide valuable farming information.

6.4 RECOMMENDATIONS

6.4.1 General findings

The majority of the 56 farming cooperatives in this study were only cooperatives at face value. Many were individual businesses that one may call ‘closed corporations [CCs]’. This was detected during the interviews, as most participants indicated that they simply requested their family members’ identity documents [IDs] to register with companies and intellectual property

commission [CIPC] to avoid fights and conflicts experienced by some cooperatives. Of the 56 cooperatives, fewer than 8% qualified to be cooperatives. Many fraudulent activities were detected, as these cooperatives were in dire need of funding and collapsed immediately when expectations were not met.

It is therefore recommended that the Department of Trade and Industry [DTI] in Limpopo, the entity responsible for cooperatives through their implementing agents, conduct a thorough audit and systems to identify genuine qualifiers. The identification of cooperatives must go beyond the submission of lists for incubation programmes to curb the malpractices observed during the interviews.

6.4.2 Mobile phones

The South African government has policies like the National Development Plan [NDP] 2030 that aim to close the gap between poor and rich. It is therefore necessary that such policies be evoked. The gap that the smartphone brings can be mitigated by low-cost mobile phones that have standard features that will include at least social media features like WhatsApp, as well as internet access for farmers to search for valuable farming information.

Devices like mobile phones primarily contain electronic components; therefore it is recommended that low-cost phones have a rubberized waterproof cover to protect them from water and other damage. Wyche and Steinfield (2015) affirm that farmers' mobile handsets should be harnessed to suit the environment.

6.4.3 Internet cafés

Most internet cafés are private businesses and the government is less involved to regulate the charges associated with the use of these facilities. It is this opportunity that causes users to become victims of the exorbitant charges faced by those who need to access the internet. The need for a competition commission to get involved is necessary to guard against taking advantage of the needy. Perhaps the government can provide subsidies to these local businesses as a way of reducing the costs for the consumers, like farmers who have detected the usefulness of technology. Distance has been mostly indicated as the contributory factor towards low visits to internet cafés. It is therefore recommended that a mobile internet café business be made available, perhaps in every street.

6.4.4 Digital applications

Since some farmers have begun to see the usefulness of digital applications, it is imperative that more training workshops led by ICT literate extension officers be conducted to expose farmers to more of these apps and how they add value to the farming fraternity.

6.4.5 Radio as a broadcasting platform

Although radio plays a critical role in the dissemination of agricultural information, some areas, especially those surrounded by mountains, still struggle to access particular channels that are critical for farming. It is therefore important that signals in such areas be strengthened. The South African government, through the Department of Communications and Postal Services [DCPS] is better placed to address this digital divide. For instance, the migration from analogue to digital services should be fast tracked to cover the entire South African population, especially the rural areas dominated by natural hindrances like mountains. More roadshows should be conducted to rejuvenate the importance of radio programmes, especially agricultural programmes. The information shared during the advocacy should be such that the audience are able to realise the significance of the radio.

6.4.6 Pro-ICT, blended ICT adoption and anti-ICT

There is an urgent need to develop programmes that will assist farmers that are still glued to the blended and anti-ICT adoption. The Limpopo Department of Agriculture and Rural Development [DARD] should develop strategies that will demonstrate the usefulness of ICT in farming. These strategies may include having to extend the presidential youth programmes in agriculture, thereby allocating some youth to the rural farming cooperatives, who can serve as ICT trouble shooters. It is another way of reducing the unemployment levels among the youth, especially in rural areas. Gradually this will be another way of exposing the youth to the farming sector, which has a limited number of youth.

6.4.7 Resistance to change

The resistance to adopt ICT farming, especially by the rural farming community, can be improved through the infusion of the indigenous knowledge systems. These systems should not be treated as inferior to the former, as this may create further tension during the application.

More indigenous knowledge systems content should be uploaded and saved on devices for use by future generations. The DARD in Limpopo should advocate the use of indigenous knowledge systems in farming. Furthermore, more research studies should be conducted to strengthen the collaboration between modern and indigenous knowledge systems.

It is recommended that rural farmers be educated on climate change as this will assist the them to fully understand this aspect, as more of these farmers incur a lot of expenditure on they should have avoided. The extension officers should plan programmes that encapsulate climate change education. DARD in Limpopo should also ascertain that farmers are provided with timely, reliable information.

6.4.8 Poor network coverage

Network providers like Telkom, Vodacom, and MTN need to strengthen their connectivity provision with particular attention to rural settings. The recommended connectivity infrastructure should be those that will be able to perform in areas with physical barriers like mountains. Network providers are also urged to frequent rural areas to ascertain that people in those settings are connected.

6.4.9 Illiteracy

Since most rural farmers have low levels of education, the need for collaboration between education and agriculture departments is dire. The two departments have to develop joint programmes focusing on reducing illiteracy levels amongst the farmers, particularly those in remote areas. Adult education programmes should be scheduled to accommodate farming times. The programmes should encapsulate training, coupled with empowerment of the rural farmers. Secondly, the farming content uploaded on technological devices should be in the language of the indigenous people, as there are those who can at least read their own mother tongue language, compared to English.

6.4.10 Costs

The cost of devices, airtime, mobile data, maintenance and repair have been revealed as among the major constraints that impede farmers from embracing technology. It is therefore recommended that the Department of Agriculture and Rural Development [DARD] in Limpopo

introduce a subsidised scheme that will provide rural farmers with devices, subsidise airtime, and negotiate with mobile network providers to zero-rated farming-related sites. A further recommendation is made for DARD in Limpopo to subsidise the insurance of rural farmers in areas of maintenance and repair of ICT infrastructure and encourage farmers to join.

6.4.11 Power outages

Power outages has frequently been mentioned as one of the challenges the farmers face. It is therefore recommended that the South African government finalise the debate on alternative means of energy for sustainable supply of energy in the country. Available natural resources should be explored through numerous research undertakings. In the meantime, scientists can explore the use of kraal manure, which has proven to be containing methane. It is a flammable gas that can be explored for use by rural people. More experiments can be conducted to test what the mining and farm waste can bring to mitigate the problem.

6.4.12 Extension officers

Extension officers are critical components of the farming sector. They are the agents of change in this sector of the economy. It is therefore recommended that the DARD in Limpopo take a closer look at these agents by thoroughly providing valuable programmes that are in line with the 21st-century skills. Performance management and development systems [PMDS] should be tightened to ascertain that remunerations, especially salary notches, are on par with performances, not necessarily the physical presence of the employee, and that good as well as excellent performers be incentivised. Devices should be provided to the extension officers to workshop farmers, especially those in rural areas, as an attempt to adopt technology. Extension officers should be encouraged conduct outreach programmes as part of their performance to conscientize the farmers about ICT. More resources like vehicles should be provided to the sector for the extension officers to service their clientele.

6.4.13 Bring your own device (BYOD)

The majority of the study respondents use their own devices like mobile phones and printing material to run the business by means of commonly known as ‘bring your own device [BYOD]’. This has been identified as one of the critical success factors and the strategy that worked for most farmers interviewed.

Although the BYOD strategy may assist especially at the infancy stage of the business, members should develop a policy around it. This policy should reflect on the commitment of those willing to use their own assets as well providing incentives. The cooperative policy should cover basics like toners, data and airtime as a relief measure to the ‘good Samaritans’ who opted to run the cooperatives using their own assets.

RECOMMENDATIONS FOR FURTHER RESEARCH

- Farming extension officers and ICT adoption in rural areas
- Exposition of value chains for attraction of youth in farming

6.5 CONCLUSION

The study aimed to explore ICT adoption for developing the incubated rural farming cooperatives, however, it can be concluded that this sector of the economy is still clouded by a myriad of challenges and ICT adoption included. Most rural areas are without ICT infrastructure like connectivity and thereby relying on internet cafés. Poverty among the rural farmers is another reason for not being able to afford these devices especially those that have internet platforms. Low adoption of ICT among the incubated farming cooperatives requires government interventions with clear policies to improve the sector. Otherwise, rural farming cooperatives will remain undeveloped.

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ETHICAL CLEARANCE

From: Michael Phaane Seroka (Mr) Contact number: 082 831 0089
UNISA: PhD Student Researcher

To: Acting Executive Manager
Limpopo Economic Development Agency (LEDA)

Dear Sir,

RE: REQUEST FOR PERMISSION TO CONDUCT RESEARCH USING YOUR INCUBATED RURAL FARMING COOPERATIVES AS PARTICIPANTS

I'm Michael Phaane Seroka, a PhD student researcher in Development Studies at UNISA under the supervision of Prof Lucius Botes. My research title is: **Adoption of information and communication technology for development of the incubated rural farming cooperatives in Limpopo Province, South Africa**

The main aim of this study is to determine the adoption of ICT among the incubated rural farming cooperatives in Limpopo Province. It is for this reason that I found your 56 incubated farming cooperatives relevant for the study. The study is purely academic and without funding.

The potential incubated farming participants will be engaged telephonically and/ or virtually comprising of stages namely:

- Firstly, the preliminary survey of only the farming cooperative leaders
- Secondly, structured interviews will be conducted with the 15 adopters and the non-adopters of ICT still focusing on the leaders of these cooperatives.
- Thirdly, two focus groups (adopters and non-adopters) will be constituted and interviewed

LEDA is guaranteed to receive a comprehensive feedback on this study which may be beneficial during their policy reviews and general development of the sector. The interested participants

University of South Africa
Preller Street, Muckleneuk Ridge, City of Tshwane
PO Box 392 UNISA 0003 South Africa
Telephone: +27 12 429 3111 Facsimile: +27 12 429 4150
www.unisa.ac.za

shall be informed of the availability of the copy of the thesis through LEDA as the gatekeeper upon completion of the study.

Initially, the study was intended to be both telephonic and face-to-face. But due to the present corona virus (Covid 19) pandemic, the interviews will be mainly telephonic and/or virtual, however, this will depend on the promulgated safety levels of the time. Interviews and questionnaires as the data collection methods of this study guarantees minimal risks to the participants.

The envisaged data collection period may last for three months, starting from April-June 2021.

I hope that my request for permission to engage your incubated farming cooperatives will be considered.

Yours sincerely

04/03/2021

Michael Phaane Seroka (Mr) Date

(UNISA: PhD Student Researcher)

University of South Africa
Preller Street, Muckleneuk Ridge, City of Tshwane
PO Box 392 UNISA 0003 South Africa
Telephone: +27 12 429 3111 Facsimile: +27 12 429 4150
www.unisa.ac.za

LEDA

To: Acting Executive Manager: EDFD

Humphrey Maphutha

Subject: Permission to conduct study

Date: 04/March/2021

Purpose:

LEDA business Support Unit has granted Mr M.P Seroka permission to conduct a study on LEDA incubation clients across Limpopo Province for his PhD studies in Development Studies at UNISA. The title of his study project is:"**Adoption of information and communication technology (ICT) for development of the incubated rural farming cooperatives in Limpopo Province, South Africa**"

Duration of the study:

The duration of the interviews may last for three months starting from April 2021.

Recommendation:

It is recommended that he must be given the necessary support as this study is a powerful diagnostic instrument for assessing support given to Co-operatives and it will benefit the wider body of knowledge

Compiled By: ..... **Date:** 17/March/2021

Sectoral Business Dev. Specialist

K. Kolobe

Approved By: ..... **Date:** 17/03/2021

Acting Executive Manager: EDFD

S.H Maphutha

UNISA university of south africa

COLLEGE OF HUMAN SCIENCES RESEARCH ETHICS REVIEW COMMITTEE

20 January 2022

Dear Michael Phaane Seroka (Mr)

Decision:
Ethics Approval from 20 January 2022 to 20 January 2027

NHREC Registration # :
Rec-240816-052
CREC Reference # :
8023603 _CREC_CHS_2021

Researcher(s): Name: Michael Phaane Seroka (Mr)
Contact details: phaanerox7@gmail.com
Supervisor(s): Name: Prof L Botes
Contact details: 083 355 2476

Title: Adoption of information and communication technology for development of the incubated rural farming cooperatives in Limpopo Province, South Africa

Purpose: PhD

Thank you for the application for research ethics clearance by the Unisa College of Human Science Ethics Committee. Ethics approval is granted for five years.

The *low risk application was reviewed by* College of Human Sciences Research Ethics Committee, in compliance with the Unisa Policy on Research Ethics and the Standard Operating Procedure on Research Ethics Risk Assessment.

The proposed research may now commence with the provisions that:

1. The researcher(s) will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.
2. Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study should be communicated in writing to the College Ethics Review Committee.
3. The researcher(s) will conduct the study according to the methods and procedures set out in the approved application.
4. Any changes that can affect the study-related risks for the research participants, particularly in terms of assurances made with regards to the protection of participants' privacy and the

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confidentiality of the data, should be reported to the Committee in writing, accompanied by a progress report.

5. The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study. Adherence to the following South African legislation is important, if applicable: Protection of Personal Information Act, no 4 of 2013; Children's act no 38 of 2005 and the National Health Act, no 61 of 2003.
6. Only de-identified research data may be used for secondary research purposes in future on condition that the research objectives are similar to those of the original research. Secondary use of identifiable human research data require additional ethics clearance.
7. No fieldwork activities may continue after the expiry date **(20 January 2027).** Submission of a completed research ethics progress report will constitute an application for renewal of Ethics Research Committee approval.

Note:

*The reference number **8023603 _CREC_CHS_2021** should be clearly indicated on all forms of communication with the intended research participants, as well as with the Committee.*

Yours sincerely,

Signature: 

Prof. KB Khan
CHS Research Ethics Committee Chairperson
Email: khankb@unisa.ac.za
Tel: (012) 429 8210

Signature: PP 

Prof K. Masemola
Exécutive Dean: CHS
E-mail: masemk@unisa.ac.za
Tel: (012) 429 2298

University of South Africa
Preller Street, Muckleneuk Ridge, City of Tshwane
PO Box 392 UNISA 0003 South Africa
Telephone: +27 12 429 3111 Facsimile: +27 12 429 4150
www.unisa.ac.za

SEMI-STRUCTURED INTERVIEW GUIDE

MAIN RESEARCH QUESTIONS IN ENGLISH TRANSLATED TO SEPEDI DEVELOPED FROM THE MAIN RESEARCH OBJECTIVES

1. **English:** To what extent does the adoption of ICT take place in the development of your farming cooperative?
   Sepedi: *Naa tšhomišo ya mafarahlahla a thekonolotši e tseneletše bjang ka mo temong ya mohlakanelwa go godišeng ga kgwebo ya lena?*

2. **English**: What are your perceptions regarding ICT adoption in your farming cooperative development?
   Sepedi: *E ka ba bjalo ka temo ya mohlakanelwa, le ka hlaolosa bjang go hlakelela goba go se hlakelele tšhomišo ya mafarahlahla a thekonolotši go godišeng ya kgwebo ya lena?*

3. **English**: What are the challenges you are faced with towards ICT adoption in your farming cooperative development?
   Sepedi: *Naa e ka ba ditlhohlo goba ditšhitišo ke di fe tšeo le lebanego le tšona go ka akaretša tšhomišo ya mafarahlahla a thekinolotši kgodišong ya kgwebo ya lena ya temo ya mohlakanelwa*?

4. **English**: What are the critical success factors on ICT adoption for development of farming cooperative development?
   Sepedi:*Le ka re nyetlela gore le bona le kgontšwa ke eng go akaretša mafarahlahla a tšhomišo ya thekinolotši kgodišong ya kgwebo ya temo ya lena ya mohlakanelwa?*

5. **English**: What role do extension officers play towards ICT adoption in your farming cooperatives development?
   Sepedi: *Naa le ka re nyetlela ka boripana ka ga mananeo/dithutwana goba yona karolo yeo balemiši ba sediko ba e kgathago go le kgontšha go akaretša tirišo ya mafarahlahla a tšhomišo a thekinolotši kgodišong ya temo ya mohlakanelwa wa kgwebo ya lena?*

6. **English:** What is the role of government and NGOs on farming cooperatives development towards ICT adoption?
   Sepedi: *Ke karolo efe yeo mmušo goba mekgatlo yeo e sego ya mmušo e e ralokago go le thuša go akaretša mafarahlahla a tšhomišo a thekinolotši kgodišong ya temo ya lena ya mohlakananelwa*?

7. **English**: What are the gains of the incubation programme on farming cooperative development towards ICT adoption?
   Sepedi: *Naa lenaneo la kalamelo le dirile go lekane mo tabeng ya go akaretša tšhomišo ya mafarahlahla a thekinolotši mo temong ya mohlakanelwa wa kgwebo ya lena? Efa ditheto goba o se rete lenaneo ge go lebeletšwe go akaretšwa ga tšhomišo ya mafarahlahla a thekinolotši kgodišong ya kgwebo ya lena ya mohlakanelwa*.

Thank you very much for your time and participation.

Ke leboga nako ya lena le go ba motšeakarolo dinyakišišong tše.

LETTER FROM EDITOR

CORNELIA GELDENHUYS

✆083 2877088
corrieg@mweb.co.za

30 October 2022

TO WHOM IT MAY CONCERN

Herewith I, **Cornelia Geldenhuys (ID 521114 0083 088)** declare that I am a qualified, accredited language practitioner and that I have edited the following doctoral thesis:

ADOPTION OF INFORMATION AND COMMUNICATION TECHNOLOGY FOR THE DEVELOPMENT OF THE INCUBATED RURAL FARMING COOPERATIVES IN LIMPOPO PROVINCE, SOUTH AFRICA

by

MICHAEL PHAANE SEROKA

All changes were indicated by track changes and comments **for the author to verify, clarify aspects that are unclear, make the necessary adjustments and finalise.** The editor takes no responsibility in the instance of this not being done. The document remains the final responsibility of the author.

.....
C GELDENHUYS
MA (Lin) cum laude, MA (Mus), HOD, HDL, UOLM

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