



**THE USE OF INFORMATION AND COMMUNICATION TECHNOLOGY BY
EMERGING COMMERCIAL FARMERS IN THEIR DEVELOPMENT IN THE
WESTERN CAPE, SOUTH AFRICA.**

by

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**A mini-thesis submitted to the Faculty of Economic and Management Sciences,
University of the Western Cape, in partial fulfilment of the requirements for the Degree
of Master of Development Studies**

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DECLARATION

Student number: 8403164

I, Hermanus Jacobus Smidt, hereby declare that this mini-thesis entitled '*The use of Information and Communication Technology by emerging commercial farmers in their development in the Western Cape, South Africa*' is my own work and that I have not previously submitted it, in part or in its entirety, at any university for a degree or examination. All sources that I have quoted have been indicated and acknowledged accordingly.

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Signed

07 / 05 / 2018

Date

ABSTRACT

Although many researchers have shown ICT can enable development it remains a great challenge to understand the link between ICT4D projects and the development of emerging commercial agriculture. There is a need to realise the potential of information and communication technologies (ICT) for emerging commercial farmer development in order to achieve agriculture expansion and transformation in South Africa. This is important in order for them to partake in the knowledge economy visualised in the 2030 National development plan of South Africa and achieving the Sustainable Development Goals in 2030. However in South Africa, it is not yet established which specific ICT are used, how they are used and the extent of deployment if used in the emerging commercial agricultural sector. Few studies have focused on the factors that influence the use of ICT in South African emerging agriculture. This study investigates and attempts to understand the usage of ICT by emerging commercial farmers and the issues that influence ICT use on the West Coast of the Western Cape Province in South Africa. The study investigates the different forms of ICT used, how they are being used, what they are used for, how important these technologies are as enablers of production, and the factors that affect their use. The study involved a survey response of 42 emerging commercial farmers and 46 of their farm employees in the Matzikama and Cederberg municipalities. A literature review draws from studies globally, regionally and in South Africa on how ICTs have penetrated and contributed to delivering development in emerging commercial agriculture. Although most emerging commercial farmers cannot afford to adopt ICT tools that are essential in their farming activities almost all who were interviewed acknowledged the importance of ICT to their businesses. However, among other ICT, mobile phones and television were found to be primarily used for social and entertainment reasons rather than for agricultural purposes. The general findings showed that occupation on farm and ICT literacy influence the use of ICT by farm employees. On the other hand the gender, capacity of the farmer, off farm income and farm size influences the use of ICT by emerging commercial farmers. Our literature review established some examples from the studies of other researchers and the efforts of multi-lateral institutions such as the FAO and ITU to illustrate how we can improve policy. I recommend that the South African government develop an e-agriculture strategy to monitor development and validation of good practices on the use of ICTs in agriculture and rural development. This strategy will examine emerging trends on the role of ICTs and the challenges faced in reaching scaled, sustainable information service models. This can increase the sustainability of emerging commercial agriculture to contribute to the improvement of the lives of the poor in rural areas. Finally I present research questions for future research.

Keywords: Information Communication Technology (ICT), Information Communication Technology for Development (ICT4D), Emerging Commercial Farmers, Extension services

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NB: Opinions expressed in this thesis and the conclusions arrived at, are those of the author, and are not necessarily to be attributed to these institutions.

DEDICATION

I dedicate this thesis to the Smidt family, especially my parents who sacrificed a lot for me to get this far. My parents were very humble people and made sacrifices beyond imagination to educate me, even though they were not educated. It is painful that my father did not live to see and enjoy the fruits of his sweat, he will always be remembered.

To the current and future generations of the Smidt family, play your part in seeking development that is economically, socially and environmentally sustainable.

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GLOSSARY

Abbreviations and Acronyms

AAI	Action Aid International
CF	Choice Framework
CA	Capabilities Approach
DAFF	Department of Agriculture, Forestry and Fisheries
DRDLR	Department of Rural Development and Land Reform
EF	Evaluative Framework
FAO UN	Food and Agricultural Organization of the United Nations
ICT	Information and Communication Technologies
ICT4D	Information and Communication Technology for Development
IS	Information System
ITC	International trade Centre
ITU	International Telecommunication Union
KM	Knowledge Management
MDG	Millennium Development Goal
MTSF	Medium-Term Strategic Framework
NDP	National Development Plan
NGP	New Growth Path
NPC	National Planning Commission
NRF	National Research Foundation
PAR	Participatory Action Research
PRSP	Poverty Reduction Strategy Programme
QMS	Quality Management Systems
RAP	Regional Office for Asia and the Pacific FAO
SDG	Sustainable Development Goal
SDSN	Sustainable Development Support Network
ToC	Theory of Change
WSIS	World Summit on the Information Society
WTO	World Trade Organisation

Definition of terms

E-Agriculture

E-agriculture sometimes referred to as ICT in agriculture is a relatively recent term in the field of agriculture and rural development practices. E-agriculture focus on the enhancement of agricultural and rural development through improved information and communication processes. More specifically, e-agriculture involves the conceptualization, design, development, evaluation and application of innovative ways to use information and communication technologies (ICTs) in the rural domain, with a primary focus on agriculture.

E-hubs

An e-hub also referred to as a telecentre is a public place where people can access computers, the Internet, and other digital technologies that enable them to gather information, create, learn, and communicate with others while they develop essential digital skills. The focus is on the use of digital technologies to support community, economic, educational, and social development. They do this by reducing isolation, bridging the digital divide, promoting health issues, creating economic opportunities, and reaching out to youth.

Emerging commercial farmer

Emerging commercial farmers are smallholders that produce a surplus of produce that is sold on open markets and where profits are re-invested or accumulated.

Future Internet

Future Internet is a general term for research activities on new architectures for the Internet. Non-technical aspects of a future Internet span large areas such as socio-economics, business and environmental issues.

M-Development

M-Development also referred to as mobile application development is a term used to denote the act or process by which application software is developed for mobile devices, such as personal digital assistants, enterprise digital assistants or mobile phones. These applications can be pre-installed on phones during manufacturing platforms, or delivered as web applications using server-side or client-side processing.

Smart Farming

Smart farming also known as precision agriculture (PA) or satellite farming or site specific crop management (SSCM) is a farming management concept based on observing, measuring and responding to inter and intra-field variability in crops. The goal of Smart farming research is to define a decision support system (DSS) for whole farm management with the goal of optimizing returns on inputs while preserving resources. Smart farming aims to provide farmers with a wealth of information to build up a record of their farm, improve decision-making, foster greater traceability, enhance marketing of farm products and enhance the inherent quality of farm products.

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CHAPTER ONE

1. INTRODUCTION

1.1. Introduction

This research study is in line with my role as a community development practitioner that is working towards convincing government of the need to provide emerging commercial farmers with Information and Communication Technologies (ICT) services support. It also responds to the launch of a guide by Food and Agriculture Organisation (FAO) and International Telecommunication Union (ITU) in 2016 that assist countries in developing their national e-agriculture strategies. They concluded that 'Agriculture is increasingly becoming more knowledge-intensive. Having access to timely, accurate information that is tailored to specific locations and conditions is critical in helping farmers make the most of their resources in often changing circumstances' (FAO and ITU, 2016:ix).

There is a need to understand and realise the potential of ICT to emerging commercial farmers in order to achieve agriculture development (Kleine, 2010). E-agriculture refers to the design, development and application of innovative ways to use ICTs in the rural domain, with a primary focus on agriculture. It focuses on the enhancement of agricultural and rural development through improved information and communication processes (FAO and ITU, 2016).

This study investigates the factors of ICT use that are helpful and necessary for the recognition of the importance and benefits of ICT in the Western Cape and South Africa's emerging commercial agriculture. It also uses a literature review to investigate some examples where ICT4D projects have been implemented successfully to develop emerging commercial farmers. It recommends that the South African government develop an e-agriculture strategy to monitor development and validation of good practices on the use of ICTs in agriculture and rural development. This strategy will examine emerging trends on the role of ICTs and the challenges faced in reaching scaled, sustainable information service models. This can assist government to implement people-centred policy and supportive legal frameworks to implement sustainable information service models for the development of emerging commercial farmers.

This chapter is divided into sections that firstly give an overview and background of the study. Next it states the rationale and scope of the research problem as well as the research

question. It subsequently discusses the objective and justification, presents the study area investigated, followed by the listing of the limitations and ethical considerations that were taken into account. It finally concludes with an outline of the subsequent chapters.

1.2. Overview and background of the study

The 2030 Agenda for Sustainable Development includes 17 Sustainable Development Goals (SDGs) that set out quantitative objectives across the social, economic and environmental dimensions of sustainable development (SDSN, 2015).

According to FAO the SDGs can only be achieved when we change the way food is produced and consumed. Thus a strong commitment from governments is needed to develop smallholders, family farmers, rural women, fisher folk, indigenous communities, youth and other vulnerable or marginalized people in rural areas where most of the poor live (FAO, 2015). In the South African context, small-scale agriculture development is one pathway to poverty alleviation. We could also increase the number of black emerging farmers that can compete with large-scale white commercial farmers in supplying both domestic and export markets. This would go a long way to transforming the agrarian structure in South Africa that is still dominated by race (Cousins, 2013).

There has been a disjuncture between the World Bank's intention for structural adjustment programmes for small-scale agriculture producers and the actual outcomes. These programmes did not raise the productivity of small-scale farmers beyond basic subsistence. More support was given to large-scale agriculture that subsequently flooded rural markets. This allowed for survival of the fittest and created more food insecurity due to the low productivity of the South African peasant farmers (NPC, 2011).

According to ActionAid development policy has an urban bias and there is a lack of investment schemes to support small-scale farmers. The lack of collateral or credit history creates a lot of obstacles for small-scale farmers to access financial assistance. Extensive strategies for implementation to support economic reforms and small-scale agriculture in many countries have been met with failure (ActionAid, 2011). Similarly in South Africa strategies to address the challenges of land tenure, land distribution, marketing and inputs have also been met with failure (Cousins, 2013). The inability of governments in many developing countries to implement these programmes stems from lack of skills in ministries

of agriculture or that extension services to small-scale agricultural development has been largely inadequate or non-existent (ActionAid, 2011).

During Apartheid unsubsidized black peasant farmers had to compete with large scale subsidized farmers, supermarket chains, and agribusiness that resulted in separate and unequal racial development in agriculture and food value chains. After Apartheid the capitalist economy continued to discriminate against small-scale African peasant farmers resulting in low productivity and food insecurity (NPC, 2011).

Although diverse views exist amongst researchers about the global digital divide, ICTs are being used more extensively in the world to deal with some of the world's most challenging problems. Some feel it has created more inequalities, while others argue that mobile phones and other technological advances have led to more socio-economic opportunities for the poor (Chib, 2015).

A research done by Cecchini and Scott (2003) suggests lives can be transformed if ICT is used effectively for development projects. On the other hand they highlight that although ICT can enable development a recent discourse has questioned exactly how it contributes to development and poverty reduction, with many researchers seeking empirical evidence of this link. Mitrovic and Taylor (2010) argue for the creation of a technology supported 'Knowledge Society' which can be more self-reliant, socially connected and equitable. This involves new ways of thinking, working and living. This requires the building of new capacities called e-skills, not only in the working force but the entire population.

It is important to go beyond issues of access and use, but to be able to determine notions of the impact of ICTs on international development. With the ending of the Millennium Development Goals (MDGs) in 2015, it is important to take stock of the impact these technologies have had on key development problems as we move forward to achieving the SDGs in 2030 (Chib, 2015).

There remains a great challenge to understand the link between ICT4D projects and development in rural areas, such as emerging commercial agriculture where many researchers are still to obtain empirical evidence of this link (Kleine, 2010). Agriculture has become more knowledge-intensive due to the ICT revolution. Farmers can better manage critical scarce resources if they have the correct information at the right time. ICTs can act as a transformative force for good socio-economic development in many ways. Thus farmers can

be empowered through ICT by improving their access to the latest and most useful agricultural techniques (FAO and ITU, 2016).

These days documented evidence of on-farm practices is a standard requirement for farmers and they must keep records of production practices. Quality Management Systems (QMS) are the associated disciplines that show their produce is safe and that they farm responsibly. This certification against a specified good practice standard is fast becoming a condition of trade for markets both internationally and locally (Reardon et al, 2009). ICT4D can assist farmers with QMS as well as in sustainable farming both economically and environmentally. We can see there is a huge research opportunity to look at how ICTs can improve small-scale agricultural development to adapt to climate change, smart farming, logistics and food traceability (FAO, 2005).

FAO and ITU, in collaboration with several other stakeholders have released a guide in support of developing countries when creating national e-agriculture strategies to mainstream the use of ICTs in agriculture. The guide is composed of three parts that includes a national e-agriculture vision that responds to agricultural and development goals, a national e-agriculture action plan that reflects country priorities and a plan to monitor implementation and manage associated risks of the strategy (FAO and ITU, 2015).

Development plans in agriculture must ensure environmental stewardship through participatory planning and must pursue partnerships to protect agricultural lands, ocean resources, ecosystems, forests, clean fresh water and a healthy environment. Development encroaches on the environment and we have a responsibility to ensure that any resource exploitation has minimum negative impact (Pretty, 1995).

Small-scale farmers in South Africa can be defined in one of three ways. Firstly farming for only a part of their livelihood, secondly for most of their livelihood, and thirdly those who make a significant profit that can be reinvested known as emerging commercial farmers (Cousins, 2011). The focus of this study is on the emerging commercial farmers and in chapter two I aim to further define and contextualise them in the South African agriculture sector.

The above arguments support the need for emphasis to be put on the delivery of ICT as an agriculture infrastructure requirement. The context that ICT could also create further

inequalities as well as address gaps makes it critical for governments to become involved in providing training and an ICT extension service.

It is with the above in mind that this research study proposes to investigate and understand the usage of ICT by emerging commercial farmers and the issues that influence ICT their use. The study investigates the different forms of ICT used, how they are being used, what they are used for, how important these technologies are as enablers of production, and the factors that affect their use. The study will first address theoretical literature of ICT in emerging commercial agriculture followed by an empirical testing to assess the link between theory and practice. There is a huge research opportunity to look at how ICTs can improve emerging commercial agricultural development to adapt to climate change and other areas such as smart farming, logistics and food traceability. Thus I review the body of knowledge that evaluates the links between ICTs and development, with particular focus on their role in rural areas to develop emerging commercial farmers. The literature review aims to identify areas of opportunities where ICT can be used successfully to facilitate economic and environmental sustainable development of agriculture that can be implemented in South Africa.

In order for the research to investigate how emerging commercial farmers are empowering themselves with ICT assets and services, I will in the next section define the research problem. I will discuss the rationale and scope of them harnessing ICTs effectively so that they can compete in a complex, rapidly changing global market and avoid falling behind the technology curve.

1.3. Research Problem: Rationale and scope of this study

We should clearly define and operationalize core concepts in the problem statement of empirical research. In empirical research the research hypothesis directs the investigation while the central theoretical thesis serves this purpose in theoretical research (Mouton and Marais, 1998).

In my literature review I shall highlight the importance of small-scale emerging commercial farming to the production of food as well as the creation of jobs in order to alleviate poverty, unemployment and inequality in rural areas. In my opinion it is accepted and recognised that in order for emerging commercial farmers to become sustainable it is crucial for them to penetrate lucrative markets.

The need for farmers to implement Quality Management Systems (QMS) is relatively new and QMS disciplines have not yet been absorbed into the agricultural development culture. The challenge is that most emerging commercial farmers don't keep records, which prevents them from accessing markets and customers, and from responding if products are recalled (FAO, 2005). Farmers must keep records of QMS production practices in order to show that food is safe and that they farm responsibly. The associated disciplines must be audited and documented evidence of on-farm practices is a standard expectation and prerequisite for certification (Reardon et al, 2009).

ICT4D can assist farmers with QMS in order to farm sustainable economically and environmentally. We can see there is a huge research opportunity to look at how ICTs can improve small-scale agricultural development to adapt to climate change, smart farming, logistics and food traceability (FAO, 2005).

Without fully knowing of how ICT is used by small-scale emerging commercial farmers it is difficult to plan for their development or understand how to influence government policy or programmes. Therefore, the purpose of this study is to investigate and understand the usage of ICT by emerging commercial farmers and the issues that influence ICT use. The intent is to make concrete proposals for strategy, policy and programmes that can be implemented by government.

The scope of the results for the investigative study is limited to descriptive statistics, chi-square tests and correlation analysis. It now becomes important to define the research question and sub-questions that would guide this investigation.

1.4. Research question

In order to investigate to what extent emerging commercial farmers' use or are inhibited from using ICTs in addressing rural economic development and sustainable agriculture, I use the following question. *What factors influence the use of ICT in agriculture by emerging commercial farmers?* This research question stated is posed in order to provide direction for both the theoretical framework and empirical analysis of the research. The question is answered by responding to the following four sub-questions in Table 1.1.

Table 1.1: Sub-questions answering main question: What factors influence ICT use by emerging commercial farmers?

Types of ICT being used	<i>What are the different kinds of ICT that are being used by emerging commercial farmers in South Africa?</i>
Major ICT uses	<i>What are ICT used for by emerging commercial farmers?</i>
Barriers inhibiting ICT use	<i>What are the major barriers that hinder the use of ICT?</i>
Benefits of ICT use	<i>What are the key benefits from ICT use</i>

1.5. The objective of the study

The Capabilities Approach (CA) has concepts that can assist us to understand issues surrounding the context of the support emerging commercial farmers can get from ICT4D projects (Kleine, 2010). The research through the literature review, investigates how ICT4D can impact sustainable economic and environmental development of emerging commercial agriculture. It focuses on how emerging farmers can improve their capabilities to use their functionings to effect better outcomes and objectives.

Using the Choice Framework (CF) together with an Evaluative Framework (EF) to operationalize the CA, the main aim of this study is to investigate the use of ICT in South African emerging commercial agriculture in the West Coast District municipality of the Western Cape Province. I investigate the following specific objectives to achieve the relevant results for this study.

- i. Exploring the different ICT being used by emerging commercial farmers.
- ii. Investigating and describing the uses of different forms of ICT among emerging commercial farmers,
- iii. Identifying barriers affecting ICT use by emerging commercial farmers, and
- iv. Describing the socio-economic benefits associated with ICT use by the emerging commercial farmers.

The study will use what was learnt from the literature review to help us identify the gaps between theory and practice in the emerging commercial agriculture sector. Getting buy-in from emerging commercial farmers and their employees, findings will form the basis for future consultations with key stakeholders. The intention of this study is to be able to influence government policies and programmes to use an ICT extension service for the development and support of the emerging commercial farming sector. This can assist

government and civil society that support the development of emerging commercial farmers to have greater impact. It is now important to justify the significance of the study.

1.6. Justification: Significance of the Study

According to available literature, a comprehensive understanding of the relationship between ICTs and the use by commercial farmers for their livelihoods is still lacking in South Africa. There has been a lack of focus on the roles of ICT in the development of emerging commercial agriculture in South Africa. This study will provide basic information for further research on ICT-driven emerging commercial agricultural development. Identifying factors that influence ICT use can help stakeholders and service providers to determine the impact of ICT development on livelihoods of emerging commercial farmers in South Africa. The identified factors of ICT use can contribute to the development of an e-agriculture strategy for ICT utilization for emerging commercial agriculture. Knowledge of these ICT use factors can assist in the shaping of government policy or programmes on agricultural development.

This research is urgent and important because it will bring about knowledge and awareness of the concrete benefits derived from ICT use. It is anticipated that this study will contribute to the body of knowledge on ICTs and rural livelihoods of emerging commercial farmers. It is hoped that the findings of the study will contribute towards the development and strengthening of ICTs related to rural livelihoods strategies.

The study is meant to highlight the gap that exists on ICT development within the agricultural sector in South Africa. The study is expected to help policy makers to comprehend the benefits of ICT in agriculture. In addition, the study can contribute to the development of an e-agriculture strategy that can be used to develop a decision-making support tool for farmers and farm employees. This tool can assist farmers on how they can adopt certain ICT for farm use. Furthermore, the findings in this study can be used to develop a benchmark to compare similar ICT use studies that targets agricultural communities.

It is now important in the next section to discuss the ethical considerations taken when dealing with the emerging commercial farmers and farm employees during the investigation.

1.7. Ethical considerations

This study has tried to ensure that the highest ethical standards were adhered to and as the researcher I have made sure that the appropriate training and preparation for conducting the

research had been acquired. Amongst others, the research has endeavoured to ensure factual accuracy and avoid fabrication, suppression or misinterpretation of data. This was done through mainly proper referencing of ideas and data sources while cross verification with the supervisor was also carried out. Similarly all the sources of knowledge, concepts, and methodology used in this research are duly acknowledged.

In addition to the above the rights, welfare, identities and interests of those involved in the research are protected. I will make sure that the results of the study pose no harm or infringement to the privacy and rights of the subjects. Permission from all stakeholders, organizations and participants was sought before they were included in this study. All participants were asked to willingly participate and were free to withdraw at any stage of the research process, and proofs of consent are provided.

Confidentiality of the information generated is guaranteed and the research was conducted in accordance with the ethical and professional guidelines of the University of the Western Cape with the support of international guidelines. Anonymity and confidentiality are ensured, that is, the nondisclosure of personal information. Participants did consent to disclosure, preferably in writing.

Finally, official external reporting and dissemination of the study's results will only be done once the UWC Post-Graduate Senate has officially examined and given its final mark on the dissertation. I have attached as an appendix the HSSREC Ethics approval letter, as required by the University of the Western Cape to show my commitment to the above ethical requirements.

The next section will conclude this chapter and also discuss the outline of the subsequent chapters that follow.

1.8. Conclusion and outline of the subsequent chapters

In this chapter I have introduced and gave an overall background to the study. I stated the research problem, research questions and objectives. The limitations and scope of the study as well as the ethical considerations was discussed. This chapter brought to the fore the need for this study, looking at how other studies have focused on ICT4D in supporting the economic and environmental sustainability of emerging commercial farmers. The gaps and the justification are also discussed. All these components help to link this study with other studies that have been undertaken in other parts of the world that is relevant to South Africa.

This chapter served to introduce the importance of information as a factor of production in agriculture and the need to influence government policy and programmes to support ICT use by emerging commercial farmers. Overall, I will now outline how this mini-thesis will be organised.

Chapter 2 will provide a literature review of what was learned from authors that have done similar studies and what is already known. I answered what we already know about the topic and identify key sources and authors that guided us through the study. Since the study deals with the use of ICT in agriculture, it was appropriate to discuss the importance of the role agriculture plays in achieving the SDGs. I define and explain emerging commercial farmers in the context of the South African Agriculture sector and try to understand the role and challenges faced in the development plans of the country. Also included in this chapter is the role of ICT in integrating agribusinesses with global markets. Since the study is also interested in how ICT is used for agricultural purposes, it is important to identify barriers to ICT use by agricultural communities in developing countries. The success stories of ICT use by agricultural communities in developing countries is also listed.

Chapter 3 discusses the literature that investigates strategies and policies that can be implemented in the development of emerging commercial farmers where ICT is used as an enabler. It discusses an e-agriculture guide to support developing countries in their national e-agriculture strategies that was developed by FAO and ITU. It further looks at policy regimes and argues the importance of the participation of small-scale farmers in bringing about policy change.

Chapter 4 provide a literature review of the theoretical approach which is the CA. The first section lays an important theoretical foundation for the study and discusses the CF and EF as the frameworks that operationalize this approach. This will form the theoretical framework for the empirical research. It presents the theoretical framework underpinning this study where the CF integrated with the EF is presented as the theoretical framework for this study.

Chapter 5 explains the research methodology and discusses the research design. It also includes the sampling techniques, size of the sample, on what basis the sample was selected and what unit of analysis is used. The research method, research plan and analytical procedures are also discussed in this chapter.

Chapter 6 explains the findings of the empirical research and provide discussion of the current and potential use of ICT by emerging commercial farmers and their employees. Descriptive statistics, correlation and chi-square tests results for emerging commercial farmers and their employees are presented in this chapter.

In Chapter 7 data analysis is done. The analysis of the results from the study, for both the farmers and farm employees is presented in this chapter. Next I discuss the contribution of the study to the theoretical model that was used. I then compare the empirical findings to the literature review and provide recommendations for the improvement of ICT use in emerging commercial agriculture.

In Chapter 8 I provide a summary of the key findings of the research, discuss the limitations of the study, makes suggestions for policies to implement sustainable information service models and provide concluding remarks with prospects for future studies.

CHAPTER TWO

2. SUSTAINABLE DEVELOPMENT AND EMERGING COMMERCIAL AGRICULTURE

2.1. Introduction

In chapter one, the background information on South African emerging agriculture and the importance of ICT to communicate agricultural information was discussed. The problem statement and objectives of the study were then stated, which led us to formulating a problem statement and objectives for the study.

In this chapter I do a literature review on ICT4D regarding the development of emerging commercial agriculture. It starts by highlighting agriculture's importance to achieving the SDGs in 2030 and discusses the importance of South Africa's agriculture development plans in achieving land reform, to reverse the Legacy of the 1913 Natives Land Act. I define and explain emerging commercial farmers in the context of the South African Agriculture sector. In doing this I also try and understand the challenges facing emerging commercial farmers and investigate government support provided to emerging commercial farmers in South Africa.

The discussion in this chapter in particular highlights the importance and uses of different ICT in emerging commercial agriculture. It also looks at the various services and applications associated with them as it is important to discuss this first in order to create an understanding of the research context. I investigate the application of ICTs in emerging commercial agriculture in rural areas, sustainable agriculture and as an extension service. The role of government in extension services has always been crucial to the agriculture sector. It would be important to understand how ICT extension services can be used to address development among rural farmers. Finally I identify factors that influence the use of ICTs in emerging commercial agriculture.

This information is reviewed to try and provide some answers to the research questions where all these issues make reference to agriculture mostly in developing countries. Specific examples from Africa are mentioned to provide insight to where and how ICT is used. The discussion highlights the importance and uses of different ICT in agriculture, as well as the various applications associated with them. This is necessary since the study would be

appreciated if the importance and benefits of ICT in agriculture are first presented. The next section will thus take us into this discussion.

2.2. Agriculture's importance to achieving the Sustainable Development Goals (SDGs) 2030.

The SDGs aims to develop inclusive and sustainable economic growth that result in a more equal, prosperous, peaceful and sustainable world. This can only be achieved by reducing and eliminating hunger and malnutrition. The way food moves down the value chain is the fundamental connection between people and the planet. Thus a strong political will is needed to develop smallholders, family farmers, rural women, fisher folk, indigenous communities, youth and other vulnerable or marginalized people in rural areas where most of the poor live (FAO, 2015).

The 2030 Agenda for Sustainable Development, adopted by Heads of State and Government in September 2015, set the world on a path towards sustainable development. The agenda includes 17 SDGs to be achieved by 2030 that set out quantitative objectives across the social, economic and environmental dimensions of sustainable development (SDSN, 2015).

FAO is a specialized UN agency with unique expertise in the three dimensions of sustainable development namely ending poverty (SDG1), zero hunger (SDG2) as well as sustainable consumption and production (SDG12). FAO supports people to interact harmoniously with the planet's ecosystems by maintaining and sustainably using biodiversity. This is to preserve natural resources for present and future generations (FAO, 2015). A more detail description of SDGs 1, 2 and 12 is depicted in Table 2.2 below.

Table 2.2 - Three dimensions of sustainable development depicting FAO's expertise

SDG1– End Poverty FACT BOX	Most of the world's extreme poor live in rural areas and are dependent on agriculture which is the single largest employer in the world. Agricultural growth in low-income and agrarian economies is at least twice as effective as growth in other sectors in reducing hunger and poverty. The battle to end poverty must thus be fought also in rural areas, where people depend directly or indirectly on farming, fisheries or forestry for incomes as well as food. Hunger is no longer an issue of insufficient global supplies, but mainly of lack of access to the means to produce or purchase food. Investing in rural
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	<p>development, establishing social protection systems, building rural-urban linkages and focusing on boosting the incomes of the critical agents of change – smallholder family farmers, foresters, fisher folk, rural women and youth – is key to achieving inclusive and equitable growth while tackling the root causes of poverty and hunger. Improving rural livelihoods will also curb rural-urban migration and increased urban poverty.</p> <p>The hundreds of millions of people who manage agricultural and food systems constitute the largest group of natural resource managers on earth. The daily management decisions of those who farm, keep livestock, fish, manage forests, and run agribusinesses are key to global food security and the health of the world's ecosystems.</p>
SDG2– Zero Hunger FACT BOX	<p>A dedicated global goal, SDG2, based on a comprehensive approach to tackling food insecurity and malnutrition while promoting sustainable agriculture is an important step to achieving zero hunger and ushering in a new era of sustainable development. Feeding a growing global population while nurturing the planet will be a monumental challenge, but it can be achieved by transforming food systems and agriculture, embracing sustainable living and working practices, improving governance and securing the political will to act. Given the mounting pressure on global ecosystems, the food production increase must be achieved in a sustainable and environmentally sound way. Recent evidence suggests that climate change, biodiversity loss and other pressures have already reached rates of change that threaten the capacity of the Earth's ecosystems.</p>
SDG12 – Sustainable consumption and production	<p>Every year, the world loses or wastes about a third of the food it produces. To feed the world sustainably, producers need to grow more food while reducing negative environmental impacts such as soil, water and nutrient loss, greenhouse gas emissions, and degradation of ecosystems. Consumers must be encouraged to shift to nutritious and safe diets with a lower environmental footprint.</p>

Source: Adapted from FAO (2015)

Over 70% of the livelihoods of the people living in Africa are dependent on small-scale agriculture and the harvesting of natural resources. They face many challenges where

emerging technologies and new materials can become key success factors in addressing the challenges of small-scale farmers. There are also new opportunities for Africa through new markets, high value products, access to biotechnology and improved ICTs. Information and knowledge are considered prime productive resources and can play a key role in ensuring food security and sustainable development ((Munyua, 2007)).

It will now be important to discuss the importance of agriculture to South Africa's Development Plans in the next section.

2.3. South Africa's Development Plans and emerging commercial agriculture

2.3.1. The South African development plans pertaining to the Agriculture Sector

South Africa's development of emerging commercial agriculture is mainly focussed on rectifying the unjust land ownership policies experienced under Colonialist and Apartheid rule in the past (DRDLR, 2016a). The challenge of the land question was created by the dispossession of land from the majority of South Africans over the last few centuries. This was made worse by the creation of a dual economy in land administration systems with an advanced system for whites and an institutionally inferior system designed for the former black reserves (DRDLR, 2011).

After the end of Apartheid unequal development continued with large scale subsidized white farmers, supermarket chains, and agribusiness competing against unsubsidized black peasant farmers (NPC, 2011). Thus land reform aims to deracialise the rural economy in order to democratise the allocation and use of land across gender, race and class. This can create a sustained production discipline for food security and food sovereignty. The aim is to achieve this with a minimum disruption to food production and based on the agrarian transformation strategy (DRDLR, 2011).

The four elements of land reform include restitution by firstly reversing the legacy of the '1913 Natives Land Act', secondly land redistribution, thirdly revise land tenure and lastly to foster development through the establishment of Agri-parks (DRDLR, 2016a). An Agri-park is defined by the Department of Rural Development and Land Reform as the following;

"An Agri-park is a networked innovation system of agro-production, processing, logistics, marketing, training and extension services, located in a District Municipality."

As a network it enables a market-driven combination and integration of various agricultural activities and rural transformation services” (DRDLR, 2016a:7).

Cousins (2013) highlights the importance of emerging commercial agriculture as a means to eradicate poverty and accelerated growth. He emphasise how black emerging farmers could transform the agrarian structure in South Africa that is still dominated by race. He articulates that this could be done by bringing under-utilized communal land and land reform farms into full production over the next few years through expanding irrigated agriculture.

To kick start the ‘Rural Economic Transformation’ Agri-parks are to be established in all of South Africa’s District Municipalities. This will be used to develop the skills of and support emerging black commercial farmers through the provision of capacity building, mentorship, farm infrastructure, extension services, production inputs and mechanization inputs (DRDLR, 2016a). An Agri-park will have the following components.

“The Agri-park comprises three distinct but interrelated basic components:

- 1. The Farmer Production Support Unit (FPSU) -a rural small-holder farmer outreach and capacity building unit that links farmers with markets. The FPSU does primary collection, some storage, provides some processing for the local market, and extension services including mechanisation.*
- 2. The Agri-hub (AH) - a production, equipment hire, processing, packaging, logistics, innovation and training unit.*
- 3. The Rural Urban Market Centre (RUMC). The RUMC has three main purposes;*
 - Linking and contracting rural, urban and international markets through contracts.*
 - Acting as a holding-facility , releasing produce to urban markets based on seasonal trends.*
 - Provides market intelligence and information feedback, to the AH and FPSU, using latest Information and communication technologies” (DRDLR, 2016a:7)*

The goals of rural economic transformation and the radical socio-economic agenda is to rekindle the class of black commercial farmers that were destroyed by the 1913 Natives Land Act, while defeating the scourge of poverty, inequality and unemployment. This would also lead to much more social cohesion in a heavily racially divided South Africa (NPC, 2011).

This is the vision of the 2030 National Development Plan that is in line with the vision of the 2030 Agenda in achieving the SDGs.

The table below shows the targets set out in government's plans, programmes and strategies in developing the emerging agriculture sector.

Table 2.3.1: Strategic objectives of NDP, NGP and MSTF in emerging agriculture

NDP (National Development Plan)	NGP (New Growth Path)	MTSF (Medium-Term Strategic Framework)
1 million additional jobs in the agricultural sector by 2030; 1 million hectares under production	145,000 new jobs in agro-processing by 2020; 300 000 new smallholders	1 million new jobs in rural economy by 2030; Reduction of rural unemployment from 49% to less than 40% by 2030

Source: DRDLR (2016a)

It is important to have the necessary policy, legislative and institutional frameworks in place, which can contribute to development and social cohesion. We can from the above see that rural development and land reform thus aims to eradicate poverty while at the same time create a class of black emerging commercial farmers, producers and manufacturers.

The importance of understanding the new emerging commercial farmer is important. The next section thus discusses the context of these emerging commercial farmers within the South African agriculture sector.

2.3.2. The context of emerging commercial farmers in South Africa

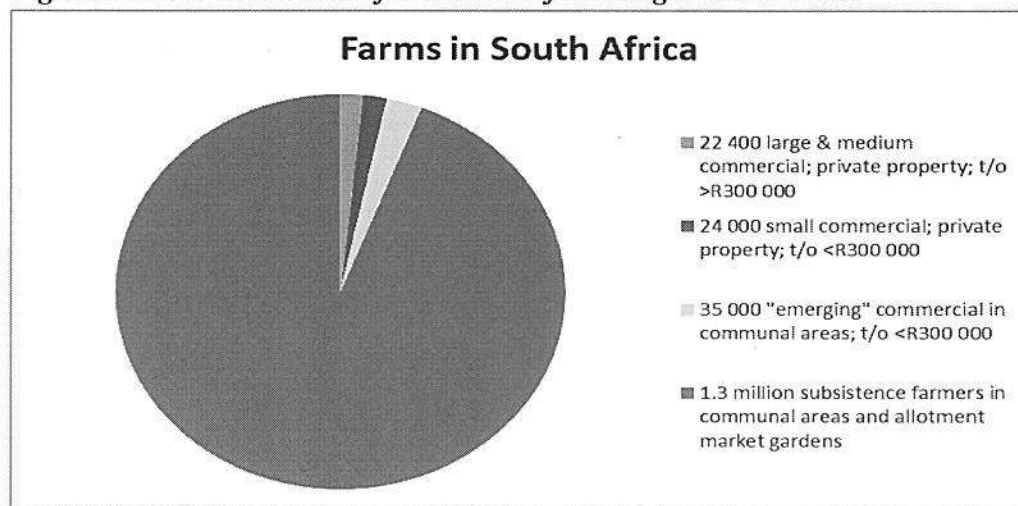
In order to better understand the context of emerging commercial farmers in South Africa I will first disaggregate the South African agriculture sector. Next I identify and discuss the challenges faced by emerging commercial farmers. Finally I identify the support programmes developed by government and try to establish if there is any impact.

South African agriculture can be classed as a dual system with mostly white well-developed capital intensive commercial farmers on the one side and mostly black less-developed smallholder and subsistence farmers that lack resources (Thamaga-Chitja and Morojele, 2014).

To change this dual system government created in 2009, the Comprehensive Rural Development Programme (CRDP) using land reform. The CRDP beneficiaries of land redistribution are the following; (i) landless households for subsistence farming; (ii) subsistence farmers who wants to farm commercially; (iii) small-scale commercial farmers who want to expand; (iv) well-established black commercial farmers who are disadvantaged by location and other circumstances; (v) and financially capable black businesspeople who will farm commercially on a part-time basis (Cousins, 2013).

A study by Vink and van Rooyen (2009) gives a breakdown of the South African Agriculture sector in fig 2.3.2.

Figure 2.3.2: A breakdown of the South African Agriculture sector



Source: Adapted from Vink and van Rooyen (2009)

The study represented in the above figure established in 2009 there was 22 400 large and medium commercial farmers on private property having a turnover greater than R300 000. There was also 24 000 small commercial farmers on private property and 35 000 emerging commercial farmers in communal all having a turnover more than R300 000. Finally there are 1.3 million subsistence farmers in communal areas and allotment market gardens.

According to DAFF (2012) smallholder farmers are those who use exclusively family labour, to grow subsistence and sometimes cash crops on small-based plots of land. They use simple, out-dated technology as production systems that yield low returns with women playing a vital role in production. Cousins (2013) argues against seeing smallholders as a homogeneous group and distinguish them as three distinct groups. He identifies them as those who use farming firstly to satisfy their social reproduction partially, secondly meets most of their

social reproduction requirements and finally those who produce a surplus where profits can be re-invested or accumulated. In this study our interest are on the emerging commercial farmers who are smallholders that produce a surplus where profits can be re-invested or accumulated.

By increasing the productivity of smallholder farmers we can ensure long term sustainable food security and livelihoods development of the rural poor to escape poverty in South Africa. Various challenges impede the growth of smallholder farmers to become commercially sustainable. This includes low productivity, access to land, poor physical and institutional infrastructure as most smallholder farmers are located in rural areas or in the former homelands. Limited access to transport inputs, produce and information make distribution channels unreliable and force farmers to grow less perishable commodities (DAFF, 2012).

Earlier we identified the need for agriculture-related policies and programmes to accelerate land reform and implement farmer support services for smallholder farmers in remote rural areas. They need to gain access to commercial supply chains through the improvement of logistics for farm inputs and outputs domestically and internationally. The creation of alternative markets can be link to the provision of information and market intelligence to enhance competition along the supply chain.

Information inefficiencies are a major challenge facing emerging commercial farmers in South Africa. The absence of reliable markets and the identification of opportunities for product diversification are important for product development. Smallholder farmers are often illiterate with poor technological skills. The lack of production knowledge makes them unable to meet the quality standards set by fresh produce markets and food processors. This subsequently leads to lower quality in production. Increasingly demanding consumers and concerns about food safety in food value chains tend to make it very difficult for smallholder farmers to enter high-value markets in light of the low quantity and poor quality of their products (DAFF, 2012).

The provincial government agricultural departments are responsible for developing the skills base of farmers within the framework of national policies, set by the national Department of Agriculture. They provide farmer support services through decentralised district offices that are intended to bridge the gap between available technology and farmers' practices by providing technical advice, information and training (Cousins, 2011).

Another major challenge faced by smallholder farmers is the inconsistency in production that leads to low bargaining power. The poor access to market information and limited access to financial markets prevents them from selling their products at the most profitable time. Cooperative development is one of the most effective interventions to provide support services for smallholder agricultural growth that can create long term food security, job opportunities and income (DAFF, 2012).

Extension officers in the past were servicing a relatively small number of white large-scale commercial farmers but now have to concentrate on the development of black small-scale farmers. They assist emerging commercial farmers with access to finance, marketing and the development of cooperatives to access economic government support. The lacks of skills of the extension officers themselves are a major challenge (Cousins, 2011).

Government and other stakeholders should promote ICT4D in order to improve agricultural production and promote food security among emerging commercial farmers (Mago and Mago, 2015). According to the Strategic Plan for 2015-2020 of the Department of Rural Development and Land Reform, “ *Agri-Parks are conceived as providing for the creation of sustainable rural enterprises and industries, agro-processing, trade development, production hubs for food security, local markets and financial services*” (DRDLR, 2015:8).

In this section we highlighted the need in South Africa for agriculture-related policies and strategies to accelerate land reform and implement farmer support services for smallholder farmers in remote rural areas. Information inefficiencies are a major challenge facing emerging commercial farmers in South Africa to access finance, marketing and the development of cooperatives to access economic government support. This section highlighted the absence of information and market intelligence to enhance the improvement of logistics for farm inputs and outputs domestically or internationally, which impedes them from competing along the supply chain. There is a need to create alternative reliable markets, commercial supply chains and to identify opportunities for product diversification that is important for product development. This section highlighted the major challenge of the South African government agricultural departments to provide farmer extension support services in technical advice, information and training. Thus the next section discusses the role of ICT in assisting government to better develop emerging commercial agriculture in South Africa. The literature review will show that ICT innovation can play a key role in improving agricultural production and the value chain.

2.4. The importance of ICT use in emerging commercial agriculture

Numerous theories and methodologies yield research findings about the potential of ICTs to make a positive difference in people's lives. Whether the findings actually contribute depends on multiple factors. It is essential that all the actors who use ICTs in beneficial ways have the capacity to learn about how they can make a difference in people's lives. The need to build capacity for learning from a range of types of evidence developed by both researchers and practitioners applies as much to government actors as it does to those in the private sector and representatives of civil society (Chib, 2015).

The usage of ICT through devices such as mobile phones and pcs', together with applications such as the internet and social media has provided many more innovative ways to communicate information (RAP and FAO, 2012). The phenomena where various ICT applications are developed for the mobile phone to give the poor more access to opportunities that assist them in their development are known as m-development (Leon et al., 2015). This opportunity as well as the use of technological sensors is discussed in this section.

ICTs can play many different roles in development of agriculture such as increasing access to education and information on health or diseases and pest outbreak. It can also provide market information, employment generation and credit opportunities. Social infrastructure should be provided by government so that small and medium scale farmers can have unlimited access to other modern ICT facilities (Chikaire et al, 2015).

After more than two decades of research on technological interventions in the transition to information societies, the burgeoning of mobile phones in developing countries has shifted the ICT4D research lens to the different domains of m-Development (Leon et al., 2015). Zimbabwean farmers communicate business through mobile phones by developing their own local content and using affordable mobile communication devices. E-agriculture has immense potential as it uses ICT's to exchange agricultural information. It allows small-scale farmers to share knowledge and experience through utilizing social media, telecenters and other ICT driven communication devices (Collence, 2010).

Farming can respond more responsive to consumers' needs on the way they expect their food to be produced. Emerging commercial farming can easier achieve sustainability through increase efficiency by making data across the board available for better planning (Brewster et al, 2012).

In Kenya the improvement of existing information services, systems, and channels of communication had empowered women farmers in ensuring food security and sustainability while promoting alternative income generating opportunities that had a significant impact on poverty alleviation (Odini, 2014).

Mobile communication enhanced the food distribution system of Côte d'Ivoire and assisted existing systems for producing, transporting and marketing of food. This allowed large- and small-scale wholesalers more responsive and flexible planning. They are able to manage and adjust the delivery of products to different retailers as surpluses and shortages develop (Djane and Ling, 2015).

I now further discuss ICT4D in relation to rural areas, sustainable agriculture and as an extension service.

2.4.1. ICT4D in Rural Areas

ICT can address the lack of access to quality education and resources in rural schools and communities that is considered basic by their urban counterparts. ICT implementation in rural areas in South Africa and effective use of technology leads to better education and development in rural areas (Herselman & Hay, 2003).

Some academics believe that ICT can become a powerful force in rural poverty reduction by helping society shift to sustainable consumption patterns. ICT can form a key component of broader and smarter strategies to educate people about poverty and promote equitable and sustainable development (Chikaire et al, 2015).

The rural communities has many challenges due to lack of information and communication compared to urban. ICT infrastructure can be used to reach the remotest areas and provide better education for the poor in rural areas. Rural ICT kiosk in India has improved access to livelihood resources and assets for improvement of living standards in rural communities (Khuhawar et al, 204).

ICT4D in the form of e-hubs are able to look at building the capabilities of a rural community by using its assets to develop multiple livelihoods outcome. This make it possible for individuals to choose alternative livelihoods (May and Diga, 2015).

In rural India it has been shown that Computer kiosks are the building blocks to address the unmet needs of Indian villagers in rural areas. Aquacultural activities were optimally exploited through e-Choupal kiosk that ensured information exchange among the fellow farmers (Mahalakshmi, 2008).

From these arguments above ICT in the form of e-hubs in rural areas can improve access to basic services for the poor through direct communication. There is also the need for communities to be fully part of the development and implementation of these e-hubs in order for them to take full ownership.

This leads us to discuss the role ICT4D can play in the development of agriculture to make it sustainable.

2.4.2. ICT4D and Sustainable Agriculture

Sustainable agricultural is dependent on the maintenance of a vital ecosystem that will lead to healthy soil. Climate change causes some effects to which people can adapt and mitigate to, as crop and livestock production contributes to climate change. To successfully address current food insecurity and climate change challenges we can use the sustainable and inclusive food value chain approach to support the transformation of the agricultural sector to become climate-smart (FAO, 2014).

According to Kaloxilos the agricultural sector needs access to sophisticated internet-based, cloud hosted, open systems that will enable them more effective collaboration. The main intelligence of the system is in the cloud while local installations are kept to a minimum resulting into cheaper solutions for the farmer. The Farm Management System must be designed and implemented by local farmers and stakeholders to facilitate their acceptance and accommodate for their requirements (Kaloxilos et al, 2013).

A growing world population and climate change require the development of agricultural farming production systems that are both more sustainable and more efficient. In order to deliver better natural-resource management we need lower energy consumption, high food

quality, safety and security. Information and Communication objectives and solutions can be applied in primary agriculture to reduce the negative impact of agricultural production on the environment (Didelot et al, 2012).

E-agriculture holds great potential in promoting sustainable agriculture while protecting the environment and finding an effective way to feed the world's population. The sector is increasingly becoming knowledge-intensive, and the availability of the right information, at the right time, in the right format, and through the right medium, influences and affects the livelihoods of many stakeholders involved in agriculture and related fields (FAO and ITU, 2016).

In Isoko agricultural zone of Delta State in Nigeria ICT training was used to increase technical efficiency of fish farmers. The lack of an enabling environment convinced government to promote concerted use of ICT facilities by fish farmers to address the challenges of maintenance, low level of production and rural poverty (Aphunu and Atoma, 2011).

We see that there is a significant role for ICT to play in contributing to sustainable agriculture as humans engage the use of the natural environment to create livelihoods.

Future Internet (FI) enables data integration amongst different systems in the agriculture value chain to explore the capabilities to address the largest environmental carbon footprint of technological developments that is agriculture. Although this reinforces industrial agriculture the external inputs and outputs are reduced as the focus on precision farming results in less harm to the environment as (Brewster et al, 2012).

The Future Internet is expected to greatly influence the food and agriculture operations sector in the future. This will take place under a highly heterogeneous group of actors and services focusing on how information management revolutionizes the agriculture sector. In order to transfer data in a bi-directionally automatic and simple way Smart Agri-food architecture intends building an integrated food chain (Kaloxylos et al, 2013).

This reaffirms that the use of the internet can improve agriculture in terms of how food are produced (Smart farming), how food are moved to markets (logistics) and the safety of food (Traceability). The next section will investigate ICT4D as an extension service to emerging commercial farmers.

2.4.3. ICT4D as an Extension Service for Emerging Commercial Farmers

There is a concerted effort to change the specific focus on agriculture technology extension service to look at the overall rural livelihoods. This would not only look at communication or information technology but also facilitate demand-driven advocacy services that could improve the lives of people in rural areas (Richardson, 2012). Agriculture is the main contributor to economic growth in most African countries and needs stability for social and economic development. Modern ICTs have the potential to increase agricultural productivity through communicating knowledge and information to rural agricultural communities. This can restructure extension services and scale up inter-linkages of development interventions such as providing capacity building, accessing markets and accessing credit (Munyua, 2007).

The difficulty experienced by traditional extension workers and the diverse challenges of agricultural production, force governments in many countries to look favourably at communication channels, such as mobile telephone technology to provide advisory services to farm communities and other actors involved (RAP and FAO, 2012).

To explore the great potential of ICT tools in agricultural extension we need to give more attention to those constrained by literacy. Extension staff through skills training must increase their capacity on the use of ICT tools. Extension service can assist farm owners on how ICT can be utilized in farm management practices (Sule et al, 2009).

ICT extension services that improve the well-being of the rural poor may also be good for agricultural development, because in developing countries the rural poor form the backbone of agricultural production. To better understand these relationships between ICTs, agriculture and poverty reduction we should do a thorough analysis of rural livelihood assets and strategies (Richardson, 2012).

The creation of 'one-stop centres' for training and linking farmers to markets can improve agricultural production. The exchange of knowledge and information can assist in the restructuring of extension services that target farmer groups (Munyua, 2007). Government policies should put an emphasis on extension organization for rural farmers to positively influence the level of production, through computer education to build the capacity of farmers and extension officers (Aphunu and Atoma, 2011).

There need to be collaboration between the agricultural and telecommunications sectors of government. We can use mobile technology to assist the livelihoods of the rural poor as it has

shown that accessibility is easy even to people living below the poverty line. This includes resource-poor farmers in many developing countries. Creative use of emerging ICT can supplement traditional public sector extension and advisory systems (RAP and FAO, 2012).

Section 2.4 illustrated that ICT innovation plays a key role in improving agricultural production and the value chain. Food traceability systems using ICTs have become very important risk management tools that allow food business operators or authorities to contain food safety problems and promote consumer confidence. ICT-enabled marketing and access to markets plays a major role, especially for information on market prices and demand. ICT-enhanced marketing and certification strengthens the capacity of emerging-commercial farmers to increase revenue by improving their position on local and international markets. Smart technologies have been introduced into programmes for various purposes including land -use planning, crop forecasting and is also essential to monitor threats from the growing number of natural disasters. In addition, the use of mobile phones has become more common for exchanging information. There are also a growing number of ICT solutions for the down-stream opportunities of the agricultural value chain such as post-harvest, transport and storage.

We see the critical need for government to develop a strategy to provide ICT extension services to emerging commercial farmers in order for them to be able to compete equally with industrial farms who can buy in the ICT support. In summarizing we have identified a number of positive trends, including mobile applications for agricultural information, mobile financial services and stronger integration of ICTs into agriculture, however, challenges may limit gains. I now discuss the factors influencing the use of ICTs in emerging commercial agriculture.

2.5. Factors influencing use of ICTs in emerging commercial agriculture

In Sudan's Gezira State the key factors that influence the use of ICT includes socio-economic status, cultural influences, technical shortcomings of information providers, and the age of farmers (Musa et al, 2013).

Low capacity usage of ICTs and a lack of ICT infrastructure in rural areas is a major problem (Munyua, 2007). A study to examine the use of ICT to secure marketing information for emerging commercial small-scale farmers in Niger State, Nigeria identified language, poverty, and illiteracy as major barriers. They suggested government and non-governmental

organizations can play a major role through training and the translation of technology and farmer education programmes into the local language (Nmadu et al, 2013). A study of small-scale women farmers in Vihiga County, Kenya founded that their information needs are not adequately satisfied due to inadequate communication and information infrastructure, low literacy levels, lack of suitable information services, and lack of technical competencies (Odini, 2014).

In Sudan's Gezira State some of the main challenges of ICT adoption by farmers are low education levels, low income, cultural inertia as well as the scarcity of relevant localised content in local languages. Inadequate ICT skills among researchers and shortage of electricity infrastructure for disseminating agricultural information among farmers are a key hurdle (Musa et al., 2013). At a conference hosted by the International Fund for Agricultural Development (IFAD), a paper presented by Samii (2008) determined that the lack of access to relevant information and ICT infrastructure by emerging commercial farmers, leads to a lack of access to key players such processors, traders and consumers in the market chain as a challenge.

We see there are numerous factors influencing use of ICTs in emerging commercial agriculture that are outside the control of the farmers. The following section concludes this chapter.

2.6. Conclusion

FAO (2015) directly links the success of the development of emerging commercial agriculture to achieving three of the seventeen sustainable development goals namely ending poverty (SDG1), zero hunger (SDG2) plus sustainable consumption and production (SDG12). From the literature discussed, we see that most of the world's extreme poor live in rural areas and over 70% of the livelihoods of the people living in Africa are dependent on agriculture. South Africa's development of emerging commercial agriculture aims on rectifying the unjust policies of the past. The establishment of Agri-parks aims to increase the number of black emerging commercial farmers and at the same eradicate poverty. Emerging technologies and new materials was shown to be the key success factors in addressing the challenges of emerging commercial farmers.

This chapter has shown literature that has described the use of ICT in agriculture and rural communities as a powerful enabler for economic growth and social development. The

importance of ICT use has provided emerging commercial agriculture many more innovative ways to communicate information. Mobile phones can play many different roles in their development. Through e-agriculture strategies they can achieve sustainability, develop their own local content to assist existing systems for producing, transporting and marketing of food.

ICT4D in Rural Areas can address the lack of access to quality education which can improve access to resources and assets for improvement of living standards. Through the use and establishment of community driven e-hubs they can create alternative livelihood strategies. ICT4D can assist in achieving sustainable agriculture through the use of sophisticated ICT systems to successfully mitigate current food security and climate change challenges. These systems must be designed and implemented by local farmers and stakeholders to facilitate their acceptance and accommodate for their requirements. ICT can improve how food is produced, moved to markets and the safety when consumed. ICT4D as an extension service for emerging commercial farmers can better communicate important knowledge and information to increase agricultural productivity. There is a need to comply with the 'Code of Good Management Conduct' regarding farming and provide proper information. There is a critical need for government to provide ICT extension services to emerging commercial farmers to address the factors that prevent them from using ICT for their development. The factors influencing the use of ICTs in emerging commercial agriculture are multiple and differ from area to area. This may include socio-economic status, cultural influences, infrastructure, low literacy levels and the lack of suitably competent information service providers. The digital divide in agriculture is not only concerned with technological infrastructure and connectivity, but is also characterized by ineffective knowledge exchange and management of information content, limited human and institutional capacity, and inadequate sensitivity to gender and diverse needs of different groups. As a result, development actors need to better address the availability of appropriate and adapted content, the affordability of access, the development of farmers' capacity to use ICTs and available information, and the inclusion in ICT initiatives of women, youth, older farmers and those lacking literacy and educational skills.

The next chapter will now look at how the South African government and other development stakeholders can develop policies, strategies and programmes to deal with the factors influencing the use of ICTs. The government could use an e-agriculture strategy to guide

them how to embrace the opportunities presented by ICTs when they develop and implement national policies and programmes.

CHAPTER THREE

3. E-AGRICULTURE STRATEGIES AND POLICY DEVELOPMENT IN DEVELOPING COUNTRIES

3.1. Introduction

This chapter focus on the development of an e-agriculture strategy and a number of policy issues that impact on production, productivity and marketing opportunities of emerging commercial farmers. This includes policy regimes and ICTs that relate to agricultural and natural resource management, land reform and institutional frameworks. Finally in this chapter I investigate the need to listen to emerging commercial farmers to ensure their participation in bringing about policy change.

To embrace the benefits presented by ICTs, the South African government needs to formulate ICT strategies and policy that provides direction and guidance for the development and application of ICTs. After the adoption of the 2030 Agenda for Sustainable Development in 2015, FAO and ITU launched a guide to assist developing countries to develop a national e-agriculture strategy (FAO and ITU, 2016).

At a national level, the Poverty Reduction Strategy Programmes (PRSPs) guide a country's intervention strategies and investment programmes. Among the challenges for a country at national level is the translation of policy into national strategies and programmes. On ICT policies there are no clear and adequate strategies to address the use and application of ICTs for rural communities (Munyua, 2007).

When a country develops a national e-agriculture strategy it is important to have a vision, an action plan, and a framework by which results can be monitored and evaluated. A dynamic approach is needed when updating these strategies and plans as the outcomes are not static but changes in a country's strategic context so that it remains relevant. Adopting a national approach to e-agriculture could result in improved livelihoods and incomes for people living in rural communities (FAO and ITU, 2016).

I believe these agriculture policies should also form the base for assisting in the attainment of the SDGs related to poverty, hunger and ensuring environmental sustainability. Government

needs to form linkages with key agricultural actors including small-scale farmers, extension workers, NGOs and private sector.

Agricultural sector policies should pay sufficient attention to the role of land distribution and rural poverty in relation to the inequalities between small-scale and large-scale farming sectors. Although some good progress in addressing the issue of ICTs and development has been made, existing ICT policies do not adequately cater for the needs of the emerging commercial farmers (Munyua, 2007).

I believe these agriculture policies should also form the base for assisting in the attainment of the SDGs related to poverty, hunger and ensuring environmental sustainability. Government needs to form linkages with key agricultural actors including small-scale farmers, extension workers, NGOs and private sector. The next section will thus discuss the development of a national e-agriculture strategy

3.2. Developing a National E-agriculture Strategy

Farming communities can enhance their ability by connecting with knowledge banks, networks and institutions via ICTs. This can improve their productivity, profitability, food security and employment opportunities substantially (FAO and ITU, 2016).

A successful e-agriculture project implemented in the state of Odisha, India, demonstrates how technology was used to address these issues and improve the livelihoods of small-scale farmers. In just over one year, the e-agriculture project helped 6,000 farmers increase their incomes as much as 300 percent, and created job opportunities for local entrepreneurs (Intel, 2012).

There are many misgivings of development planners, governments, and donors regarding the outcomes of ICT4D. A generic Theory of Change (ToC) establishes causal links between attributes of information society and the MDGs. It developed indicative Theory of Change maps or pathways to change applicable to e-Agriculture, ICT for education, and Knowledge Management (KM) for climate change (Flor, 2015).

Agriculture in its operations has significant linkages with other related sectors such as rural development, natural resource management, banking, insurance, media, governance, transportation and logistics management (FAO and ITU, 2016). We will in the next section define what we mean by e-agriculture.

3.2.1. What is e-agriculture?

FAO's Strategic Objectives are to eliminate hunger, food insecurity and malnutrition. They aim to make agriculture, forestry and fisheries more productive and sustainable. They believe this would reduce rural poverty, enable inclusive and efficient agricultural food systems, while it increase the resilience of livelihoods to threats and crises (FAO, 2015).

Institutional competence, alongside varying costs and levels of training and capability, will be elements which will make ICTs access and usage possible even for the underprivileged population. For the poor to truly benefit in wellbeing change, a country's economic growth strategy would likely need the support of complementary ICTs and other poverty reduction strategies, to ensure that ICTs find their place within a balanced frame of inclusive growth (May and Diga, 2015).

More specifically, e-agriculture involves the conceptualization, design, development, evaluation and application of innovative ways to use ICTs in the rural domain, with a primary focus on agriculture. Provisions of standards, norms, methodologies, and tools as well as the development of individual and institutional capacities, and policy support are all key components of e-agriculture (FAO and ITU, 2016).

We need to recognise the reasons for policies and strategies that include political and economic benefits for certain groups. This has political implications that set new agendas, which change the way problems are depicted and shed light on its solutions. An e-agricultural strategy will define the complexity of the context and the types of policies (Ordóñez, 2015).

An essential first step for any developing country to develop ICTs solutions for agricultural challenges is to adopt a strategic approach and a national e-agriculture strategy (FAO and ITU, 2016). I will now look at why it is necessary for an e-agriculture strategy

3.2.2. The case for an e-agriculture strategy

Agriculture is increasingly knowledge-intensive and there is a need for the right information to make crucial decisions in order to provide an ever growing population with food security. Information needs to be tailored to local conditions to have effective impact, as agriculture is highly localized. ICTs have been a significant contributor to growth and socio-economic development in business sectors, countries and regions where they are well adopted and integrated. Adoption and integration of ICTs have improved service delivery and created new

jobs (FAO and ITU, 2016). There was a significant impact when an e-agriculture project was implemented among rural tribal farmers in the North-East of India. The extension services cost to provide farm advisory services were saved 3.6 times in comparison with the conventional extension system. Sixteen fold less time was required to avail the services and threefold less time was required to deliver the services to the farmers compared to the conventional extension system (Raj, 2013).

During the World Summit on the Information Society (WSIS) in 2014, agriculture as one of the main action lines identified six major action points why e-agriculture is important beyond 2015. These points are listed

“WSIS+10 Vision for WSIS Beyond 2015.

- a) As part of national ICT strategies, foster the development and implementation of national e-agriculture strategies focusing on providing reliable and affordable connectivity and integrating ICTs in rural development to support food security and hunger eradication.*
- b) Foster collaboration and knowledge sharing in agriculture via electronic communities of practice, including the e-Agriculture Community, in order to showcase and promote models, methodologies, good practices and the adoption of Open Access and interoperability standards, for effective and equitable use of ICTs for sustainable agriculture and rural development.*
- c) Promote the creation and adaptation of content including in local languages and contexts from reliable and trusted sources, including, to ensure equitable and timely access to agricultural knowledge by resource poor men and women farmers, foresters and fisher folk in rural areas.*
- d) Foster digital literacy of institutions and communities in rural and remote areas taking into consideration local needs and constraints by providing appropriate learning opportunities for all which will enhance individual and collective decision-making skills.*
- e) Promote the use of ICTs to reinforce the resilience capacity of states, communities and individuals to mitigate and adapt to natural and manmade disasters, food chain challenges, socio-economic and other crises, conflicts and trans-boundary threats, diseases, and environmental damages.*

- f) Promote Public-private partnerships in cooperation with relevant CSOs/ NGOs, cooperatives, farmer organizations, academia, research institutions in the agricultural sector (which also includes forestry and fishery) for inclusive, efficient, affordable and sustainable ICT services and initiatives in agriculture and rural development which will promote the wide scale use of ICT and foster sustainable agri-business models.” (FAO, 2015:3)*

It was earlier pointed out that the rapid growth of mobile phone ownership globally provides new avenues to share and access information. We have seen that in rural farming communities’, smartphone access is on the rise and the rapid growth of broadband which is increasingly affordable provides a great opportunity for e-agriculture. It is now important to look at the different policy regimes that could be necessary to implement an e-agriculture strategy.

3.3. Policy regimes

Development research should focus on capacity building as a basis to investigate and learn from empirical evidence offered on the impact beyond academic research. We need to examine the impact within communities to a global audience, including policymakers and practitioners (Chib, 2015).

E-agriculture strategies rationalize both financial and human resources to holistically address the ICT opportunities and challenges of the agricultural sector to generate new revenues. The lives of people in rural communities are improved and it helps countries to achieve the goals and policies of national agricultural plans (FAO and ITU, 2016).

Costs of access as well as fast real-time delivery of information to large dispersed audiences can be substantially reduced by mobile technology. Government needs to establish an enabling environment and formulate clear policies. This should clearly define in a formal written agreement the split of roles for the private and public (RAP and FAO, 2012).

Appropriate policies and training are essential to improve the technical skills of farmers. This can limit the constraints that can prevent them from exploiting the benefits of ICT (Aphunu and Atoma, 2011).

ICT4D should take centre stage in policy formulation and planning. The advantages it presents to rural farmers should be harness to improve livelihoods. More research is needed

to be undertaken to generate useful information for ICT policy-making and implementation (Mago and Mago, 2015).

Research needs to be more relevant to society in order to influence policy change in the use of ICT4D. The ICT4D community needs to explore the policy processes with the aim to better understand the context and where they do participate in policymaking process. Influencing policy thus requires intent from the onset of a research project and not only as part of its post communication strategies (Ordóñez, 2015).

Weak ICT policies and poor implementation capacity are among the biggest obstacles to the wider use of ICTs in Africa. ICT policies that affect the use of ICTs by rural communities and rural development for agriculture are inappropriate. Most ICT initiatives are project-based, disjointed and uncoordinated. They lack good ICT infrastructure, ICT skills, good and affordable connectivity and appropriate ICT policies (Munyua, 2007).

A framework developed for policy impact needs to consider aspects of the policymaking process. It needs to communicate results wisely, identify meaningful and timely research questions, their connection with policies and pinpoint appropriate methods. The main argument is that not all research influence policy and ICT4D policy has not been an area of interest (Ordóñez, 2015).

FAO support governments and development partners to design the right policies, programmes and legal frameworks that promote food security and nutrition. FAO also assist countries seeking to access public and private funding for agriculture and rural development (FAO, 2015).

There is a massive rollout of basic information communication infrastructure in Africa as African governments have continued to support ICT initiatives in under-served areas. The provision of infrastructure can enhance the livelihoods of farmers through adoption of modern technologies and appropriate policies (Munyua, 2007).

An overemphasis on a link between ICT and development has overshadowed finding policy options and understanding the factors that may affect them and successfully implement them. There is a lack of focus on the power struggles and the decision-making knowledge production concepts of policies and politics. It is critical that ICT policy consider politics and policy aspects within other sectors policies. This will bring a better understanding of the

policy choices and political constraints. These are important to better understand all research involved in the process of informing policymaking (Ordóñez, 2015).

For academic research to have an impact on policy and practice it is worthwhile to take research projects beyond the academic level. Researchers need to engage at the policy level with local communities, at the university level with regard to research and represent the research perspective in global public consultations. They should also work with national media and policymakers at the international level (Chib, 2015).

The incorporation of participatory methods that involve the participants' aspirations and wellbeing are recommended for developing countries when developing national policy that involves inclusive growth. Economic growth alongside social welfare policies have to be included within one's limited national budget (May and Diga, 2015). In less developed areas, information through ICTs alone may not create expected development as they also need forward and backward linkages. Appropriate public-private partnership between knowledge and other rural advisory service providers should facilitate appropriate agricultural information and knowledge for agricultural development (Raj, 2013).

We have learned from the above arguments about the importance of involving people in the development of policy that aims to develop their welfare. I will in the next section further discuss the importance of participation of emerging commercial farmers in bringing about policy change in agriculture.

3.3.1. The participation of emerging commercial farmers in bringing about policy change in agriculture.

Climate Smart Agriculture includes the adoption of people-centred participatory approaches and management structures to align sectorial policies. This creates integrated sustainable management of natural resources that will contribute to improving the resilience of the agro-ecosystem. It increases the resilience of vulnerable communities against climate change and improves the socio-economic conditions in rural areas (FAO, 2014).

For agriculture to be a key success factor for food security and pro-poor economic growth it has to be inclusive and provide opportunities for improving the livelihoods of the poor. Enhancing the productivity and incomes of smallholder family farmers is the key to this progress (FAO and ITU, 2016).

ICT4D address the challenges of the poor rural areas by realising their potential to empower and secure their livelihoods. Nevertheless, ICT projects should be implemented with commitment to work with communities. This can achieve encouraging results as participation of the community leads to local ownership of these ICT projects by the community (Cecchini and Scott, 2003).

Beneficial results are yielded where impact is defined as empowerment of stakeholders in their competences, confidence level and attitudes towards change, when participatory processes are in technology introduction, (Olivera et al., 2015).

A lack of understanding and awareness of the needs and challenges of small-scale farmers can also influence the adoption of ICTs in agriculture. The failure to use participatory approaches and the lack of systematic inclusion of ICTs in national poverty reduction strategy are a major cause of concern (Samii, 2008).

Public consultation is a formal mechanism of social participation where government invites citizens to participate in policymaking. For the purpose of policymaking, different models of democratic environments of political communication can overlap. This can produce a different model of online democratic communication that can either reinforce or diminish political communication (Steibel and Estevez, 2015).

Social media can be used by government to promote e-government and to listen to the voices of the people. Government should make efforts to build online platforms, efficient systems to receive and respond to these feedbacks. For practitioners, the active opinion expression is a necessary foundation for the energy of the online community and skill sets of the engaged constituencies (Zhou, 2015).

Critical agents of change such as rural women, smallholder and family farmers, investors in roads, markets and infrastructure as well as vulnerable people and policy-makers are all important when developing policies for inclusive growth in developing countries.

“Policies directed towards critical agents of change have the potential to produce dramatic and lasting effects on the economies of developing countries, transforming people into investors and stewards of their environment.

Rural women: *Women make up almost half the agricultural labour force in developing countries, but they own less land and lack access to resources. If women are more involved in decision-making, and if they had the required and needed access*

as men to productive and financial resources, income, education and services, agricultural yields would increase and the number of poor and hungry people would fall.

Smallholders and family: Investing in small producers, family farmers, fisher folk, livestock breeders, forest users, rural workers and indigenous peoples can promote growth and development in rural areas. Increasing their access to resources, employment and incomes will lead to better food security and nutrition. At the same time, it helps ensure sustainable stewardship of the planet's natural resources raises productivity and contributes to national economic growth.

Farmers: Investing in small producers, family farmers, fisher folk, livestock breeders, forest users, rural workers and indigenous peoples can promote growth and development in rural areas. Increasing their access to resources, employment and incomes will lead to better food security and nutrition. At the same time, it helps ensure sustainable stewardship of the planet's natural resources raises productivity and contributes to national economic growth.

Investors in roads, markets and infrastructure: The majority of people in developing nations still live in rural areas. Investment in rural infrastructure – roads, transportation, electrification, communication - diversifying rural employment and improving rural-urban linkages can contribute to a more interconnected, inclusive and vibrant society while slowing the exodus of rural people to cities.

Vulnerable people: Many of the world's poor and hungry live in areas prone to natural disasters or protracted conflict. These crises directly affect food access and production, undermining efforts to eradicate hunger, malnutrition and poverty, and to achieve sustainable development. Resilience policies, which range from rehabilitating flood-damaged waterways to planting climate resilient crops and developing capacities, can sustain the livelihoods of the most vulnerable.

Policy-makers: A strong entrepreneurial spirit already exists in the rural sector, where small-scale producers invest much more in agriculture than governments, donors and private enterprises combined. Policies and public investments must increase smallholders' investment capacity and access to finance, participation in decision-making processes, rights to land tenure and access to technology and innovation. Multi-stakeholder platforms, like the Committee on World Food Security (CFS), can play a crucial role in policy guidance and accountability." (FAO, 2015)

3.4. Conclusion

In recognising the importance of ICTs, the government needs to come up with an ICT policy framework that enables the provision of ICTs in all sectors including agriculture. The development of an e-agriculture strategy with a vision, an action plan and a monitoring framework can assist government with a number of policy issues that impact on the production, productivity and marketing opportunities of emerging commercial farmers. This also has the potential to reduce duplication of efforts among different sector ministries and create more coordination.

South Africa as a developing country has yet to adopt a strategic approach in making the best use of ICT developments in agriculture. The government can use a guide provided by FAO and ITU to conceptualize, design, develop, evaluate and apply innovative ways to use ICTs in the rural domain, with a primary focus on agriculture.

Existing ICT policies do not adequately cater for the needs of the emerging commercial farmers. Through the implementation of policies government can address challenges such as inadequate infrastructure, ICT facilities and lack of financial resources. FAO can support governments and development partners to design the right policies, programmes and legal frameworks that promote food security and nutrition.

ICT4D should take centre stage in policy formulation and planning. It is critical that ICT policy considers politics and policy aspects within other sectors policies. The participation of emerging commercial farmers in bringing about policy change in agriculture is important to promote a people-centred participatory approach and an integrated sustainable management approach.

The participatory process needs to acknowledge that stakeholders can become technological leaders and gain the capacity to engage participants in the technology development process. These critical agents of change have the potential to produce dramatic and lasting effects on the economies of developing countries. These agents of change that relates to emerging commercial agriculture can be vulnerable people such as rural women, smallholders and family farmers.

The following chapter discusses the literature regarding the conceptual approach and theoretical frameworks to be used for this investigative study. The conceptual approach is the Capabilities Approach (CA) and theoretical frameworks discussed are the Choice Framework (CF) and an Evaluative Framework (EF).

CHAPTER FOUR

4. THEORETICAL FRAMEWORK

4.1. Introduction

The framework for any research is to include the belief about reality (ontology), the knowledge that exist and use in our research (epistemology), the data gathered, analysed and processed to create new knowledge (Tuli, 2005).

In this chapter I discuss theoretical underpinnings and the conceptual framework within which this research is conducted and analysed. It also provides a review of concepts used in ICT4D projects to do development in rural areas. I look with particular focus on the role ICT4D projects can play towards emerging commercial agriculture development.

I will approach this research using the Capabilities Approach (CA) in terms of understanding the choices people make to enhance their capabilities in order to support their functionings. ICTs can improve people's capabilities so as to improve their livelihoods and coping strategies (Mago and Mago, 2015).

Sen (1985) argues that income or utility alone is not the only important factor when analysing or developing the poor. He suggests that the freedom to choose and achieve certain functionings should be central. This achievement directly relates to the capability set an individual possesses to achieve such a functioning.

Research has shown a link among ICT development, emerging commercial farmers' livelihoods and poverty reduction. This means that ICT improves the farmers' capabilities and livelihoods that lead to economic growth and reduce poverty as explained by the CA (Mago and Mago, 2015).

We see that in developing countries, ICT is used more and more by the poor, to increase their capability to achieve a certain functioning. This research investigates how the ability of emerging commercial farmers and their employees to utilise ICT as a development tool, in their processes and strategies, can increase their functionings to create sustainable farming businesses. This directly links to the development agenda of poverty eradication that according to FAO is arguably the single most important SDG. I further assess concepts that make up the CA and investigate poverty eradication using both emerging commercial agriculture and ICT application.

I will now first discuss the CA as presented by Amartya Sen and developed further by other scholars. Secondly I evaluate frameworks that operationalize the CA and finally the theoretical framework underpinning this study is introduced.

4.2. Capabilities Approach Explained

The utilitarian research tradition is found in welfare economics literature and assesses the standard of living by evaluating objects of value in terms of utility and resource valuation methods. The two basic questions to evaluate are what the objects of value are and how valuable are they. Sen argues against only using utility and resource valuation to assess the welfare of individuals but feels that pleasure and happiness is also important as he thinks that the utilitarian metric is misleading. He sees the metric of development as the degree of choice an individual has in living the kind of life he /she values, not as happiness. Although he also argues that making those kinds of choices will eventually make one happy. Thus Sen argues that development is not primarily about pleasure and happiness, but about opportunities for choices (Sen, 1985).

Poverty is defined within the CA as the lack of multiple freedoms people value and have reason to value when they are deprived of certain capabilities. What people value and have reason to value “ should be explicit, open to public debate and scrutiny”. Thus according to Alkire a ‘mixed’ method approach should be selected when researching the dimensions of chronic poverty. This could combine a set of core dimensions with their relative importance to respondents during different waves of a survey (Alkire, 2005).

Assessing the standard of living using only opulence and utility is not right as there should be a level of self-assessment. It is still important to assess functionings and capabilities although it is not easy to incorporate in empirical studies (Sen, 1985). Sen argues that individuals should choose on what they should be assessed. The freedom of choice in choosing the lives they feel happy to live thus take centre stage in the CA (Robeyns, 2005).

The CA can be used to evaluate the well-being of individuals or groups of people in terms of concepts such as inequality and poverty. It starts from the base of assessment on an individual level where it looks at the well-being and social arrangements of that individual (Robeyns, 2005).

I will now explain functionings, capability, individual agency and conversion factors in terms of the CA.

4.2.1. Functionings, capabilities, individual agency and conversion factors

Functionings are any “beings” and “doings” we perform daily in order to survive and recreate ourselves. Capabilities relate to the structural opportunities we have access to or develop as an individual’s capability or ability to achieve desired functions. A person can use physical resources and convert it into a functioning using the conversion factors that enable an individual to convert a resource (Alkire, 2005).

CA sees development as a freedom to exercise one’s choice to live the life you want to live. An individual’s agency is the backbone of the capability approach. The fact that human development is embedded in socio-cultural conditions highlights the effect of social structures on individual agency (Zheng, 2007).

Sen moved away from just focusing on utilities to widen the informational basis and focusing on freedom. His concern in using well-being freedom and agency freedom is to use individuals’ abilities, skills and choice) in combination with their capabilities (opportunities) to achieve certain functionings (Sen, 1985).

According to Robeyns conversion factors are the degree to which a person can transform a resource into a function. The three different types of conversion factors identified include personal, social and environmental. Personal conversion factors are internal to a person and can include sex, literacy level, health and intelligence. Social conversion factors stems from the society that one lives and the people with which you relate to. Examples of social conversion factors are public policies, social structures, discriminating practises, gender roles, and cultural hierarchies within society that directs and influence the power relations. Environmental conversion factors are the physical or built environments where we live that include the climate, infrastructure, institutions and public goods (Robeyns, 2005).

People with the same means do not automatically produce the same outcomes as there can be a difference in their capability to function for a number of reasons. Firstly, conversion factors such as disability or illness can lead to physical or mental conditions among people that make them achieve differently with the same capability set from individuals without any impairments. Secondly, variations in non-personal resources can also influence a person’s ability to achieve certain functionings. Thirdly diversities in the environment such as climate or varying threats from epidemic diseases or from local crime can affect different individuals

differently. Finally the relative positions we need to achieve in relation to others can influence our capability (Sen, 1985).

People have different freedom to convert resources that is influenced by their social and environmental conversion factors as well as what resources or structural opportunities they have access to. Individuals are said to have a capability or opportunity when they can convert their resources into functionings. A good quality life relates to having a large and varied capability set with many opportunities that you have both the capacity and freedom to realise (Sen, 1999).

The next section discusses the central human capabilities and their relation to choice and valuation.

4.2.2. Central Human Capabilities: Overview of Choice and Valuation

Choice and valuation looks at functionings in their order of importance to an individual, such as the ability to access clean water versus the ability to own an I-pad. Another example is a person's freedom to harm another person versus a person's freedom to live without persecution (Nussbaum, 2000).

The Capability set are the alternative lives people can choose to live using their means and resources to reach alternative ends. The individual thus has a claim to alternative means and freedom in choosing capabilities to aspire to different functionings (Sen, 1989).

Policy aims to support small-group focus and not individuals and aggregation can thus become useful for measurement. Sometimes a capability needs to be secured before others which relates directly to agency. As each individual has different needs and sometimes need to choose important capabilities. Whereas Sen prefers to have no list, the CA was further developed by Nussbaum to consider the focuses of gender and social justice included on a list of central human capabilities (Nussbaum, 2000).

We can increase capability and the freedom of choice through education, which in turn increases economic freedom and income disposal freedom. Sen argues strongly for the responsibility of the state's involvement in education, health and other social responsibilities. He believes market freedom and income are not enough to be a perfect indicator of a person's capabilities (Knopf, 1999). The CA is an alternative in evaluating human development and achievement that focuses on freedom as the basis. Education can expand an individual's

capability and assist in the conversion of means and resources to capabilities that can achieve particular functionings (Nussbaum, 2000).

Although human rights and capabilities both create conditions for development, they are essentially different. Individuals' values can be quite divergent and it would be very difficult to consolidate the freedom of divergent choices of capabilities and human rights (Sen, 2005). Human rights are entitlements that belong to all human beings because they are human and they deserve protection of their rights, no matter where they are, or whether the state recognises these rights (Nussbaum, 2000). Capabilities, on the other hand, are opportunities which individuals can realise by choosing them, given that these are "real" and realisable opportunities.

Culture leads to certain norms and values that can impede the relationship between rights and freedom to choose. An individual's freedom being a social commitment are realised through social choice and individual behaviour (Knopf, 1999). Justice relates to the fairness used to create personal features and combinational characteristics between the divergent objectives of different persons to achieve different goals in their lives. As people have different objectives in life, it can become a challenge if we want to achieve justice in terms of means and freedom (Sen, 1989).

According to Andersson, Human Development (HD) theory operationalizes Sen's CA in order to guide empirical data collection and analysis. Social Capital leads to collective capital and it is argued that Sen puts too much emphasis on the individual. The CA can be complemented by incorporating theoretical and conceptual thinking that emphasise the collective and society. Thus Social Capital of communities is increased by the use of ICT that can lead to human development, where newly collective capabilities are created through collective action (Andersson et al, 2012).

In this section I investigated how the Capabilities Approach was conceptualized by using Sen's concerns for analyzing poverty eradication in terms of focusing on freedoms and not on utilities or resources alone. He emphasized the freedom for individuals to choose the life they want to live and articulated an approach that included the focus on the individual. I further defined what is meant by functionings, capabilities, individual agency and conversion factors. I further mentioned how well-being freedom, together with agency freedom could be used to transform capabilities and opportunities into functionings that allow people effective freedom. We see by critiquing and assessing social practices that it may induce certain

behaviour that restricts people's capability sets, or privileges some group's capabilities at the expense of other groups.

After discussing the CA as the conceptual approach I shall now discuss two theoretical frameworks on technology use and adoption. In the next section I analyse and discuss the Choice Framework (CF) and an Evaluative Framework (EF) that attempt to operationalize Sen's CA.

4.3. Frameworks on technology use and adoption

Andersson explains that there is a need for theories to assist ICT4D projects to assess or implement projects to eradicate poverty. It is important to understand what ICTs' yield to people in developing countries so that we can understand what outcomes can be expected. He further mentions that most ICT development practises are still viewed through Modernisation or Evolutionism theories. This is directed by the need for markets and economic growth as the most important measure for development (Andersson et al, 2012).

We use the CA to evaluate or look at the state of well-being of individuals or communities. It can be used as a normative framework for the evaluation and design of policies that starts from the base of assessment of an individual level to eradicate poverty or inequality (Robeyns, 2005).

ICT4D can make a huge contribution to human development where the CA can provide some theoretical reflections. It allows taking in a variety of important issues surrounding ICT adaptation for development. The CA can provide a lens which helps to avoid the pitfalls of ICT4D narrow focus on ICT in relation to the economy. The CA can identify technological utilities embedded in ICT4D, that presents a pursuit for development as a freedom to achieve greater capabilities for individuals to lead a life they can value (Zheng, 2007).

Thus we can see that we can use other frameworks to operationalize Sen's CA when we are implementing or analysing ICT4D projects in order to develop the poor. The use of these frameworks could fill the gaps presented by the CA. In order to identify some of the gaps and solutions we need to look at applications to operationalize the CA. This leads us to discuss how the CF developed by Kleine in 2010 aims to operationalize the CA.

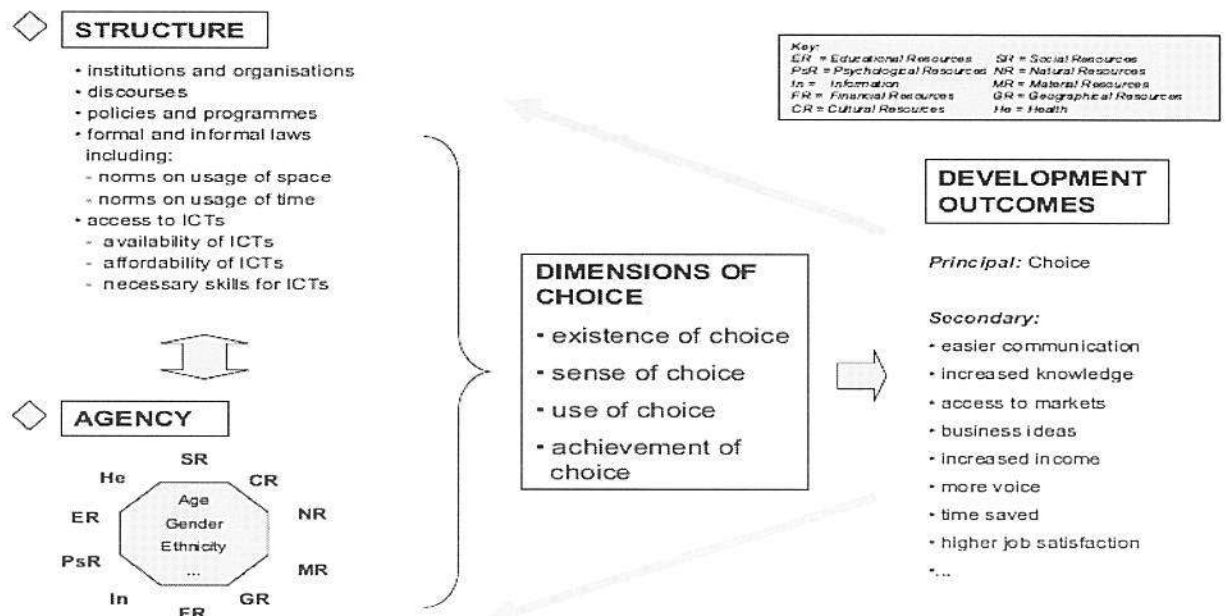
4.3.1. The Choice Framework (CF)

ICT connection to poverty should be measured in a multitude of dimensions as poverty acknowledges a new dimension called “digital poverty”. Who the poor are and the ICTs they have are important when we investigate the empirical linkages between ICT and the concepts of poverty. Across developing countries there is variability within equity of affordability that is sensitive to price and few studies have been able to show the micro-level impact linkage between ICTs and poverty (May and Diga, 2015).

The CA offers a way of thinking about development not as economic growth, but as individual freedom. The CF is operationalizing this approach by conceptualising the development process and can be applied as a guide to a systemic and holistic analysis. Identifying the specific contribution of the use of ICTs to specific development goals has proven to be extremely difficult (Kleine, 2010).

We see Kleine’s CF shown in figure 4.3.1 looks at ICT4D in a systemic and holistic way rather than trying to conceptualise ICT4D impacts within a linear economic view of development.

Figure 4.3.1: A schematic representation of the Choice Framework



Source: Kleine (2010)

The four key elements in Kleine's CF are structure, agency, choice, and outcomes. The development outcomes are achieved functionings rather than capabilities. Kleine sees the main development outcome as the choice people exercise to achieve these functionings. She also lists secondary outcomes such as easier communication, increased knowledge, access to markets, business ideas, increased income, more voice, time saved and higher job satisfaction.

At one end of the framework is structure and agency. Structure is made up of institutions and organisations, discourses, policies and programmes, laws and informal laws as well as access to ICT. Access to ICT includes its availability, affordability and the skills needed to use ICT. Agency comprises different types of resources that include educational, psychological, information, financial, cultural, social, natural, material, health and geographical resources. In the CF age, gender and ethnicity are conceptualised as personal characteristics.

When developing communities the structure that exists could influence people's choices that can lead to certain development outcomes. The outcomes can make a person's agency better, which can lead to a better utilisation of structure. The utilisation of structure can also influence a person's agency. How structure and agency interact can influence choices, and such choices can lead to development outcomes. For development outcomes to be achieved, there must first exist the possibility of a choice, secondly the sense of people being aware of the availability of that choice, thirdly that people make use of option to choose, and finally achievement of an outcome of choice. The analysis of ICT4D projects based on the CF to determine how certain outcomes were achieved works backwards from outcomes to structure and resources.

Figure 4.3.1 reflects the systemic and pervasive impact of ICT on development when applying the CF. Effects are aggregated and their systemic interrelatedness plus co-causality is demonstrated. It offers a way to operationalize Sen's capability approach which is an alternative to the economic growth-focused conceptualisations of development. Sen's approach is of particular interest to the ICT and development research community, as ICTs has enormous potential to give individuals a greater sense of choice (Kleine, 2010).

There are limitations to the application of the CF where more theoretical work needs to be done. Firstly it aims to model the complex relationships between agency, structure, degree of empowerment and outcome. A trade-off is made on the depth of theorisation of each element. Secondly it is easily applied in qualitative work on the micro-level of the individual

but becomes problematic when applied to groups of individuals, communities, or even nations. Thirdly it suggests that impacts of ICTs occur based on individual's choices in a systemic, pervasive and transversal way. This is in contrast to most funders' predefined and clearly measurable impacts although some who are open to participatory evaluation and monitoring methods that forms the cornerstone of people-centred development theory (Kleine, 2010).

An analytical framework based on the three stages of hierarchical digital achievements namely access, usage and appropriation is needed to guide the assessment of ICT's impact on wellbeing. This should also include one last divide stage in terms of ICT's outcomes. To enhance the study of ICT's impact in a much wider and more diverse array of subjects we introduce ICT assets such as access, usage and appropriation as independent variables (Dodel, 2015).

Participatory project design and participatory monitoring and evaluation techniques would be most appropriate to target the group as individuals empowered to choose the lives they themselves value. Democracy where people have the power to choose is a practical way to aggregate individual capabilities in order to enable collective decision making. This could be used for ICT4D although we must realise the more individuals in a group, the less probable it is that they can agree on a similar set of capabilities (Kleine, 2010).

I will now explore an Evaluative Framework that also aims to operationalize the CA.

4.3.2. Development, Capabilities and Technology – an Evaluative Framework (EF)

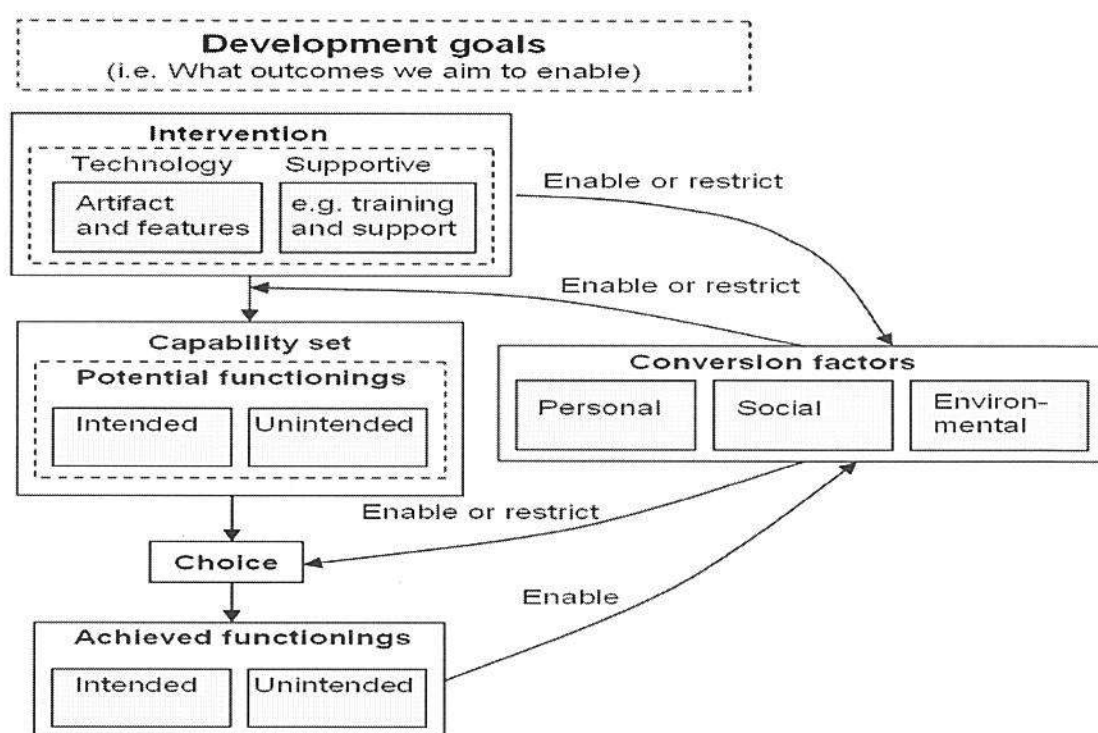
The EF is based on Sen's notion of development as a freedom where human capabilities and functionings are seen as key aspects to development. This can be used for evaluation of ICT4D projects as an alternative way of seeing and evaluating development to the more traditional ways of measuring development (Hatakka and De', 2011).

Sen's CA takes into account a true bottom up approach as it starts with the life individuals choose to live. This impact on development practise as evaluation is limited as it is hard to operationalize how freedom to choose is measured. There is thus a great interest to look at elaborations and central concepts to leverage these deficiencies through the design of

technology in a participatory way to capture, analyse and evaluate capabilities and functionings (Andersson et al, 2012).

The approach is based on expanding freedoms, or eliminating unfreedoms, for people so that they can live a life that they have reason to value. There is a lack of guidelines presented by Sen on how to use the Capability Approach and he never mentioned ICT. The framework aims to operationalize the evaluation process and to include a clear role for technology in Sen's capability approach (Hatakka and De', 2011). A framework developed by Hatakka and De' to operationalize the CA is presented in figure 4.3.2.

Figure 4.3.2: Development, Capabilities and Technology – an Evaluative Framework (EF) by Hatakka and De', 2011



Source: Hatakka and De' (2011)

In figure 4.3.2 we see that when evaluating development outcomes achieved by ICT4D projects the focus is on achieved functionings versus capabilities or potential functionings. Technology intervention should include ICT training and support which can influence the ability to make a choice. Thus the framework evaluates the intended or unintended functionings achieved. Conversion factors might enable or restrict the outcomes or choice in transforming potential functionings into achieved functionings. On the other hand the ICT4D

intervention might enable or restrict the conversion factors whereas the achieved will better enable the conversion factors.

ICT4D initiatives capture the capabilities enabled and the contextual factors influencing both their transformation into potential functionings and the user's choices. The capabilities enabled to enrich people's lives must come from them and therefore the analysis has to be the individual. This is both in terms of which capabilities they value and the factors that hinders their choices (Hatakka and De', 2011).

The centrality of ICT use in our lives should be understood as a key independent variable for studying an array of diverse social phenomena. We can address the relevance of ICT in our lives evaluating the unintended micro- or individual-level development effects achieved outside the fields of ICT. The digital divide that embeds the concept of ICT inequalities are a multidimensional phenomenon that involves several theoretical levels, difficult to integrate into nonspecific ICT research (Dodel, 2015).

The achieved functionings are based on their capability, opportunity, choice and their ability to use ICT4D. The framework helps us to capture the users based on their context and their appropriation of the system. Using a bottom-up approach we can capture the functionings that the system actually enable and not just how the outcome maps against the implemented intervention. The framework focuses on all aspects of the intervention, including the context of the conversion factors and the notion of choice. (Hatakka and De', 2011).

The next section discusses the theoretical framework underpinning this study.

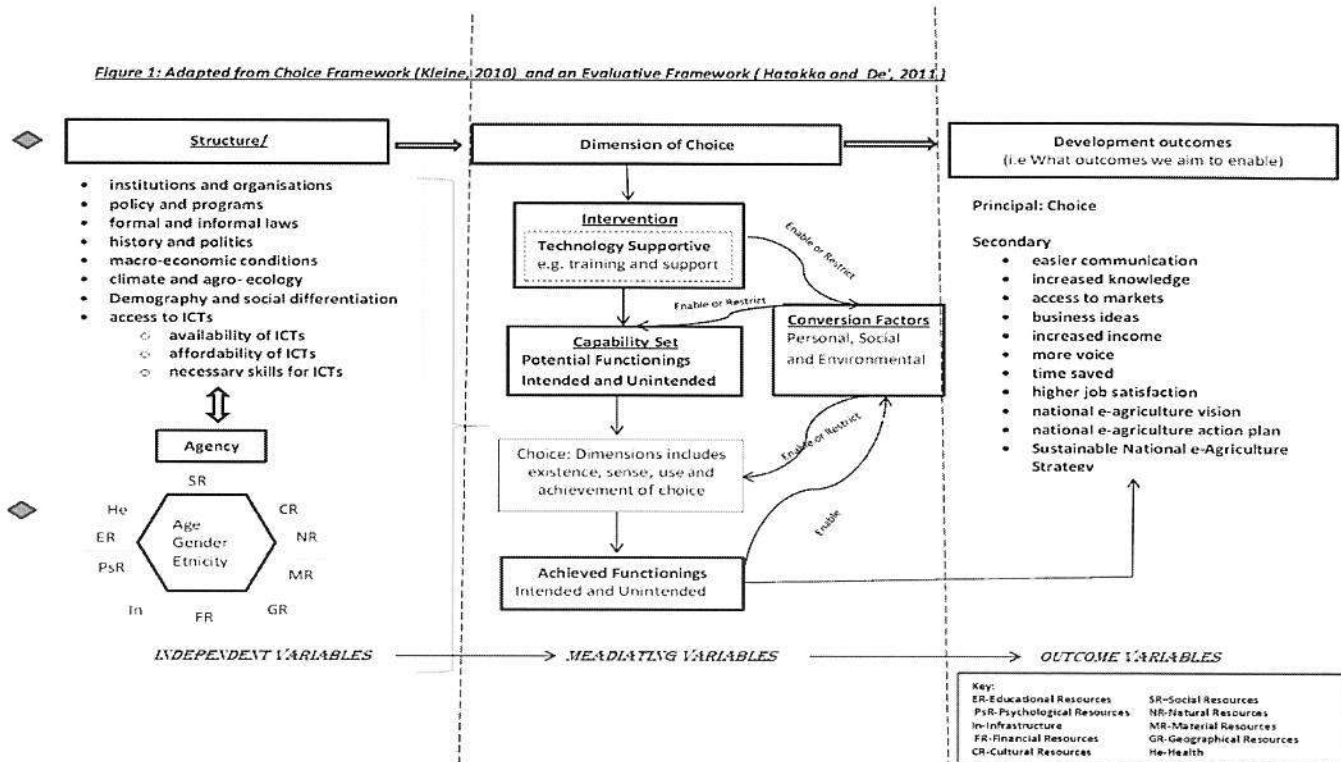
4.4. Theoretical framework underpinning this study

In this section I discuss theoretical underpinnings and conceptual frameworks within which this research will be conducted and analysed. It provides a review of concepts used in ICT4D projects to do development in rural areas. I look at the role ICT4D plays towards developing emerging commercial farmers.

Since this study is interested in investigating the factors that determine the use of ICT in agriculture, it employs CF (Kleine, 2010) together with the EF (Hatakka and De', 2011) that operationalizes the CA.

This framework will be used to explain farmer and farm employee ICT use. The model looks at the independent variables and uses mediating variables to assess the relationships with the outcome variables. The model is shown diagrammatically in figure 4.4.

Figure 4.4: Framework underpinning this study



Source: Adapted from the Choice Framework (Kleine, 2010) and an Evaluative Framework (Hatakka and De', 2011)

The next section will discuss the different variables under investigation in the study, within the framework in figure 4.4 in more detail.

4.5. Variables under investigation in the study

This section discusses the variables that are under investigation in this study based on the variables identified by other studies and additional variables which are considered to be applicable to developing countries. The Choice Framework (Kleine, 2010) was extended to include the Evaluative Framework (Hatakka and De', 2011) to better explain the use of ICT in emerging commercial agriculture in developing countries like South Africa. Figure 4.4 shows the extended model.

Analysis of the contexts, conditions and trends are the structure in which an emerging commercial farmer operates. Fig 4.4 shows us the independent variables can be determined by institutions and organisations, policy and programmes, formal and informal laws, history and politics, macro-economic conditions, climate and agro- ecology, demography and social differentiation as well as the access to ICTs. Other independent variables are determined by the agency or livelihood resources available which can be educational, social, psychological, natural, infrastructural, material, financial, geographical, cultural and health as shown in fig 4.4.

The mediating variables are determined through people- centred approach strategy intervention. Technology supportive intervention is to increase the capability set and potential functionings whether intended or unintended. We can enable or restrict achieved functionings by using personal, social and environmental conversion factors. Through the dimensions of choice we can create intended or unintended achieved functionings.

This study investigates factors of ICT use that are helpful and necessary to understand the importance and benefits of ICT. The study investigates the different forms of ICT used by emerging commercial farmers, how they are being used, what they are used for, how important these technologies are as enablers of production, and the factors that affect their use.

The dependent or outcome variable namely, ICT USE is measured as a principal of choice to achieve various development outcomes. The outcomes that we can enable include a sustainable national e-agriculture strategy addressing smart farming, food traceability and agri-logistics. Various other outcomes can increase livelihood sustainability adaptation, vulnerability and enhance resilience of the natural resource base.

What is important to the farmers is to use ICT productively for farm operations. A number of variables were derived from the framework in figure 4.4 and they are presented in Table 4.5. The lists of variables that are hypothesised to have influence on ICT use by farmers and farm employees were identified in a previous study. Similar relationships have been found to exist in the use of computers and other ICT by commercial wine farmers and their employees in the Cape Wine-lands District of the Western Cape (Tembo, 2008).

Additional important variables that are related to ICT use and relevant to developing countries have also been added to the list to better account for developing countries.

Table 4.5: List of variables and their predicted signs

Variable	Description	Type of measure	Expected sign	
Dependent variables				
ICTUSE (Y)	-Whether ICT is likely to be used productively for farm operations -Whether farm employee is likely to use ICT productively for farm operations	[1]=yes, [0]=no [1]=yes, [0]=no		
Independent variables				
			Farmers	Farm employees
Demographics				
AGE	Age of farmer/ employee	Years	-	-
INC	Income per month/year	Rands	+	+
OFFINC	Off-farm income	[1]=yes, [0]=no	+	+
EDUC	Education level	Years	+	+
AGRIC	Agricultural qualification	[1]= yes, [0] = no	+	+
GENDER	Gender	[1]=male, [0]=female	-	-
EMPLMT	Nature of work contract	[1]=permanent, [0]=seasonal		+
Farm & farmer characteristics				
EXP	Farm experience	Years	-	+
FSIZE	Farm size	Hectares	+	
Managerial factors				
EXP	Farm experience	Years	-	+
MKT	Market	[1]=yes, [2]=no	+	
ICT related factors				
GOAL	Farmer/employee ICT goal	[1]=yes, [0]=no	+	+
ICTLIT	Employee ICT literacy	Count	+	+
TRAIN	Employee ICT training	[1]=yes, [0]=no		+
Perceptions and attitude				
ATTI	Farmer/employee attitude towards ICT	[1]=positive, [0]=negative	+	+
AFFOD	Affordability of ICT	[1]=yes, [0]=no	+	+

(+) Positive association with ICT use

(-) Negative association with ICT use

Dependent variable

Use is usually defined in terms of a binary variable. In this case, ICTUSE is the dependent variable Y and is defined as a binary variable with a value of 1 and 0. For farm employees, Y has a value of 1 if a farm employee is likely to use ICT productively for farm operations and 0 if otherwise. In the case of farmers, Y has a value of 1, if ICT is likely to be used productively on the farm and 0 if otherwise.

Independent variables

The potential independent variables in Table 4.4 fall under 5 categories or factors and was influenced by Tembo (2008). They are farmer and farm employee demographics, farm and farmer characteristics, managerial factors, ICT related variables, and perception and attitudes. Some variables that influence use of ICT by farmers may not be necessarily the same as those that influence the use of ICT by farm employees. Even if some of the variables are the same, they may have different relationships with ICT use. Since the variables are different for farmers and farm employees, they are explained separately for each group.

4.6. Assumptions of the study

The following are the assumptions underlying the predicted relationships between the independent variables and ICT use. Each independent variable and its assumed association with ICT use, is shown by either a positive or negative sign in terms of their influence on ICT use (as shown on Table 4.6.1 for farmers and Table 4.6.2 for farm employees). The exact relationship was validated after data collection.

Table 4.6.1: Predicted relationships between the independent variables and ICT use for emerging commercial farmers

<i>Age:</i>	Younger farmers tend to use ICT more than older farmers. This is mainly because younger farmers have a chance to absorb and apply new knowledge.
<i>Income:</i>	High level of income implies the ability to invest in ICT and to bear the risks associated with the use. With less income a farmer has less to spend on new technology and may stick to old less expensive methods.
<i>Education:</i>	Farmers with higher levels of education attainment are more likely to use more ICT than less educated ones.
<i>Agricultural qualification:</i>	Those farmers with agricultural qualifications are more likely to use more relevant technology and they are well equipped with knowledge of the appropriate technology for different farm operations.
<i>Farm size:</i>	As farms increases in size, complexity and business transactions, the use of ICT also increases. This is because as the farm size increases, it becomes difficult to manage efficiently, and use of ICT will help with record keeping, management, effective and efficiency measures.
<i>Farming</i>	Farmers with experience in agriculture are reluctant to change; they prefer

<i>experience:</i>	old technologies and their old ways of practising farming. Those with less experience depend on agricultural aids for more information on how to practice agriculture, so they are likely to be willing to use ICT.
<i>ICT goal:</i>	A farmer who has ICT goals is more likely to use ICT than the one who does not have any goals pertaining to ICT.
<i>Market:</i>	A farmer who exports the farm produce is likely to use more ICT than the one who sells locally.
<i>Attitude towards ICT:</i>	Positive attitude towards ICT has a positive effect on ICT use and negative attitude towards ICT has a negative effect on use.
<i>ICT affordability:</i>	It is negatively related to use since it is an anticipated barrier to the use of ICT. The high cost of ICT is negatively related to use. More expensive ICT are less likely to be afforded by farmers and thereby limiting their use.

Table 4.6.2: Predicted relationships between the independent variables and ICT use for farm employees

<i>Age:</i>	Young farm employees are more likely to be interested in learning and applying new knowledge than older ones.
<i>Income:</i>	Farm employees with a higher disposable income are more likely to use ICT than those with less income.
<i>Education:</i>	Farm employees who have attained higher levels of education are more likely to be interested in ICT use than those who have no or attained lower education level.
<i>Farm experience:</i>	As farm experience of the farm employee increases, the probability of ICT use also increases.
<i>ICT goal:</i>	A farm employee who has ICT goals is likely to use ICT than the one who does not have any goals pertaining to ICT.
<i>ICT literacy:</i>	Farm employees who are ICT literate and can operate a number of ICT are more likely to be interested in learning about new ICT and using them than those who are not ICT literate.
<i>Gender:</i>	In the South African context where more women are now emancipated they are expected more readily to adopt technology than men.
<i>ICT training:</i>	The trained employees are more likely to use ICT than the untrained ones.

<i>Nature of work contract:</i>	Permanent employees are more likely to be knowledgeable in ICT use due to a lot of exposure than seasonal employees. Training is also likely to be given to permanent than seasonal employees.
<i>Attitude towards ICT:</i>	Positive attitude towards ICT has a positive effect on ICT use and negative attitude towards ICT has a negative effect on use
<i>ICT affordability:</i>	It is negatively related to use since it is an anticipated barrier to the use of ICT. The high cost of ICT is negatively related to use. More expensive ICT are less likely to be afforded by farm employees and thereby limiting their use.

Based on the underlying theoretical model that was adopted for this study, the variables that were discussed in Section 4.5 are grouped in three categories according to framework. Table 4.6.3 shows the classification of these Variables.

Table 4.6.3: Classification of variables

Antecedent Variables	Mediating variables	Outcome Variable
Age	ICT goals and objectives	ICT use
Income	Market	
Education		
Household size		
Agricultural qualification		
Experience		
Gender		
ICT literacy		
Off farm income		
ICT training		
Perceptions and attitude		
Nature of work contract		
Farm size		

4.7. Conclusion

In this chapter I have discussed the theoretical underpinnings and the conceptual framework within which this research is to be conducted and analysed. I explained that I will approach this research using the Capabilities Approach (CA) in terms of understanding the choices people make to enhance their capabilities in order to support their functionings. I first discussed the CA as presented by Amartya Sen and developed further by other scholars. I then presented the theoretical framework underpinning this study using the Choice Framework (Kleine, 2010) extended to include the Evaluative Framework (Hatakka and De', 2011). The variables that are under investigation in this study were then identified. The variables that are under investigation in this study were based on variables identified by other studies and additional variables which are considered to be applicable to developing countries.

The next chapter thus presents the research method used in this study, data analysis techniques as well as a description of the location of study.

CHAPTER FIVE

5. RESEARCH METHODOLOGY

5.1. Introduction

The aim of the research design is to outline the methodology of research, focus areas of data collection, data collection tools, the processing of data and data analysis. It is the purpose of the research proposal to align the accomplishment of a research goal within specified considerations and limitations of time and resources (Mouton and Marais, 1998). Research methodology is a way to systematically solve the research problem and the methods which are used by the researcher during research are called research methods (Kothari, 2004).

This research uses only quantitative analysis within the research methodology. The quantitative analysis sometimes has time constraints whereas an interpretation of the literature review normally goes quicker.

Many scholars argue for or against one of the two approaches. The qualitative research associated with interpretivist and quantitative researches associated with positivist are not in competition with each other. They have both weaknesses and strengths, thus should not compete but can be used to complement one another (Tuli, 2005).

This study had employed a quantitative approach to establish, confirm and validate relationships. I used a survey to establish the existing relationships among the variables and in explaining the possible reasons or causes behind those relationships. The proposed research study included primary empirical findings obtained from a survey study and a literature review.

The interpretive approach is per definition qualitative and can be used in quantitative analysis when it is used for seeking the truth. It is important that truth claims by interpretative research based on ontology and epistemology can be accepted as truth is never finite (Sandberg, 2005).

The next sections will discuss the design of the study, data collection methods, presentation and analysis.

5.2. Design of the Study /The Research Paradigm

The aim of research design is to enable the researcher who is not able to control all threats and frequently have to compromise but make sure the findings are still valid. It is a blueprint of the research proposal to align the accomplishment of a research goal within a specified considerations and limitations of time and resources resulting in the project (Mouton and Marais, 1998).

Quantitative Methods

The quantitative methodology is grounded in a realist or positivist where the researcher is independent from that being researched. It manipulates observations to give a numerical representation for the purpose of describing and explaining the phenomena that those observations reflect (Tuli, 2005). The research methodology of positivist is normally quantitative and scientific in character (Mamabolo, 2009). In this research I use techniques such as surveys and a case study.

For this study I use quantitative methods on primary data to discuss penetration of ICT and usage among emerging commercial farmers. I analyse and discuss the ICT penetration in terms of different usage of ICT on farms in the world, developed countries, Africa and the Western Cape. This is to draw a link between the rise in usage of mobile ICT and the need for government to develop its extension support to emerging commercial farmers.

Interpretivist use qualitative methods which are interpretive and argumentive. They use techniques such as reviews, action research, case studies, descriptive/interpretive, futures research and role/game playing to produce results (Mamabolo, 2009). The qualitative methodology that is grounded in an interpretivist approach combines data into belief systems whose manifestations are special to a case (Tuli, 2005). Qualitative work can be positivist in that it documents processes that leads constantly to one outcome and can also be interpretivist in that it seek general concepts people believe at a given time (Chin Lin, 1998).

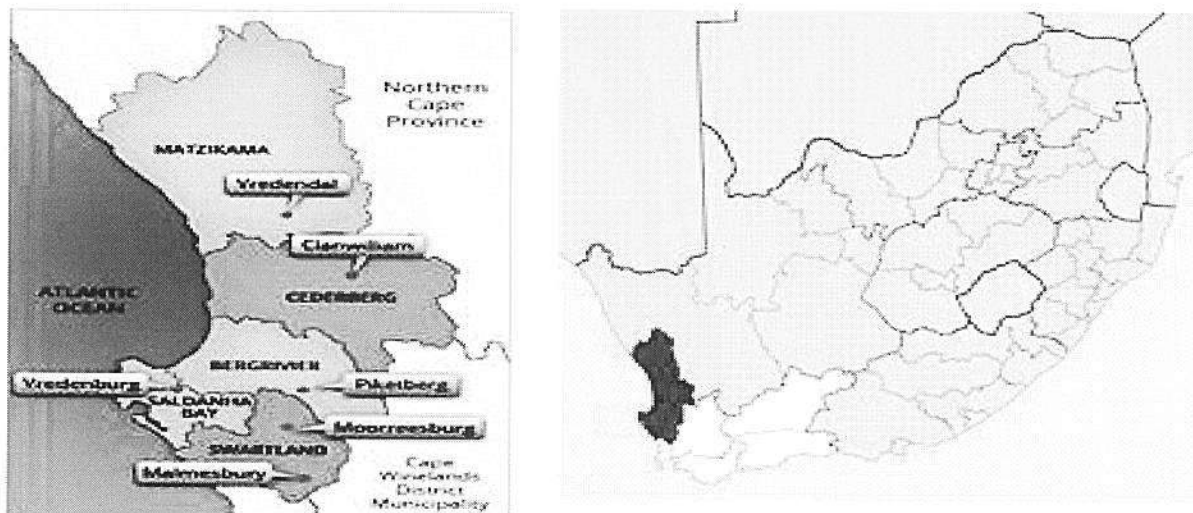
In this study I mostly interpreted the work of other authors in my literature review. At the end I interpret findings that investigated whether there is a need for the introduction of ICT4D projects within rural areas, with a particular focus on emerging commercial agriculture.

5.3. Study area: Population and sample

Case studies are vital tools in scientific enquiry given that they give much information on the context within which they are set (Mouton, 2001). This study was conducted in the West Coast District Municipality at various sites with particular emphasis on emerging commercial farmers in the Matzikama and Cederberg Local Municipalities.

The West Coast District Municipality is located in the Western Cape province of South Africa and is highlighted in the second map of figure 5.3. The first map in figure 5.3 shows the location of Matzikama and Cederberg Local Municipalities within the West Coast District Municipality.

Figure 5.3: Map showing location of investigation area



Source: DWA(2009)

Matzikama municipal area is well known for export agriculture. The Matzikama Farmers' Forum established since 2003 brings together small-scale, emerging farmers' associations and was established to collectively address the issues facing emerging farmers. Although members have access to municipal commonage land, they face many challenges. There is no coherent municipal commonage policy and the lack of lease agreements makes gaining access to state agricultural support infrastructure impossible (DWA, 2009).

The farmers cannot expand production and support from a range of government institutions is necessary to ensure the farmers have real prospects of being able to generate sustainable livelihoods for themselves.

The Cederberg Municipality area is known for its export citrus fruit, rooibos tea, wine and grapes. The emerging black farmers in this part of the West Coast have a long history of farming and a close relationship with the land. The area is famous for natural rooibos tea farming, some of the best in the area. They face a new challenge of commercialisation (DWA, 2009).

According to Stats SA 10 to 13 percent of available agricultural land in South Africa are currently farmed by smallholders and subsistence farmers. Of this only 40 percent is cultivated by smallholders whose farm sizes range from five to 20 hectares which are mostly used as a source of food for the household. Table 5.3.1 informed by the Land Reform Strategy for the West Coast show the land available in both the Matzikama and Cederberg Municipal area for land (Stat SA, 2011).

Table 5.3.1 – Land available in Matzikama and Cederberg Municipal area for land reform.

	Amount of land in hectares	
	Matzikama	Cederberg
State Land	56 801,682	324 109 115
Commonage	70,000	240 000
Coloured Rural	65 724	

Source: Stat SA (2011)

Historically in Matzikama and Cederberg municipalities the minority white population and the state have owned the most productive land. Other limiting factors black emerging farmers face in these municipalities are 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, and high transaction costs, insufficient land availability to expand production, lack of agricultural implements to better production, poor production and farm management skills, as well as low education levels which results in an inability to interpret market information to be used in production planning and marketing (DRDLR, 2016b).

In both of these regions' emerging black farmers have longed to become part of the mainstream agriculture. With the advent of the government's Land and Water reform programmes this is slowly becoming a reality.

There is a great potential for land reform to give access to black emerging commercial farmers in Matzikama and Cederberg Municipal areas. It is important to educate farmers in the specific crops and stock which they must farm which is specific for the area. When

aligned with a skills development strategy it can become a key economic base providing sustainable sufficient economic opportunities. Agricultural projects can be linked to nutritional initiatives such as community gardens aligned to the needs of the poor in the Matzikama and Cederberg Municipal area (DRDLR, 2016b).

These areas were selected to provide an opportunity to investigate the factors of ICT use that are helpful and necessary for the importance and benefits to these emerging commercial farmers. These two areas generally represent emerging commercial farmers as described in Section 2.3.2 earlier. The study will then use what was learnt out of the theoretical literature to help us identify the gaps between theory and practice in these regions.

In the next section I will discuss the data collection methods.

5.4. Data collection methods

The process of gathering data passively or receptively is known as data collection. The validity of data can be threaten by a hypothesis or by preconceived believes of the researcher. This is in contradiction to where the research process originates in the identification of either an empirical or conceptual problem (Mouton and Marais, 1998).

Data was collected from various sources in order to get information about the subject at hand. This study used both primary and secondary sources of information.

The first-hand information used in this study was gathered from a survey instrument. Two separate questionnaires attached as appendices were developed and administered on two samples namely emerging farmers and their employees. The questionnaires have both open and close-ended questions. The questionnaire for employees investigated types of ICT used, factors influencing ICT access, ICT literacy and training as well as perceptions and attitudes towards ICT. The questionnaire for farmers addressed issues of production, asset and input procurement, communication, types of ICT used, challenges of ICT use, socio-economic benefits and the role of ICT in marketing.

The data collection methods investigated the use of ICT by emerging farmers in input procurement, production, harvesting, processing, packing, distribution and marketing. Providing an answer to the research question of the study, the collection of field data focussed on the following major themes surrounding emerging commercial farmers:

- 1) Exploring the different ICT being used,

- 2) Assessing and describing the uses of different forms of ICT,
- 3) Describing the socio-economic benefits associated with ICT use and
- 4) Identifying barriers affecting ICT use.

5.4.1. Literature Review:

A literature review assists the researcher to build on the existing body of knowledge and to avoid duplication in order to address the concepts and issues surrounding the topic. It also ensures an appropriate theoretical framework is selected to establish the relationship between these concepts and issues (Mouton, 2001).

Through the literature review earlier I believe I answered what we already know about the topic. I also identified key sources and authors to further guide me as I continue with the literature review while doing the study.

The various relationships between this study and other studies is that it focus on the penetration of mobile technology and the internet, especially amongst the rural poor and how we could use this to support the development of emerging commercial farmers and the agriculture sector. I can see that there are shortcomings in our knowledge and understanding of the topic as there has not been enough research done around this specific topic.

5.4.2. Questionnaires:

The main purpose was to gather information on the use of ICT to implement sustainable economic and environmental agriculture development. Also to get an understanding on how the respondents perceive ICT to implement sustainable economic and environmental agriculture development. I managed to gather questionnaires from 87 people using a semi-structured check list to understand how the participants understood the usage of ICT to implement sustainable economic and environmental agriculture development.

Credible recommendations will be made after I compare the literature and the data gathered using the collection tools explained above. The next section will describe how I will be analysing the data collected and presented.

5.5. Data analysis techniques

Analysis of data means studying the tabulated material or information in order to determine inherent facts or meanings and create knowledge. It involves breaking down existing complex factors into simpler parts of information. This make the raw data meaningful while turning it and putting the parts together in new arrangements for the purpose of interpretation and provide us with new knowledge (Singh, 2006).

Analysis of data is done by identifying patterns and themes from which I draw conclusions. Data analysis in a case study typically involves the steps of organising the data, categorising the data, interpreting the data, identifying patterns within the data, synthesizing and generalising until finally drawing a conclusion (Mouton and Marais, 1998).

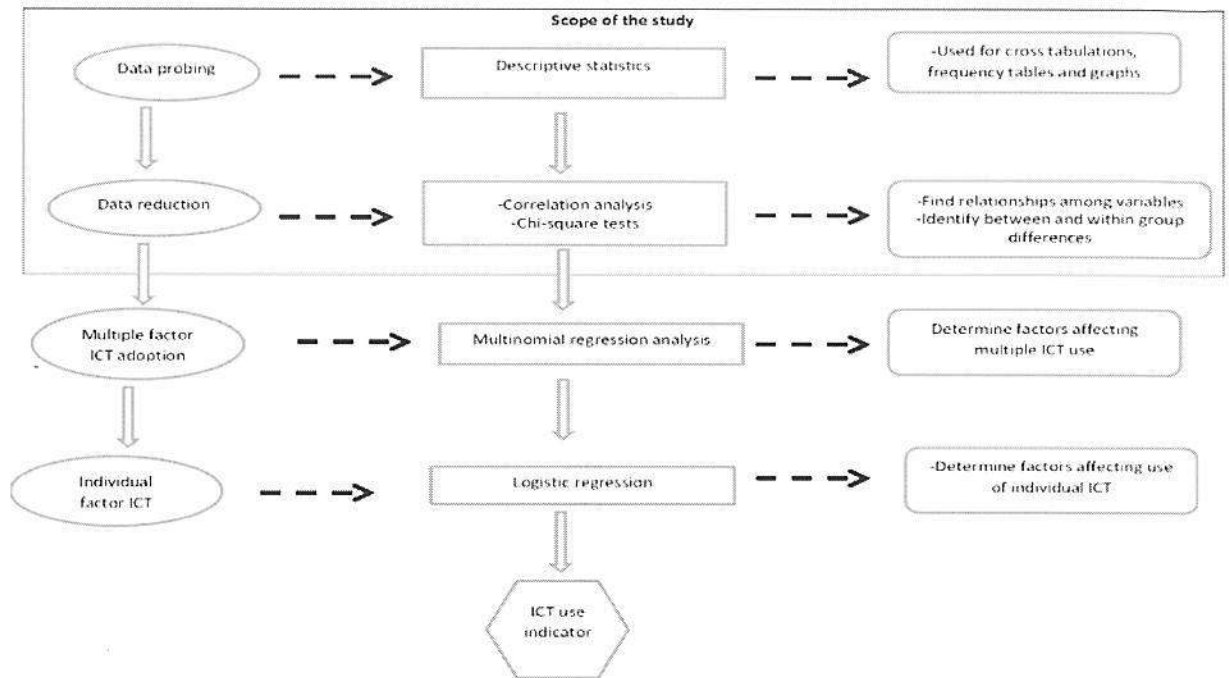
In this analysis I first look at the secondary data with regard to ICT penetration and then by analysing through a study primary data obtained on the ICT usage by emerging commercial farms. I then draw conclusions on how this links to my broader research.

A number of data analysis methods are used and discussed briefly. As stated in earlier chapters and shown in figure 5.5, only descriptive statistics, chi-square tests and correlation analysis are used in this study. The latter two methods, namely, multinomial regression and logistic regression are included in figure 5.5 to show how the results of such a study can be analysed further. The data are presented in the form of a narrative analysis and graphical representations as well as tables and flow diagrams.

Descriptive statistics are used to make cross tabulations, frequency tables, pie charts, histograms, bar graphs and to calculate averages, ranges, percentages, means and correlations among key ICT use variables.

Correlation analysis and chi-square tests will be conducted to identify and find the relationship between ICT use and some variables, and between the variables themselves. The cross tabulations help to identify differences between and within variable groups.

Figure 5.5: Data analysis methods that would be used



Source: Tembo (2008)

Primary data are obtained through engaging people on a personal or impersonal level. This data can be collected either through experiment or through survey. In the case of a survey, data can be collected by observation, through personal interview, through telephone interviews, by the completion of questionnaires and through schedules. The researcher should select one of these methods of collecting the data taking into consideration the nature of investigation, objective and scope of the inquiry, financial resources, available time and the desired degree of accuracy (Kothari, 2004).

For this study primary data are collected through a survey by doing personal interviews and the completion of questionnaires. It is through constraints produced by available time and financial resources that in this study I am unable to obtain as much primary data needed to make this study more realistic. I suggest however that for further research a Participatory Action Research (PAR) approach should be taken to collect primary data.

The secondary data used in this research was obtained from published statistics focusing on ICT penetration of ICT and mobile penetration in developing and developed countries. It also looks at a various other studies researched in Africa to investigate the usage of ICT on emerging commercial farms.

I will now discuss the delineation, reliability and viability issues of the study.

5.6. Delineation, reliability and viability issues of the study

Reliability is the central consideration of validity when data is collected. It is important that the same set of data analysed under different sets of circumstances and different groups using the same methods results in the same observations. Thus the reliability of data is influenced by the researcher(s), the individual who participates in the research project (participant), the measuring instrument, and the research context (Mouton and Marais, 1998).

In this study I have made sure that the individuals interviewed are emerging commercial farmers as defined in Section 2.3.2 earlier and their employees. As already stated, this research project is restricted to emerging commercial agriculture and confined to the Matzikama and Cederberg Local Municipalities of the West Coast District Municipality in the Western Cape Province of South Africa. It mainly emphasizes the use and benefits of ICT, and the factors influencing the use of ICT by emerging commercial farmers.

The reliability of this data is dependent on how reliable the statistics of it is and how thorough the method applied by the case study was reliable. Reliability of data can be influence by multiple sources of data collection and these uses of multiple methods of data collection are referred to as triangulation (Mouton and Marais, 1998).

I have tried to include multiple sources of data in order to make my research more reliable. The study does not focus on individual ICT. Rather, all types of ICT are investigated. These, however, are not the only factors to be considered in making decisions by agriculture role players.

Methodological analysis is the most important rationale for placed on the scientific nature of research in order to ensure the validity and credibility of findings. It also develops and articulates strategies to maximize the validity and credibility of research results in the social sciences (Mouton and Marais, 1998).

In the study I have stick to the method of analysis designed in order to maximise the validity and credibility of the research results. Only descriptive statistics, chi-square tests and correlation analysis are used, since the aim is to investigate the factors of ICT use. The regression methods are stated solely to note an extension of this study that is slated for a later study.

5.7. Conclusion

In this chapter I have discussed the research methodology, the design of the study, data collection methods, presentation and analysis. This study only used a quantitative research methodology. I do an interpretation of the literature review while the quantitative analysis is guided by a primary analysis research design. The quantitative research is used to determine the impact of ICT use among emerging commercial farmers.

For the quantitative analysis the study area was the West Coast District Municipality at various sites, with particular emphasis on emerging commercial farmers in the Matzikama and Cederberg local municipalities.

Data was gathered from a survey instrument using two separate questionnaires for emerging farmers and their employees. The questionnaire investigated the use and benefits of ICT, and the factors influencing the use of ICT by emerging commercial farmers and their employees.

Descriptive statistics was used to make cross tabulations, frequency tables, pie charts, histograms, bar graphs and to calculate averages, ranges, percentages, means and correlations among key ICT use variables. Correlation analysis and chi-square tests will be conducted to identify and find the relationship between ICT use and some variables, and between the variables themselves.

To maximise the reliability and viability of this study I have made sure that the individuals interviewed are emerging commercial farmers as defined. Multiple sources of data were included and stick to the method of analysis designed in order for the research results to be viable.

The following chapter presents the empirical results of the survey that was undertaken in the study area.

CHAPTER SIX

6. EMPIRICAL RESULTS OF THE STUDY FOR EMERGING COMMERCIAL FARMERS AND FARM EMPLOYEES

6.1. Introduction

This chapter presents the empirical results of the main findings from the analysis of data that was collected from surveys conducted in Cederberg and Matzikama municipalities. The scope of this study was limited to descriptive statistics, chi-square tests and correlation analysis. The chi-square tests and correlation analysis were used to find relationships between factors influencing the use of ICT in South African emerging commercial agriculture. STATA was used as statistical analysis software. From the study, the following information was found about the ICT access, ICT awareness and use patterns, perception and attitudes towards ICT, and demographics of the farmer and farm employees.

Section 6.2 discusses empirical results for emerging commercial farmers while Section 6.3 discusses empirical results for their employees. Sections 6.2.1, 6.2.2 and 6.2.3 present the descriptive statistics, chi-square tests and correlation analysis results for emerging commercial farmers. Similarly, Sections 6.3.1, 6.3.2 and 6.3.2 present the descriptive statistics, chi-square tests and correlation analysis results for farm employees.

It should be noted that most of the questions on the questionnaire had multiple responses and a respondent could choose more than one option. Therefore, some of the results were presented in terms of percentage responses, not percentage respondents. However, it is stated if percentage responses or percentage respondents were used. Some questions have subsections that were only completed when the respondent qualifies for the first part of the question. The stated results are for the whole sample, unless stated otherwise.

6.2. Descriptive statistics for emerging commercial farmers

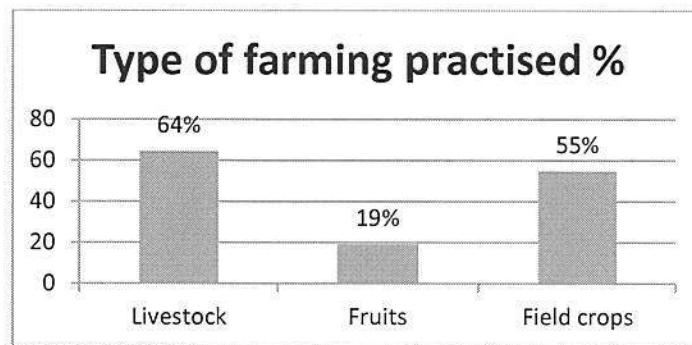
This section gives an overview of the results from the sample of farmers on their farm activities, ICT use patterns, ICT costs and constraints, employees and ICT, perceptions and attitudes and demographics. The data has a sample of 42 farmers who participated in the survey.

Farm Activities

The farms in this region vary in sizes, from 1 to 25 hectares. The average farm size is about 6 hectares. Only about 88% of the emerging commercial farmers answered the question on

farm sizes and hectares allocated. Among the emerging commercial farmers included for this study, 64% practiced livestock, 19% fruits and 64% field crop production. Figure 6.2.1 shows the percentage of emerging commercial farmers to practicing a certain type of farming.

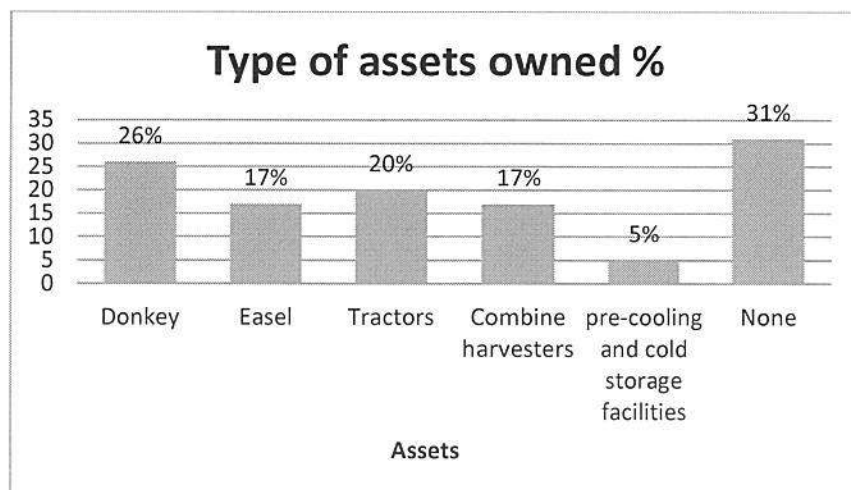
Figure 6.2.1: Percentage of emerging commercial farmers to practicing a certain type of farming



Source: Survey data, 2017

The emerging commercial farmers have a number of various assets that are basically for production, processing, packing and storage purposes. In figure 6.2.2 about 20% of the emerging commercial farmers have tractors where as 5% has precooling and cold storage facilities. Combine harvesters are owned by about 17% of the emerging commercial farmers. Other assets, including donkeys and easels are owned by about 26% and 17% respectively.

Figure 6.2.2: Percentage of the type of assets emerging commercial farmers own



Source: Survey data, 2017

ICT use patterns

During the survey, the emerging commercial farmers were requested to indicate the different types of ICT they use on their farms. Table 6.2.1 shows some of the ICT used by the emerging commercial farmers and the percentage of them using it.

Table 6.2.1: ICT used by emerging commercial farmers

Do you use the following ICT at your farm?	Resp	Land-line	Mobile	Computer	Fax	Photocopy	Internet	Printers
	N	25	31	15	15	15	15	13
	%	60%	74%	36%	36%	36%	36%	31%

Source: Survey data, 2017

Out of the total percentage of emerging commercial farmers who use the respective ICT, it seems that the mobile phone, up to 74% is the most used. The computer, fax, photocopy and Internet are all used by 36%. On the other hand landline and printers are used by 60% and 31% respectively.

It is interesting to note that 95% of emerging commercial farmers do not have their own website and only 5% have for the purposes of carrying out online transactions. Table 6.2.2 shows these statistics which was similar for emerging commercial farmers who have any business goals with regard to ICT.

Table 6.2.2: Own websites and business goals with regard to ICT

Do you have your own website?	Responses	Yes	No	Total
	N	2	40	42
	%	5	95	100
Do you have any business goals with regard to ICT?	Responses	Yes	No	Total
	N	2	40	42
	%	5	95	100

Source: Survey data, 2017

Having a website would be advantageous for the purposes of information dissemination and communication with prospective and current customers. The emerging commercial farmers were also asked whether they have any business goals with regard to ICT. As shown in Table 6.2.2, 5% of them indicated that they have business goals that pertains to ICT and 95% indicated no.

Figure 6.2.3 shows that in purchasing ICT for farm use, about 43% of the responses from the emerging commercial farmers indicated that they make a personal decision without necessarily consulting any other sources about the type of ICT to purchase for the farm. Only

about 48% of the responses showed that some emerging commercial farmers purchase ICT based on a response to advertisements on TV, radio or other media.

Figure 6.2.3: ICT Purchase decisions influence



Source: Survey data, 2017

There are a number of ICT that can be used on the farm for different purposes. Table 6.2.3 indicates whether these different ICT are used by emerging commercial farmers for personal, business, or both purposes.

Table 6.2.3: ICT purposes

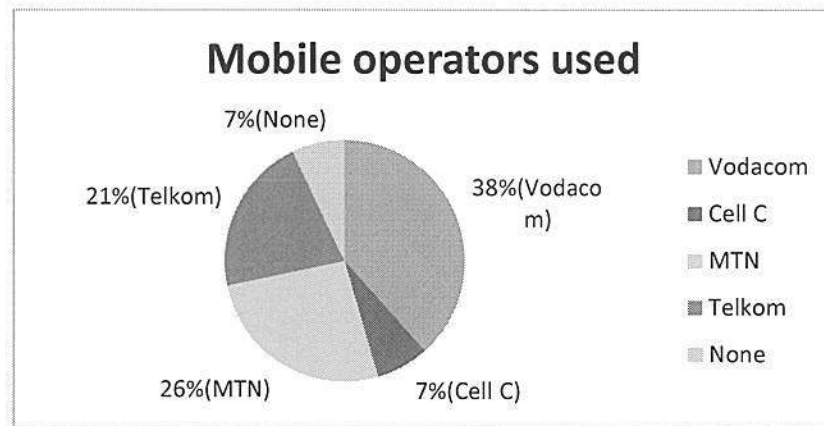
Do you use the following ICT for personal or business purposes?	Responses	Personal	Both	No response	Total
	N	37	3	2	42
	%	88%	7%	5%	100

Source: Survey data, 2017

From the emerging commercial farmers who indicated that they use ICT, approximately 88% of them use ICT for personal purposes while 7% use it for both personal and business purposes.

The most popular mobile operator among the emerging commercial farmers is Vodacom, then MTN, Telkom and Cell C respectively. Some emerging commercial farmers do not use a mobile operator at all.

Figure 6.2.4: The Mobile phone operators used by emerging commercial farmers

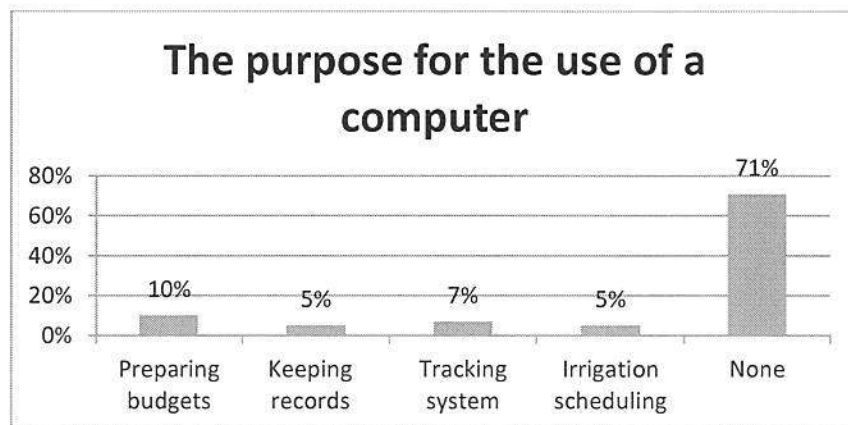


Source: Survey data, 2017

From figure 6.2.4 we can see that about 38% of the responses from the emerging commercial farmers showed that they use Vodacom, about 26% use MTN, about 21% use Telkom mobile and only 7% use Cell C.

During the survey, the emerging commercial farmers were requested to indicate the different purposes they use a computer on their farms. Figure 6.2.5 shows some of the purpose the emerging commercial farmers use the computer.

Figure 6.2.5: Purposes emerging commercial farmers uses a computer



Source: Survey data, 2017

Very few emerging commercial farmers use a computer for making decisions pertaining to their farm business. About 10% use the computer to prepare budgets, while 5% use it to keep farm and payroll records. We also see 7% using it as a tracking system together with 5% using it for irrigation scheduling and water budgeting. However, 71% showed that they do not use a computer in their decision-making processes. This can be attributed to the fact that

they do not own or have access to a computer. On the other hand if they do have access it might be because they were not exposed to the benefits of using a computer.

Table 6.2.4: Emerging commercial farmers whose computers are connected to the internet and advertise their farm produce

Are your computers connected to the Internet?	Responses	Yes	No	No response	Total
	N	3	28	11	42
	%	7%	67%	26%	100
Do you advertise your products?	Responses	Yes	No	No response	Total
	N	1	41	0	42
	%	2%	98%	0%	100

Source: Survey data, 2017

When asked whether their computers are connected to the internet only 7% of emerging commercial farmers responded yes, while 67% responded no and 26% did not respond.

Table 6.2.4 shows that 98% of the emerging commercial farmers do not advertise their produce. Only 1 respondent which is 2% advertise their produce.

Although almost all emerging commercial farmers do not have internet at home, with the next question I wanted to establish if they had any other means of connecting to the Internet and why they use it.

Table 6.2.5: Means of accessing the Internet and reasons why

Where do you access the Internet?	Resp	Community telecentre	In town	At home	Nowhere	No response
	%	71%	6%	7%	6%	10%
What do you use the Internet for?	Resp	Accessing agri info	Communication	e-commerce	Other	No response
	%	60%	24%	7%	0%	33%

Source: Survey data, 2017

When asked where emerging commercial farmers accesses the Internet, 71% connected to it at community telecentres, 6% in town and 7% at home. However 6% did not connect at all and 10% did not respond to this question.

Table 6.2.5 also shows that 60% uses the internet to access agriculture information, 24% use it for communication and 7% for e-commerce.

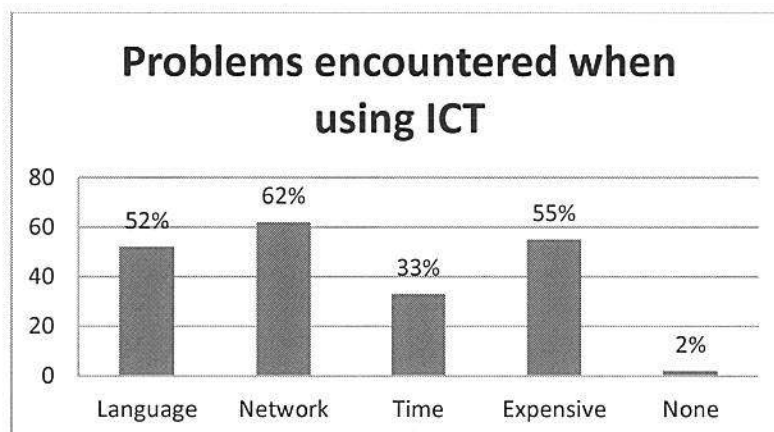
The survey also established that 100% emerging commercial farmers sell their produce locally and none of them have any contract with any marketing agent.

ICT costs and constraints

Emerging commercial farmers pay for services provided by ICT to different service providers. Most of the costs that are incurred by them for ICT use are very little as they cannot really afford it.

There are a number of problems encountered by emerging commercial farmers when using ICT. They were asked to indicate the different problems they face and given an option of choosing from given alternatives. Figure 6.2.6 shows the response percentages of the different problems encountered when using ICT.

Figure 6.2.6: Problems encountered when using ICT

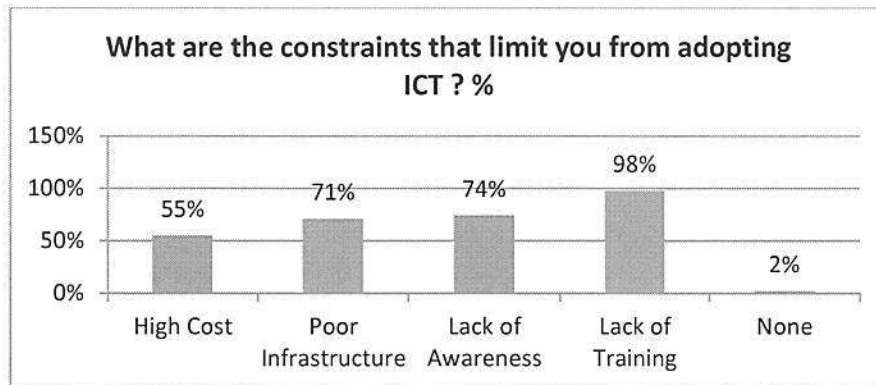


Source: Survey data, 2017

The major problem that the emerging commercial farmers encounter is poor network and reception. Figure 6.2.6 shows about 62% of the emerging commercial farmers reported this problem as the Internet and cell phones are greatly affected by this problem. The respondents further indicated language (52%), time (33%) and that ICT are too expensive (55%) as other barriers.

Besides problems encountered when using ICT, there are other constraints that inhibit the acquisition and adoption of ICT by the emerging commercial farmers. Some of the reasons included poor infrastructure, high cost, lack of ICT awareness and lack of ICT training.

Figure 6.2.7: Major constraints encountered when using ICT



Source: Survey data, 2017

From figure 6.2.7 about 98% of the responses indicated that the major barrier is the lack of ICT training, this was followed by 74% indicating the lack of ICT awareness, next 71% indicated the lack of or poor ICT infrastructure and 55% indicated the high cost.

There is a need through training to increase awareness and acquire the skills to use ICT that are user-friendly and effective.

Employees and ICT

Emerging commercial farmers were asked if they communicate with their employees using ICT. The results are depicted in Table 6.2.6 and from the results of the survey, about 31% of emerging commercial farmers communicate with their employees using ICT, while 69% do not.

Table 6.2.6: ICT communication with employees and provision of formal training to employees

Do you communicate with your farm employees using ICT?	Response s	Yes	No	Total
	N	13	29	42
	%	31%	69%	100
Do you provide formal training to your employees on how to use ICT at work?	Response s	Yes	No	Total
	N	10	32	42
	%	24%	76%	100

Source: Survey data, 2017

The emerging commercial farmers were asked to indicate if they provide formal training to their employees on how to use ICT at work. As shown on Table 6.2.6, 24% provide some

form of formal training for their employees on how to use ICT at work. However, 76% indicated that they do not provide formal training to their employees on the use of ICT because many of them do not use ICT within their farming business.

Perceptions and Attitudes

The emerging commercial farmers did not specify the ICT they needed, but they generally emphasized that they needed any ICT that can reduce their costs and improve the production. This section presents the perceptions and attitudes of the emerging commercial farmers about ICT in general. Most of the questions in this section were binary (yes/no). Others were on a scale which indicated agree, disagree or neutral.

Table 6.2.7: Perceptions and Attitudes on a scale of agree, disagree or neutral

The benefits are greater than the costs		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total
	N	27	1	3	11	0	42
	%	64%	3%	7%	26%	0	100
Adoption improves agricultural development		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total
	N	27	15	0	0	0	42
	%	64%	36%	0%	0%	0%	100%
ICT facilitates the easy flow of and access to information		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total
	N	26	13	2	1	0	42
	%	62%	31%	5%	2%	0%	100%
ICT can be used to form farming business partnerships		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total
	N	27	15	0	0	0	42
	%	64%	36%	0%	0%	0%	100%

Source: Survey data, 2017

We can see from Table 6.2.7 that 67% of the emerging commercial farmers agree that the benefits of ICT are greater than the costs, 7% are neutral and 11% disagree. The notion that ICT improves agricultural development and it can be used to form farming business partnerships are also agreed to 100% by emerging commercial farmers. This shows how ICT use is appreciated over non-ICT use. We see that 93% farmers also agree that ICT facilitates the easy flow of and access to information, 2% are neutral and 2% disagree.

Besides being fast and time-saving, ICT use also saves money through lowering of costs, thereby increasing the profits of farm businesses. In Table 6.2.8 about 64% of the emerging commercial farmers agree that the use of ICT can enhance the profitability of their farms. Only 36% of the emerging commercial farmers do not agree that ICT use increase profits. Earlier on page 76 in Figure 6.2.7, when asked the question what emerging commercial farmers saw as the major constraints they encountered that limits the adoption of ICT, 98% responded to the lack of ICT training, 74% the lack of ICT awareness and 71% indicated poor ICT infrastructure. Despite this Table 6.2.7 shows that their perceptions and attitudes of how ICT can benefit their agricultural business still remain positive. When asked whether they agree or disagree with the following, 67% agreed the benefits of using ICT are greater than the costs, 100% agreed adoption of ICT improves agricultural development, 93% agreed ICT facilitates the easy flow of and access to information while 90% agreed we can use ICT to form farming business partnerships.

Thus in my opinion as a consequence of the above in Table 6.2.8 show that 64% of respondents believe that ICT could enhance the profitability of their farms despite the major constraints they encountered.

Table 6.2.8: ICT and profitability

ICT could enhance the profitability of farm enterprises	Responses	Yes	No	Total
	N	27	15	42
	%	64%	36%	100%

Source: Survey data, 2017

Demographics

Table 6.2.9 presents the demographic aspects of the emerging commercial farmers.

Table 6.2.9: Emerging commercial farmers' demographics

Demographics by:	Variable categories	Number of Respondents	Percentage of Respondents
Gender	Male	28	67%
	Female	14	33%
Age	20 and below	2	5%
	21- 40	8	19%
	41- 60	22	52%
	61 and above	10	24%
Marital status	Married	26	62%
	Single	16	38%

Experience on farm	5 and below	9	21%
	6- 10 years	6	14%
	11- 20 years	20	48%
	21 and above	7	17%
Average Farm income per month	Less than R100 000	42	100 %
Average salary per month	Less than R10 000	42	100 %
Permanent off-farm income	Yes	13	31%
	No	29	69%
Education	Primary	30	71%
	Matric	10	24%

Source: Survey data, 2017

The majority (about 67%) of the emerging commercial farmers are males. Although the male-female proportions are not the same, it is interesting that at least about 33% of the emerging commercial farmers are women. About 52% emerging commercial farmers are from 41 to 60 years of age while 24% are 61 and above. This shows that there is a need to get more younger farmers, where 19% are from 21 to 40 years of age and only 5% are below 20 years old. About 62% are married and 38% are single. About 65% emerging commercial farmers have more than 10 years farming experience. This includes 48% between 11- 20 years and 17% 21 and above years. Only 21% have 5 and below years while 14% have 6- 10 years' experience, which shows that most of them have been in the farming business for a long time.

The average farm income shows 100% emerging commercial farmers earn less than R100 000 per month. Similarly, the average personal salaries (from farming) of most of the emerging commercial farmers are below R10 000 per month and all (100%) of the emerging commercial farmers fall in this salary category.

Besides their farm income, about 31% emerging commercial farmers have off-farm income. Some receive off-farm income from government grants and pension investments. The majority emerging commercial farmers (69%) concentrate on farming as an only source of income.

The emerging commercial farmers only attained primary and matric education. About 71% only attained primary education and 24% attained matric. None of them have college or university qualification and 5% did not respond to this question. On a different note, all the emerging commercial farmers have small household sizes.

Descriptive statistics for the emerging commercial farmers were discussed in this section. The following section presents the chi-square tests results for the emerging commercial farmers.

6.2.1. Chi-square tests results

The chi-square tests results for the emerging commercial farmers are presented next. Both the significant and non-significant variables are presented to assist decision makers and emerging commercial farmers to know the variables they should consider when making farm decisions. The chi-square tests were conducted to test and confirm the relationship between ICT use and different variables, and the relationship between the variables themselves.

In this study, it was found that not all the emerging commercial farmers use ICT, therefore further tests were carried out to find differences in their ICT use. The chi-square tests were carried out to find relationship between variables which do affect ICT use directly and may affect management style or decision-making of the emerging commercial farmers. These relationships are reported next.

Significant variables

In this section, only the variables which have statistically significant relationships are presented.

Gender

```
. tabulate ictfarmuse gender, chi2
```

ICT use on farm	Gender of respondent		Total
	1	2	
1	6	9	15
2	22	5	27
Total	28	14	42

```
Pearson chi2(1) = 7.4667 Pr = 0.006
```

There is a statistically significant difference in the use of ICT between the gender of the emerging commercial farmer ($p\text{-value} < 0.05$). In the South African context where more women are now emancipated they are expected more readily to adopt technology than men.

Capacity

```
. tabulate ictfarmuse cap, chi2
```

ICT use on farm	Capacity farming: owner of the farm or the manager			Total
	1	2	3	
1	15	0	0	15
2	16	2	9	27
Total	31	2	9	42

Pearson chi2(2) = 8.2796 Pr = 0.016

There is a statistically significant relationship between ICT use on farm and whether the commercial farmer is the owner or farm manager (p-value<0.05). Owners who are the farmers (1) are more likely to use ICT on their farm than when they use managers (2).

Off farm income

```
. tabulate ictfarmuse offin, chi2
```

ICT use on farm	Permanent off-farm income		Total
	1	2	
1	0	15	15
2	13	14	27
Total	13	29	42

Pearson chi2(1) = 10.4598 Pr = 0.001

There is a statistically significant relationship between ICT use on farm and permanent off-farm income (p-value<0.05). Emerging commercial farmers who have off farm income are mostly pensioners and thus do not use ICT on their farms.

Perceptions

```
. tabulate ictfarmuse partner, chi2
```

ICT use on farm	facilitates business partnerships		Total
	1	2	
1	13	2	15
2	14	13	27
Total	27	15	42

Pearson chi2(1) = 5.0907 Pr = 0.024

```
. tabulate ictfarmuse profit, chi2
```

ICT use on farm	enhance the profitability		Total
	1	2	
1	6	9	15
2	21	6	27
Total	27	15	42

Pearson chi2(1) = 5.9941 Pr = 0.014

```
. tabulate ictfarmuse agridev, chi2
```

ICT use on farm	ICT improves agricultural development		Total
	1	2	
1	13	2	15
2	14	13	27
Total	27	15	42

```
Pearson chi2(1) = 5.0907 Pr = 0.024
```

There is a statistically significant difference between the use of ICT and the perceptions of emerging commercial farmers that ICT is good for farming businesses (p-value<0.05). Almost all of those that use ICT and more than half that do not use ICT believe that it facilitate business partnership, enhance profitability and improve agricultural development.

Farm size

```
. tabulate ictfarmuse farmsize, chi2
```

ICT use on farm	size of farm				Total
	1	2	3	4	
1	7	0	2	4	13
2	22	2	0	0	24
Total	29	2	2	4	37

```
Pearson chi2(3) = 13.6992 Pr = 0.003
```

There is a statistically significant difference between the use of ICT and the farm size of emerging commercial farmers (p-value<0.05). The bigger the farm the more likely it is to use ICT on the farm.

Non-significant variables

In this section, some relationships that are not statistically significant in this study are presented.

Income

```
. tabulate ictfarmuse income, chi2
```

ICT use on farm	Average farm income per month	
	1	Total
1	15	15
2	27	27
Total	42	42

High level of income implies the ability to invest in ICT and to bear the risks associated with the use. With less income an emerging commercial farmer has less to spend on new technology and may stick to old less expensive methods. However, the relationship between ICT use and income is statistically insignificant. The p-value could not be computed because the income of the emerging commercial farmers is constant, as all fall in the category of making less than R100 000 per month.

Formal training

```
. tabulate ictfarmuse trainemp, chi2
```

ICT use on farm	formal training to your employees		Total
	1	2	
1	2	13	15
2	8	19	27
Total	10	32	42

```
Pearson chi2(1) = 1.4117 Pr = 0.235
```

It is usually expected that there should be a relationship in that those emerging commercial farmers who train their employees are more likely to use ICT. In this study the relationship between training of employees and ICT use is highly insignificant (p-value>0.1).

Advertise

```
. tabulate ictfarmuse advert, chi2
```

ICT use on farm	advertise products		Total
	1	2	
1	0	15	15
2	1	26	27
Total	1	41	42

Pearson chi2(1) = 0.5691 Pr = 0.451

It is usually expected that emerging commercial farmers who advertise their produce will more likely use ICT than those who do not advertise. The relationship between those who advertise and ICT use is highly insignificant ($p\text{-value} > 0.1$).

This section presented the chi-square tests results for the emerging commercial farmers. The correlation analysis results for the emerging commercial farmers are discussed next.

6.2.2. Correlation analysis results

The spearman correlation analysis was carried out to find the relationships between ICT use and different variables and, to determine the strengths of each relationship by the use of correlation coefficients. The correlation results of the correlation analysis for the emerging commercial farmers are presented next.

Spearman's correlation analysis was used to investigate the relationships among the different variables of the emerging commercial farmers. The results of the Spearman correlation analysis of the emerging commercial farmers are shown in Table 7.14. Both significant figures and correlation coefficients are indicated. Correlation coefficients are indicated by the asterisks.

Table 6.2.10: Correlation analysis results for the emerging commercial farmers

	age	years	cap	offin	type	benefits	train	atti	fsize	mobile	purc	ictfar-e
age	1.0000											
years	0.3904 0.2990	1.0000										
cap	0.0000 1.0000	0.8783* 0.0018	1.0000									
offin	-0.6325 0.0676	-0.4629 0.2096	-0.3162 0.4071	1.0000								
type	-0.8783* 0.0018	-0.0762 0.8455	0.3904 0.2990	0.3703 0.3266	1.0000							
benefits	-0.1091 0.7799	0.2662 0.4887	0.1091 0.7799	0.6211 0.0743	-0.0745 0.8489	1.0000						
train	-0.3780 0.3159	0.1107 0.7769	0.3780 0.3159	0.5976 0.0892	0.5533 0.1223	0.3712 0.3254	1.0000					
atti	-0.7000* 0.0358	-0.2440 0.5270	-0.1000 0.7980	0.9487* 0.0001	0.4587 0.2143	0.7419* 0.0221	0.5669 0.1114	1.0000				
fsize	-0.8783* 0.0018	-0.6095 0.0814	-0.3904 0.2990	0.7407* 0.0224	0.5429 0.1310	0.2662 0.4887	0.1107 0.7769	0.7710* 0.0150	1.0000			
mobile	0.1952 0.6148	0.8857* 0.0015	0.8783* 0.0018	-0.6481 0.0591	0.1333 0.7324	-0.0745 0.8489	-0.1107 0.7769	-0.4001 0.2859	-0.4762 0.1950	1.0000		
purc	1.0000* 0.0000	0.3904 0.2990	0.0000 1.0000	-0.6325 0.0676	-0.8783* 0.0018	-0.1091 0.7799	-0.3780 0.3159	-0.7000* 0.0358	-0.8783* 0.0018	0.1952 0.6148	1.0000	
ictfarmuse	0.3780 0.3159	0.6639 0.0512	0.7559* 0.0185	-0.5976 0.0892	0.1107 0.7769	-0.3712 0.3254	0.2857 0.4561	-0.5669 0.1114	-0.7746* 0.0142	0.6639 0.0512	0.3780 0.3159	1.0000

Source: Survey data, 2017

* Correlation is significant at $P\text{-value} < 0.05$

From Table 6.2.9 there is a significant relationship between ICT use of the emerging commercial farmers and

- ✓ Capacity in which the emerging commercial farmers are farming at 0.0185 significant level with a correlation coefficient of 0.7559. ICT use increases if the owners are the farmers and do not have farm managers.
- ✓ Farm size at 0.0142 significant level with a correlation coefficient of -0.7746. As the farm size increase there is a more likely hood of using ICT.

There is a significant relationship between the way ICT is purchased and

- ✓ Age of emerging commercial farmers at 0.000 significant level with a correlation coefficient of 1.000. Older farmers are less likely to explore new technology.
- ✓ Type of category of worker employed at 0.0018 significant level with a correlation coefficient of -0.8783. Type of category of worker is permanent, seasonal or

administrative. The more emerging commercial farmers employ permanent workers the more likely it is to use ICT.

- ✓ Farm size at 0.0018 significant level with a correlation coefficient of -0.8783. As the farm size increase there is a more likely hood of using ICT.
- ✓ Attitude of emerging commercial farmers towards ICT at 0.0358 significant level with a correlation coefficient of -0.7.

There is a significant relationship between the mobile operator used and

- ✓ Years' experience farming at 0.0015 significant level with a correlation coefficient of 0.8857. As the years' experience increase there is a less likely hood of using ICT.
- ✓ Capacity as owner or manager at 0.0018 significant level with a correlation coefficient of 0.8783.

There is a significant relationship between the Farm size and

- ✓ Age of emerging commercial farmers at 0.0018 significant level with a correlation coefficient of -0.8783.
- ✓ Off farm income at 0.0224 significant level with a correlation coefficient of 0.7407.
- ✓ Attitude of emerging commercial farmers towards ICT at 0.0150 significant level with a correlation coefficient of 0.7710.

There is a significant relationship between attitude of emerging commercial farmers towards ICT and

- ✓ Age of emerging commercial farmers at 0.0358 significant level with a correlation coefficient of -0.700.
- ✓ Off farm income at 0.0001 significant level with a correlation coefficient of 0.9487.
- ✓ Benefits of ICT are greater than the cost to emerging commercial farmers at 0.0221 significant level with a correlation coefficient of 0.7419.

Other significant relationships are between

- ✓ Type of category of employees and age of emerging commercial farmers at 0.0018 significant level with a correlation coefficient of -0.8783.
- ✓ Capacity as owner or manager and farming years' experience at 0.0018 significant level with a correlation coefficient of 0.8783.

6.3. Descriptive statistics for farm employees

This section gives an overview of the results from the sample of farm employees on firstly their ICT access, secondly their ICT awareness and use patterns, thirdly on their perceptions and attitudes towards ICT and finally a description of the demographics. A sample of 46 farm employees participated in the survey.

ICT access

The respondents were presented with options to indicate where they get access to a computer and the Internet.

Table 6.3.1: Sources of computer and Internet access for farm employees

Answers	Responses	home	work	Internet café	None	Total
<i>Do you have access to a Computer?</i>	N	3	7	1	35	46
	%	7%	15%	2%	76%	100%
<i>Do you have access to the Internet?</i>	N	1	4	1	40	46
	%	2%	9%	2%	87%	100%

Source: Survey data, 2017

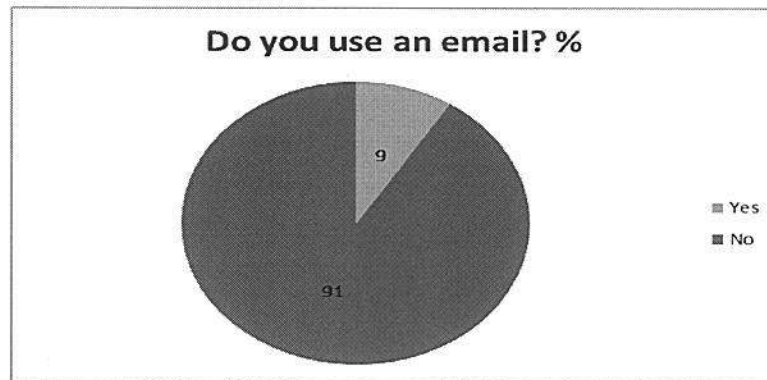
As shown in Table 6.3.1 about 15% of responses have access to computers only at work. On the other hand, about 76% of responses have no access to computers at all. This is typical of the farm employees who do not have enough income to buy ICT of their own. The other reason is the high levels of illiteracy among the farm employees that hinders them from using ICT, even when it is readily available. About 7% of responses indicated that they have access to the computer at home and about 2% of responses access computers at Internet cafes.

The Internet access scenario shown in Table 6.1 is almost similar to computer access for the farm employees, although the percentage responses for Internet access are lower than that of computer access. The highest number of responses for Internet access is 9% from those who access it from work. There are some 87% of employees who have no access to Internet at all and this imply that there are employees who have access to computers but do not have access to the Internet for some reasons.

One interesting finding shown in Figure 6.3.1 indicate that about 9% of the total farm employees use email addresses which is the same as those who access the Internet from work.

About 91% of the employees do not use email addresses which is mainly due to no access to computers and the Internet in the first place.

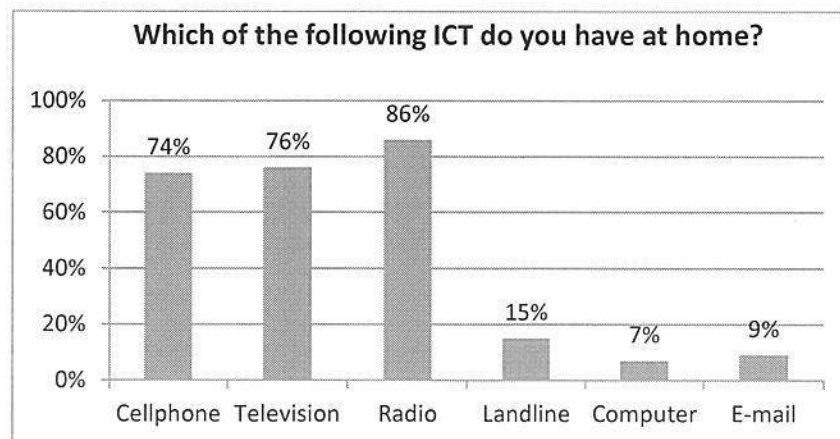
Figure 6.3.1: Farm employees' use of email



Source: Survey data, 2017

As shown in Table 6.3.1 and Figure 6.3.1 only 13% of the farm employees know how to access the Internet on their own without being assisted. About 87% do not know how to access the Internet on their own which shows a very low level of Internet knowledge and e-literacy among farm employees.

Figure 6.3.2: ICT used by farm employees at home



Source: Survey data, 2017

A question on the types of ICT the farm employees used at home we see from. Figure 6.3.2 show that 74% of the responses have cell phones. Approximately 76% and 86% of the responses have television sets and radios in their homes respectively. This is due to these two basic ICT used by average South Africans for entertainment purposes. Only the cell phone,

television and radio are popular with the farm employees. The other ICT are used by a few farm employees. The farm employees' ICT awareness and use patterns are discussed in the next section.

ICT awareness and use patterns

Depending on the type of work they do, farm employees use different ICT in their daily work on the farm. The farm employees were asked if they use ICT to support their farm work.

Table 6.3.2: Percentage responses of farm employees who use ICT to support their farm work

<i>Do you use ICT on your farm to support farming activities?</i>	Responses	Yes	No	No response	Total
	N	13	32	1	46
	%	28%	70%	2%	100%

Source: Survey data, 2017

We see in Table 6.3.2 that 28% indicated that they use one or more ICT and 70% indicated that they do not use ICT at all in their farm activities. This observation shows that there are a large percentage of farm employees who do not use ICT at all to perform their work. This can be as a result of the low usage of ICT by emerging commercial farmers.

Table 6.3.3: Percentage of farm employees who know how to access the internet and use ICT for personal or businesses purposes.

<i>Do know how to access the internet on your own?</i>	Responses	Yes	No	No response	Total
	N	11	31	4	46
	%	24%	67%	9%	100
<i>Do you use the following ICT for personal or business purposes?</i>	Responses	Personal	Business	No response	Total
	N	38	0	8	46
	%	83%	0	17%	100

Source: Survey data, 2017

The farm employees were asked if they knew how to access the internet on their own. From Table 6.3.3 the responses show more than 67% of farm employees did not know how to access the Internet on their own. The low response of only 24% that know how to access the

Internet, give an idea of the low usage of information that is available to improve farm production.

Also in Table 6.3.3 83% of farm employees responded to using ICT for only personal purpose while 17% did not respond. The ICT used are mainly the cell phone, television and radio as shown earlier. There are no farm employees that use some ICT for business purposes.

For one to use ICT there is need for training on how to use it. Approximately 100% of the employees indicated that they did not receive any formal training on how to use ICT. The results from this scenario indicate that some farm employees take it upon themselves to equip them on how to use ICT.

To identify the pattern and frequency of ICT use, the farm employees were asked to indicate the number of hours they spend per week using different ICT. All the respondents included in the study answered this question. Table 6.3.4 shows the percentage of farm employees who use different ICT and the hour's category they spend on each ICT per week.

Table 6.3.4: Percentage of farm employees using ICT per week

<i>How many hours do you spend using ICT per week?</i>	Response	0-3 hours	4-6 hours	7 + hours	No response	Total
	N	37	3	3	3	46
	%	80.5%	6.5%	6.5%	6.5%	100

Source: Survey data, 2017

Considering that the indicated hour are for the whole week and not for each day shows that there is minimal use of ICT among the farm employees. This is indicated by the high percentages under the category 0 to 3 hours.

Perceptions and Attitudes

This section presents the perceptions and attitudes of the farm employees about ICT in general. Some of the questions in this section were binary (yes/no). Others were on a scale which indicated agree, disagree or neutral.

Table 6.3.5: Perceptions and Attitudes on a scale of agree, disagree or neutral

ICT promotes access to banking	Responses	Agree	Strongly Agree	Neutral	Disagree	Strongly Disagree	Total
	N	33	2	11	0	0	46
	%	72%	4%	24%	0	0	100
ICT makes work easier	Responses	Agree	Strongly Agree	Neutral	Disagree	Strongly Disagree	Total
	N	33	5	8	0	0	46
	%	72%	11%	17%	0	0	100%
The use of ICT saves time	Responses	Agree	Strongly Agree	Neutral	Disagree	Strongly Disagree	Total
	N	33	9	4	0	0	46
	%	72%	19%	9%	0	0	100%
The use of ICT increase productivity	Responses	Agree	Strongly Agree	Neutral	Disagree	Strongly Disagree	Total
	N	32	8	4	2	0	46
	%	70%	17%	9%	4%	0	100%
Adoption of ICT important for agriculture	Responses	Agree	Strongly Agree	Neutral	Disagree	Strongly Disagree	Total
	N	32	10	0	4	0	46
	%	70%	22%	0	8%	0	100%
ICT is more effective if in local language	Responses	Agree	Strongly Agree	Neutral	Disagree	Strongly Disagree	Total
	N	38	8	0	0	0	46
	%	83%	17%	0	0	0	100%

Source: Survey data, 2017

The respondents acknowledge the importance of ICT for agricultural development where 92% agreed that using ICT is important for agricultural development. However, 8% disagreed that ICT is important for agricultural development. The larger proportion of the surveyed employees agreed with the view that ICT makes work easier and saves time. Approximately 83% of the employees agreed that ICT makes work easier and about 17% were neutral.

Approximately 91% of employees agreed that using ICT saves time. Some acknowledged that ICT have made their work to be easier and faster than before. However, other employees just acknowledged that ICT saves time and makes work easier, even though most of them do not use it. Only 9% were neutral. About 87% agreed that the use of ICT leads to increase productivity, 9% was neutral and about 4% indicated that they disagreed. The farm employees were asked the type of language they prefer when using ICT like computers.

We see 100% of them agreed that ICT would be more effective if local languages are used. Where 83% agreed and 17% strongly agreed.

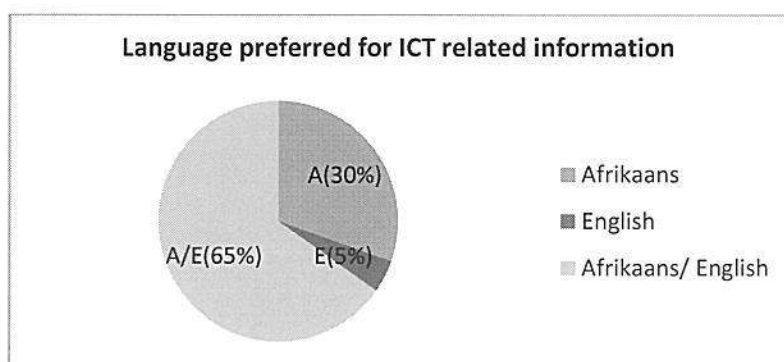
Table 6.3.6: Perceptions and attitudes on a binary scale yes or no

	Responses	Yes	No	Total
ICT is not affordable because of high costs	N	44	2	46
	%	96%	4%	100%
I am satisfied with the services offered by ICT	N	30	16	46
	%	65%	35%	100%
Does ICT help to increase your income?	N	33	13	46
	%	72%	28%	100%
Does ICT help to increase your income?	N	33	13	46
	%	72%	28%	100%

Source: Survey data, 2017

We see from Table 6.3.6 that 96% of the respondents agreed that ICT is not affordable because of the high costs. Due to the high prices, only employees who earn a substantial salary may be able to afford most of the ICT, while the rest are constrained to using a cheap cell-phone. However, only 65% of them were satisfied with the services they receive from the ICT while 35% was not satisfied. This could be due to a lack of training, or poor infrastructure, or both. Even if some of the employees lacked knowledge on most ICT, 100% acknowledged that it was important to teach their children about ICT.

Figure 6.3.3 Language preferred for ICT related information



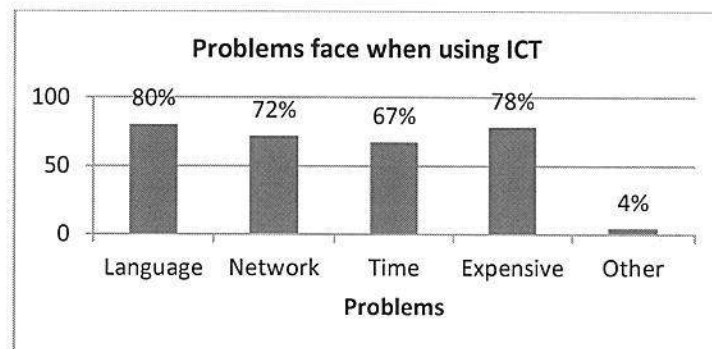
Source: Survey data, 2017

In figure 6.3.3, 65% responded that ICT related information to be in either Afrikaans or English language. Out of the 65%, not all have English as their mother tongue but it is the dominant language used today on most ICT such as computers, e-mails and the worldwide

web. Although Afrikaans speaking people dominates the area 30% indicated that they prefer only Afrikaans and 5% only English.

There are a number of problems encountered by users of ICT. The farm employees were asked to indicate the different problems they face when using ICT. They were given an option of choosing from given alternatives. Figure 6.3.4 shows the response percentages of the different problems encountered when using ICT.

Figure 6.3.4: Major problems encountered when using ICT



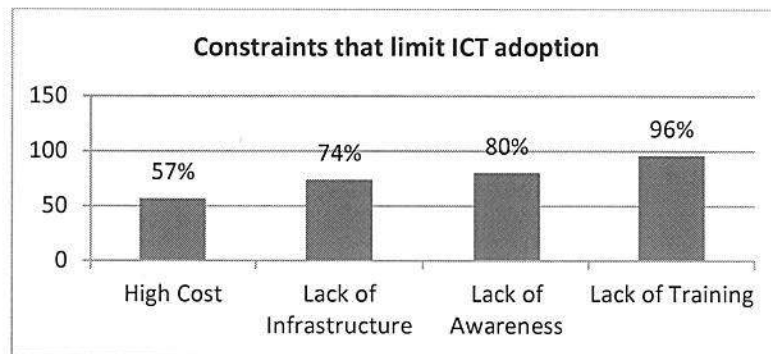
Source: Survey data, 2017

The highest percentage of the respondents of 80% indicated that language is a barrier. Due to the fact that most of the farm employees are not highly educated, some find it difficult to use English as a medium of communication. Therefore, the language itself is a barrier to the use of ICT. The second highest percentage of 78 % of the respondents indicated that the cost of using ICT is very high, beyond the means of many farm employees. The cost of airtime and Internet cafe charges was identified as the main obstacles that cannot be afforded every time. Poor network and reception which is 72% of respondents have been identified as the third major obstacle to ICT use in the area. Some farms are located in valleys and uneven landscapes. This causes communication problems with a result in poor telephone and mobile reception.

Besides problems encountered when using ICT, there are other constraints that inhibit the acquisition and adoption of ICT by the farm employees. Some of the reasons included high cost of ICT, lack of ICT awareness and lack of ICT training.

From Figure 6.3.5 about 57% of the responses indicated that the major barrier is the high cost of ICT, 80% indicated lack of ICT awareness, 74% indicated lack of ICT infrastructure and 96% indicated lack of ICT training.

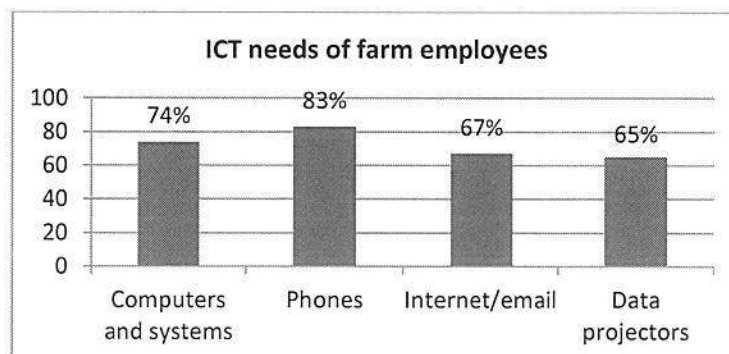
Figure 6.3.5: Major constraints encountered when using ICT



Source: Survey data, 2017

For farm employees there is a need to acquire the skills to use ICT that are user-friendly and effective. They greatly need training to increase awareness and through an e-agriculture strategy more support and implementation of infrastructure from government.

Figure 6.3.6: ICT needs of farm workers



Source: Survey data, 2017

Figure 6.3.6 shows that about 74% of farm employees responded to a need for computers and computerize systems. Besides the computers, 67% farm employees indicated that they also need access to the Internet/email and 65% needed data projectors. Most, almost 83% are in need of phones because almost every worker has a cell phone.

Demographics

Table 6.3.7 presents the demographics for farm employees who were interviewed for this study.

Table 6.3.7: Farm employees' demographics

Demographics by:	Variable categories	Number	Percentage
Gender	Male	23	50%
	Female	23	50%
Age	30 and below	9	20%
	31- 40	19	41%
	41- 50	12	26%
	51 and above	6	13%
Marital status	Married	24	52%
	Single	22	48%
Occupation on farm	Seasonal	12	26 %
	Permanent	32	70%
	None of the above	2	4%
Experience on farm	5 and below	26	56%
	5- 10 years	2	4%
	10- 20 years	9	20%
	20 and above	9	20%
Average salary per month	Less than R4 000	41	89 %
	R4 000- R8 000	5	11%
Permanent off-farm income	Yes	4	9%
	No	42	91%
Education	Primary	40	87%
	Matric	6	13%
Race	Coloured	42	91%
	Blacks	4	9%

Source: Survey data, 2017

In Table 6.3.7 the results from the study showed that about 50% of the respondents were females and about 50% were males. About 20% of the employees had ages of 30 years or below, while about 26% had ages ranging from 41 to 50 years. A majority of about 41% had ages ranging from 31 to 40 years. There were 13% of employees aged 51 or above. About 52% of the farm employees are married and about 48% are single. The two main races represented by the employees are coloured and black. The blacks were about 9%, while the coloureds were about 91% respectively.

The employees were grouped under four occupations that are performed at the farm, namely (i) seasonal workers, (ii) permanent workers, (iii) administrative workers, and (iv) other workers. About 26% were seasonal workers, 70% were permanent workers and 4% worked in other areas. Most of the respondents (about 56%) have less than 5 years' experience of working on the farm. About 4% have 5 to 10 years' experience, 20% have 10 to 20 years' experience and only 20% have more than 20 years farm experience.

In terms of their monthly salary, the majority of the farm employees (about 89%) receive less than R4 000 per month. About 11% have salaries ranging from R4 000 to R8 000 per month. The respondents were also asked to indicate if they have off-farm income or not. The majority of about 91% indicated that they do not have any off-farm income and only 9% indicated otherwise.

From the results of the study, it was found that the farm employees do not have professional qualifications. Approximately 13% of the employees only attained matric education, while about 87 attained only primary education. Most, if not all of those who have not attained matric have difficulties in communicating in English. They can fluently speak the Afrikaans language only. The following section presents the chi-square tests results for the farm employees.

6.3.1. Chi-square tests results

The chi-square tests results for the farm employees are presented next. Both the significant and non-significant variables are presented to assist decision makers and farmers to know the variables they should consider when making farm decisions. The chi-square tests were conducted to test and confirm the relationship between ICT use and different variables, and the relationship between the variables themselves.

Significant variables

In this section, only the variables that have a statistically significant relationship with ICT use of the farm employees are presented. The cross tabulation and chi-square tests for each significant variable are presented next and a brief summary of the relationship is given. In this case, ICT use, which is the dependent variable, was binary with a 1 for yes and 2 for no answer.

Occupation

```
. tabulate ictfarm emplmt, chi2
```

Use ICT on farm	Occupation on farm			Total
	1	2	4	
1	5	6	2	13
2	6	26	0	32
Total	11	32	2	45

Pearson chi2(2) = 7.9937 Pr = 0.018

There is a statistically significant difference in the use of ICT between the three occupation groups of the farm employees ($p\text{-value} < 0.05$). From the shown table, occupation 4 (other) employees responded positively to the use of ICT than the 2 (permanent) and 1 (seasonal) employees.

ICT literacy

```
. tabulate ictfarm ICTLIT, chi2
```

Use ICT on farm	ICT Literate		Total
	1	2	
1	7	4	11
2	4	26	30
Total	11	30	41

Pearson chi2(1) = 10.3746 Pr = 0.001

There is a statistically significant relationship between ICT use and the ICT literacy levels of the farm employees ($p\text{-value} < 0.05$). Most employees who used ICT on the farms were classified as ICT literate and those who did not use ICT were not ICT literate. Employees who have high ICT literacy responded more positively to the use of ICT than those who have low ICT literacy.

In summary, according to the chi-square tests, the variables which are highly related to ICT use of employees are occupation on farm and ICT literacy.

Non-significant variables

The variables in this section have non-significant values, indicating that they do not have a statistically significant relationship with farm employee's ICT use.

Age

```
. tabulate ictfarm age, chi2
```

Use ICT on farm	age of farm employee				Total
	1	2	3	4	
1	4	6	3	0	13
2	5	13	8	6	32
Total	9	19	11	6	45

```
Pearson chi2(3) = 3.5785 Pr = 0.311
```

There is a non-significant relationship between farm employees' ICT use and their age (p-value>0.1). We earlier assumed that young farm employees are more likely to be interested in learning and applying new knowledge than older ones. In this study, age does not have an influence on ICT use.

Income

```
. tabulate ictfarm inc, chi2
```

Use ICT on farm	Income		Total
	1	2	
1	11	2	13
2	29	3	32
Total	40	5	45

```
Pearson chi2(1) = 0.3380 Pr = 0.561
```

We may think that farm employees with a higher disposable income are more likely to use ICT than those with less income. In this study, the relationship between farm employees' ICT use and income is non-significant (p-value>0.5). This could be due to the low wages of all farm employees of emerging commercial farmers.

Experience

```
. tabulate ictfarm Yearsexp, chi2
```

Use ICT on farm	Experience working on farm				Total
	1	2	3	4	
1	10	1	2	0	13
2	16	2	5	9	32
Total	26	3	7	9	45

```
Pearson chi2(3) = 4.8452 Pr = 0.183
```

There is a non-significant relationship between farm employees' ICT use and their years' experience working on farms ($p\text{-value} > 0.1$).). We earlier assumed that as farm experience of the farm employee increases, the probability of ICT use also increases. In this study, farm working experience does not have influence on ICT use of employees.

Gender

```
. tabulate ictfarm gender, chi2
```

Use ICT on farm	gender		Total
	1	2	
1	6	7	13
2	16	16	32
Total	22	23	45

```
Pearson chi2(1) = 0.0547 Pr = 0.815
```

In the South African context where more women are now emancipated they are expected more readily to adopt technology than men. In this study, the relationship between farm employees' ICT use and gender is non-significant ($p\text{-value} > 0.5$).

Two main variables were found not to be related to farm employees' ICT use. These are age, income, experience and gender. The following section presents the correlation analysis results for the farm employees.

6.3.2. Correlation analysis results

The spearman correlation analysis was carried out to find the relationships between ICT use and different variables as well as to determine the strengths of each relationship by the use of correlation coefficients. The correlation results of the correlation analysis for the farm employees are presented next.

Some of the significant variables that were significant in the chi-square test were also identified in the spearman correlation analysis. According to the spearman correlation analysis ICT use is influenced only by ICT Literacy. On the other hand ICT literacy is influenced by 4 other variables which are age, experience, access to internet and access to email. Significant levels of relationships between variables and the correlation coefficients are presented on Table 6.3.8 where the p-values are <0.05 and <0.01.

Table 6.3.8: Levels of significance and correlation coefficients for farm employees

	age	inc	educ	gender	emplmt	exp	accomp	accint	email	ictfarm	ICTLIT
age	1.0000										
inc		1.0000									
educ		0.4783*	1.0000								
		0.0016									
gender	-0.4083*			1.0000							
	0.0080										
emplmt					1.0000						
exp	0.7678*					1.0000					
	0.0000										
accomp							1.0000				
accint							0.4388*	1.0000			
							0.0041				
email							*		1.0000		
ictfarm										1.0000	
ICTLIT	0.4061*					0.4303*		0.6818*	0.5430*	0.5030*	1.0000
	0.0084					0.0050		0.0000	0.0002	0.0008	

Source: Survey data, 2017

* Correlation is significant at $P\text{-value} < 0.05$

From Table 6.3.8 there is a significant relationship between ICT use of the farm employee and ICT Literacy with a significant value of 0.008 and a correlation coefficient of 0.503. The more ICT literate the employees are, the more they use ICT.

There is a significant relationship between the ICT Literacy of the farm employee and

- ✓ Age with a significant value of 0.0084 and a correlation coefficient of 0.4062. The younger the farm employee, the higher the ICT literacy. As the farm employee's age increases, the ICT literacy decreases.
- ✓ Experience of the farm employee with a significant value of 0.0050 and a correlation coefficient of 0.4303. The more the employee is experienced, the less ICT literate. Maybe employees on the farm for a long time choose to stick to their traditional ways of doing things and are not willing to use ICT.
- ✓ Access to Internet with a significant value 0.000 and a correlation coefficient of 0.6818. The higher the ICT literacy of the employee, the more likely the employee is to access the Internet.
- ✓ Access to email with a significant value 0.0002 and a correlation coefficient of 0.543. The higher the ICT literacy of the employee, the more likely the employee is to use email.

The results from the study for the emerging commercial farmers and farm employees were discussed in this chapter.

CHAPTER SEVEN

7. ANALYSIS OF RESULTS AND DISCUSSION

7.1. Introduction

Firstly this chapter presents the analysis of the results that were found in this study for both the emerging commercial farmers and the farm employees. Secondly it discusses the contribution of the study to the theoretical model that was used. Thirdly, the findings from this study are compared to findings reported in related studies in the literature review, to assess their similarities and differences. Finally, the chapter provides general recommendations on how ICT use can be greatly improve the development of emerging commercial agriculture.

7.2. Analysis of results

This study set out to ascertain and probe the factors that influence the use of ICT in emerging commercial agriculture in the context of a developing country. The investigation was centred on a number of research questions that were posed in chapter 1 to guide the study. In this section, an analysis of the research findings is done to answer the research questions. Although some of the research questions were answered through the literature review that was presented in chapter two, they are briefly restated here under the appropriate and pertinent research questions. Added to those findings from the literature review is the analysis of the findings from the experiment.

Different kinds of ICT being used by emerging commercial agriculture

From the results of the study the mobile phone is the ICT used the most by emerging commercial farmers. The computer, landline, printers, fax, photocopy and Internet are also used. Only 5% have their own website and have any business goals with regard to ICT.

The types of ICT the farm employees used the most are cell phones, television sets and radios. Most farm employees do not have access to a computer and the Internet.

Uses of ICT by emerging commercial agriculture

Most emerging commercial farmers use ICT for personal purposes and very few uses a computer for making decisions pertaining to their farm business. The little that use the

computer, use it to prepare budgets or keep information such as farm and payroll records. Less than 10% use it as a tracking system, for irrigation scheduling and water budgeting. The decision to purchasing ICT for farm use is either a personal or in response to advertisements on TV, radio or other media. The mobile phone is the most used follow by the computer, fax, photocopy and Internet. More than 70% of farmers and farm employees uses the mobile phone.

Barriers that hinder the use of ICT by commercial agriculture

The results of this study showed that the major barriers inhibiting the use of ICT by emerging commercial farmers and farm employees is the high cost of purchasing and accessing ICT. Given the low incomes of most emerging commercial farmers and farm employees, it is difficult, if not impossible, to buy ICT of their own. Some indicated that internet cafe charges and airtime are not affordable all the time.

A number of employees highly recommended training on the use of ICT since most of them are recruited from poor and illiterate communities. The lack of training and awareness of ICT hinder most of the emerging commercial farmers and farm employees from using ICT productively on the farms. This is coupled with language and content limitations placed by most ICT that use English as their interaction language. Unless training is provided, ICT use will be difficult for some farm employees who are illiterate and are only familiar with the Afrikaans language.

The study indicated that an e-agriculture strategy in South African emerging commercial agriculture is still new or not present at all. As a result, this places a limitation on their usage of ICT for their productivity and economical sustainability. What this suggests is that, for ICT to be used successfully in emerging commercial agriculture, they need to be supported by government and other developmental organisations in the agriculture sector. This will greatly improve the use of ICT in the sector and enable the emerging commercial agriculture farmers to benefit from using it. There is a need through training to increase awareness and acquire the skills to use ICT that are user-friendly and effective.

Low quality networks and poor communication reception infrastructure are also concerns. Both the emerging commercial farmers and farm employees indicated that this as a major communication barrier.

Benefits of ICT use in emerging commercial agriculture

Major benefits from ICT use include the facilitation of communication and information exchange. The respondents also acknowledge the importance of ICT for agricultural development. They believe ICT makes work easier and saves time, which leads to increase productivity.

From the study emerging commercial farmers agree that the benefits of using ICT are greater than the costs and it assist with the easy access to information. They also believe ICT improves agricultural development and they can use it to form farming business partnerships. Besides being fast and time-saving, ICT use also saves money through lowering costs that increase the profits.

Factors that influence the use of ICT in emerging commercial agriculture

This study identified different factors that influence ICT use for both the emerging commercial farmers and farm employees. Some possible reasons for the relationships found from the results of this study are stated below.

Farm employees that are permanent responded more positively to the use of ICT than seasonal employees. Most employees who used ICT on the farms were classified as ICT literate and those who did not use ICT were not ICT literate. Employees who have high ICT literacy responded more positively to the use of ICT, than those who have low ICT literacy.

The trained employees use ICT more than the untrained ones. This is mainly because training is essential for the effective use of ICT by the employees, especially the ICT that need a user to be computer literate. Without ICT training it is difficult for farm employees to be able to use the ICT productively for farm purposes.

Emerging commercial farmers who have off farm income are mostly pensioners and do not use ICT on their farms. This means most young people are willing to learn as they are flexible than older ones.

The bigger the farm owned by emerging commercial farmers the more they use ICT on the farm. Permanent employees tend to use more ICT on farms than the seasonal employees.

In this study the level of income or education, receiving formal training and whether produce are advertised has no influence on ICT use by emerging commercial farmers. Similarly the age, gender, level of income and years working experience on farm had no influence on ICT use by farm employees.

7.3. Contribution of the study to the theoretical model

This paper is situated in the field of information and communication technologies for development (ICT4D) where we investigate how information and communication technology (ICT) can be used to foster development in the emerging agriculture sector in South Africa. Technology's role for development is not always clear and in developing countries ICT interventions is challenged by critical issues associated with social change improvement.

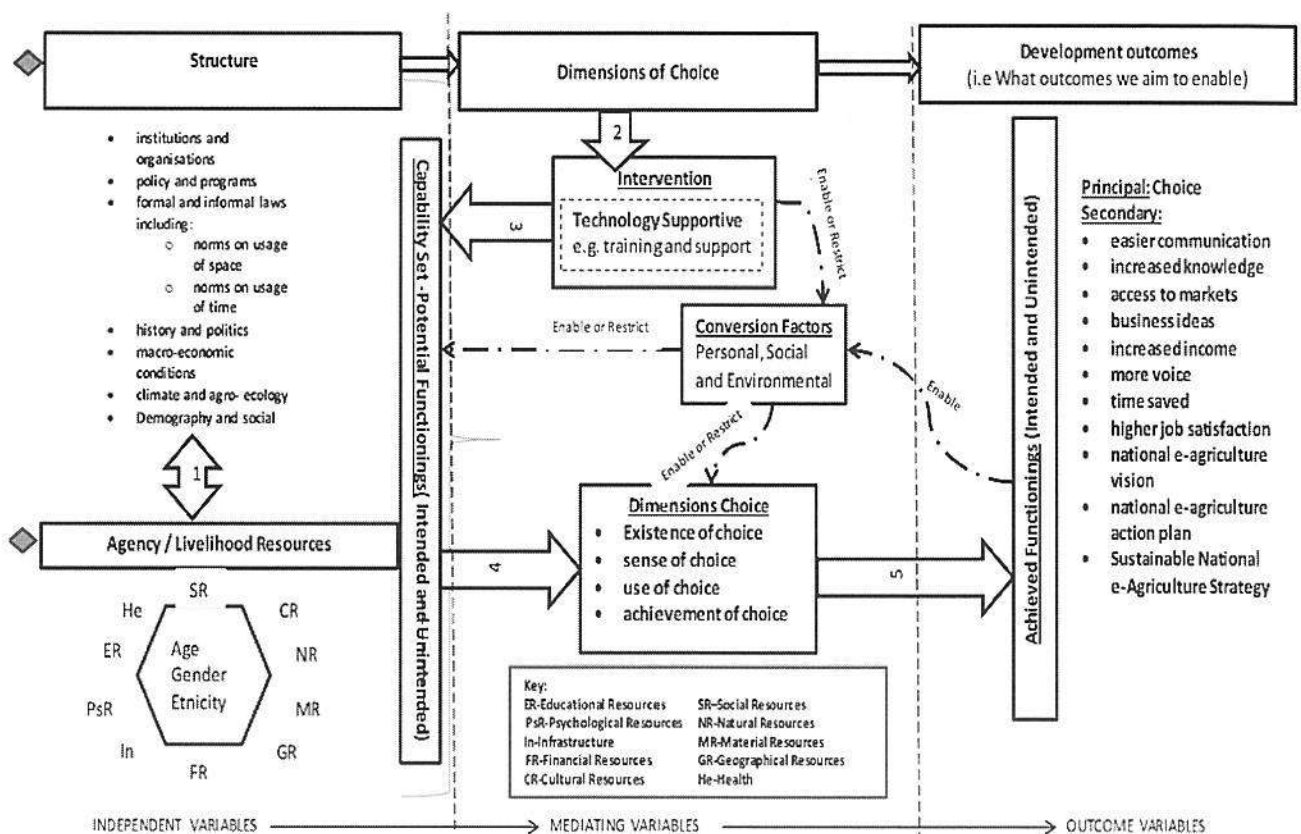
In ICT4D there have been several attempts to develop frameworks for evaluation. To help us answer the questions about the different kinds of ICT being used, barriers that hinder the use, benefits of ICT use and the factors that influence the use of ICT in emerging commercial agriculture we used Amartya Sen's Capability Approach (CA). By using the CA as the theoretical foundation we recognize the systematic nature of the development processes and defined a development framework for this study. Kleine's Choice Framework (CF) extended by an Evaluative Framework (EF) by Hattakka and De' was used as the framework for this study.

From a systemic and holistic view of identified use of ICT by emerging commercial farmers this section examines how the empirical findings fit within the adopted framework in figure 7.3.1 for this study. It discusses individual outcomes and key factors that influenced the use within the adopted framework of this study.

This framework uses the CF extended by the EF and attempts to translate Sen's CA into a tool for systemic analysis in ICTD. As illustrated in Figure 7.3.1 the Framework underpinning this study can be categorised into three types of variables namely independent variables representing structure and agency, mediating variables representing dimensions of choice and outcome dependent variable of ICT use representing the development outcomes.

Aspects of structure can be illustrated with examples found within the research findings. For example a structure barrier is the non-existence of appropriate policies and programmes to facilitate awareness and training to encourage the use of ICT among emerging commercial farmers. Furthermore, the insufficient laws and informal laws that regulate the affordability of purchasing and accessing ICT lead to the high cost of internet cafe charges and airtime. This creates structural impediments in terms of access to ICT. Low awareness of the potential of computer use to improve the sustainability of emerging commercial farmers because of insufficient government policies or programmes was also a structure barrier. Implementing policies and programmes to establish rural ICT e-hubs to act as an ICT extension service to emerging commercial farmers can be an example of a structure that could facilitate the use of ICT in the emerging commercial agriculture sector.

Figure 7.3.1: The Theoretical framework underpinning this study



Source: Adapted from the Choice Framework (Kleine, 2010) and an Evaluative Framework (Hatakka and De', 2011)

Similarly there are many examples of how types of agency resources affected an emerging commercial farmer's level of participation in ICT use, and subsequently, the influence it has on their degree of empowerment. For example, the poor networks are an example of the lack of infrastructure resources that can create a hindrance for emerging commercial farmers to use ICT. There are also other considerations for the poor use of ICT due to limitations of various other resources of an emerging commercial farmer. This includes insufficient financial resources and poor level of illiteracy as a result of low educational resources. This is coupled with the lack of training as well as language content limitations among the emerging commercial agriculture communities that was investigated. Variations of development outcome exist as a few were able to use ICT for administrative purposes of their business. This example illustrate that you can have different outcomes among participants who share similar structure and agency resources.

We can thus affirm that for developing emerging commercial farmers the structure that exists would influence the farmer's choices that could lead to certain development outcomes (achieved functionings). The outcomes can make a farmer's agency better which can lead to a better utilisation of structure. The utilisation of structure can also influence a farmer's agency. How structure and agency interact can produce choices, and such choices can lead to development outcomes.

Arrow 4 in the diagram above shows that the interaction of structural factors with individual resources directly influenced the nature and implementation of choice. It is important to implement ICT supportive awareness programmes in emerging commercial agriculture that goes beyond the '*existence of choice*' to use ICT. When technology intervention is implemented, training and support plays a significant role in terms of the '*sense of choice*'. The conversion factors, which change over time, can affect the '*sense of choice*' of emerging commercial farmers. Therefore only having a '*sense of choice*' does not mean individual emerging commercial farmers will exercise the '*use of choice*'.

Arrow 5 shows that when emerging commercial farmers choose to use or not to use ICT, it would make them achieve the primary outcome which is the '*achievement of choice*'. These dimensions of choice have impact on the nature and extent of development outcomes.

Having secondary development outcomes like easier communication and increased knowledge can lead to others such as better access to markets, business ideas and increased income. Thus the goals to achieve development outcomes can increase the capabilities of

your resources under agency. If emerging commercial farmers can increase achieve functionings such as easier communication through the use of ICT, they can impact on their resources within agency and thus increase their potential functionings. Just as some development outcomes influenced agency resources so too do they have the potential to influence structure.

When implementing ICT to develop emerging commercial farmers the structure that exists would influence emerging commercial farmers' choices that could lead to certain development outcomes. The outcomes can make a farmer's agency better which can lead to a better utilisation of structure. The utilisation of structure can also influence a farmer's agency. **Arrow 1** shows that how structure and agency interact can produce choices, and such choices can lead to development outcomes. As stated earlier for development outcomes to be achieved, there must first exist the possibility of a choice, secondly the sense of emerging commercial farmers being aware of the availability of that choice, thirdly that emerging commercial farmers make use of option to choose, and that will finally give the achievement of the principal outcome of choice.

From the above discussions we can see that analyses based on this framework to determine how certain outcomes can be achieved through the use of ICT also works backwards from outcomes to structure and resources. In the next section we will now compare the findings of this research with literature discussed in previous chapters.

7.4. Comparison of findings with the literature

ICT use includes the facilitation of communication and information exchange that is important for agricultural development found in this study support the results of Collence(2010) ; Djane and Ling(2015) and Brewster et al(2012).

Although only a few emerging commercial farmers use ICT, from this study most of them perceive that the benefits of using ICT are greater than the costs. They believe ICT improves agricultural development and increase profits. This perception founded in this study support the results of FAO and ITU (2016); Reardon et al (2009); RAP and FAO (2012) and Chikaire et al (2015).

From the literature the key factors that influence the use of ICT included socio-economic status, cultural influences, technical shortcomings of information providers, and the age of

farmers (Musa et al, 2013). In this study the age, gender, level of income and years working experience on farm had no influence on ICT use by farm employees.

The effects of language, low income, scarcity of localised content and illiteracy as major barriers to ICT use in this study support the results found in Nmadu et al (2013); Odini(2014) and Musa et al(2013).

ICT has become a powerful force in rural poverty reduction where rural ICT kiosk in rural communities has improved access to multiple livelihoods resources. This can improve living standards and is supported by May and Diga (2015); Chikaire et al (2015) and Khuhawar et al (2014). However this study found that there are very few ICT kiosks to support emerging commercial farmers. Thus the lack of any government support through an e-agriculture strategy is highlighted. In the next section I will give some recommendations for the improvement of ICT use in emerging commercial agriculture.

7.5. Recommendations for the improvement of ICT use in emerging commercial agriculture

The challenges of emerging commercial farmers in South Africa are many, complex and multi-faceted. These challenges need to be addressed in a holistic manner, through a joint approach of establishing priorities by the South African government and their development partners. The government can develop an e-agriculture strategy to assist with dealing with these challenges such as e-microfinance, access to agricultural and market information, agricultural inputs, technologies and innovations, training, local knowledge and e-commerce.

Some of the envisaged solutions include the adoption of appropriate ICTs in line with people centred supportive policy within legal and institutional frameworks. Emerging commercial farmers need to be assisted to adopt some of the emerging agricultural practices to help them increase agricultural production, productivity, enhance incomes and access improved markets that offer better prices for their products. The government and development practitioners should forge alliances or partnerships that can together chart out an e-agricultural strategy, having a vision, action plan and a monitoring and evaluation strategy to guide the implementation of the action plan.

Some technologies are too expensive and not affordable to emerging commercial farmers. More importantly, the present ICT infrastructure in most rural areas in South Africa cannot support it. The government should implement ICT rural e-hubs that could provide more

affordable ICTs that hold great potential to assist emerging commercial farmers. This could be used as ICT extension services to deliver agricultural information and collect farmers' questions from the field. This can be managed by a central decision support system that would provide solutions to emerging commercial farmers to enable them to benefit from these ICTs that address the number of challenges they face.

The cellular phone is the most used ICT by emerging commercial farmers and their employees, with the biggest challenge the cost of connectivity. The integration of the cellular phone and the internet through the "Internet of Things" needs to be further explored to integrate conventional ICTs with newer ICTs. It is recommended that government and other development partners support capacity building for ICT innovations such as mobile technology to improve access to markets and increase agricultural productivity.

There is a need for South Africa to learn from other developing countries and replicate holistic models that use various ICTs to provide financial, decision making tools, agricultural information and other services to farmers. This would enable emerging commercial farmers in South Africa to move out of the poverty cycle and advance beyond subsistence farming by adopting new improved technologies and better access to agricultural inputs, such as improved seed varieties and fertilizers.

Supportive policy, legal and institutional frameworks are crucial in ensuring success of any agricultural or ICT interventions. There is a need for government to support policy initiatives, and legal frameworks that ensure empowerment through active involvement and participation by emerging commercial farmers. They need to influence policy review or development and institutional reforms on local, provincial and national government levels in South Africa. This will ensure that policy and legal frameworks are supportive of initiatives such as rural connectivity, e-commerce and e-microfinance that will benefit a large constituency in the rural areas. It is recommended that government and other development partners work closely in South Africa in the area of ICT policies to assist emerging commercial farmers.

The following chapter concludes the study with a brief summary, a discussion of the limitations of the study, concluding remarks, suggestions to assist policy development and the prospects for future studies.

CHAPTER EIGHT

8. SUMMARY OF FINDINGS, CONCLUSIONS AND PROPOSALS

8.1. Introduction

This chapter presents a summary of the study and highlights the main findings and conclusions drawn from the study. The major themes and concepts that emerged are revisited with the aim of reconnecting the narrative and arguments.

In chapter one the research reflects on the background of the challenges of the agriculture sector in light of South Africa's 2030 National Development Plan in terms of its land reform and agriculture development strategies. It also reflects on a global outcry of the 2030 Sustainable Development Goals (SDGs) to reduce the numbers of people living in poverty and extreme hunger as well as the rate at which the earth is losing its biodiversity. These factors are most pertinent at this time when the balance between the global demands for poverty reduction and food security, and those of environmental sustainability translate into a complex national development agenda which this research attempts to articulate for the benefit of appropriate reforms in the agricultural sector by using an e-Agriculture strategy. The introductory chapter also laid the foundation of the study by giving context to some of the key concepts applicable to the study, defining the research question and emphasising the relevance and importance of ICT use in the emerging commercial agriculture sector broadly but specifically in South Africa.

As part of the literature review in Chapter two unique attributes of the South African emerging commercial agriculture sector was explored and some of the challenges were highlighted with the focus remaining on the use of ICT in the sector. Trends in some of the key usages of ICT in emerging literature were presented. From these cases lessons was drawn that can greatly assist government in developing strategies and policies to support ICT use within the emerging commercial agriculture sector. Having established from literature the significance of ICT use in the emerging commercial agriculture sector as well as the major factors influencing or constraining its use, the study set out to identify major strategies and policies that can be adopted by government to confront this. This includes an investigation of ICT use in the emerging commercial agriculture sector in the Western Cape, South Africa in order to enhance the sustainability of this sector.

Chapter three showed how the development of an e-agriculture strategy can provide the basis to monitor development and validate good practices on the use of ICTs in agriculture and rural development. An e-agriculture strategy can also continue to examine emerging trends and the evolving role of ICTs as well as the challenges faced in reaching scaled, sustainable information service models. This chapter also highlights how critical it is for ICT policy to consider politics and policy aspects within other sectors policies. It further emphasised the importance of the participation of emerging commercial farmers in bringing about policy change in agriculture. This is important for participatory people-centred development and an integrated sustainable management approach.

The present investigation focused on the use of ICT in the Western Cape agriculture with special reference to emerging commercial farmers. The study also investigated the different forms of ICT used in emerging commercial agriculture, how they are being used, what they are used for and the factors that affect their use. Unlike most studies which focus on farmers only and no consideration for the participation of the farm employees, this study focused also on farm employees. The reason is that the farmers and employees are all players on an emerging commercial agriculture farm. Leaving one of them will give us inadequate information about their farm activities. Farmers were interviewed face-to-face to get insight on, among other things, how, when and where they use different forms of ICT in their day-to-day agricultural activities. Face-to-face interviews were conducted with the farm employees to investigate, among other things, their use of ICT, ICT literacy, training on ICT use and challenges of using ICT. 46 farm employees and 42 emerging commercial farmers responded to the questionnaire and participated in the face-to-face interviews.

From the study, it was found that ICT is not playing a major role in the development of the South African emerging commercial agriculture sector. ICT can help to link the South African emerging commercial farmers with export markets where they can sell their produce. The use of ICT will not only facilitate communication with international customers and stakeholders, but also online advertising, e-commerce and traceability. Before summarising the key findings of this study it thus becomes important to next first state the objectives of the study.

8.2. The objectives of the study

The main aim of this study was to investigate the use of ICT in South African emerging commercial agriculture in the West Coast District municipality of the Western Cape Province. We investigated the following specific objectives to achieve the relevant results for this study.

- i. Explored the different ICT being used by emerging commercial farmers.
- ii. Investigated and described the uses of different forms of ICT among emerging commercial farmers,
- iii. Identified barriers affecting ICT use by emerging commercial farmers, and
- iv. Described the socio-economic benefits associated with ICT use by the emerging commercial farmers.

The study used what was learnt from the literature review to help us identify the gaps between theory and practice in the emerging commercial agriculture sector. Findings can form the basis for future consultations with key stakeholders. The intention of this study is to be able to influence government policies and programmes to use ICT as an extension service for the development and support of the emerging commercial farming sector. This can assist government and civil society that support the development of emerging commercial farmers to have greater impact.

8.3. Summary of key findings

Although most emerging commercial farmers cannot afford to adopt all the new ICT that are essential in their farming activities almost all who were interviewed for the purpose of this study acknowledged the importance of ICT to their businesses. However, among other ICT, mobile phones and television were found to be primarily used for social and entertainment reasons rather than for agricultural purposes.

The general findings showed that occupation on farm and ICT literacy influences the use of ICT by farm employees. Age, gender and years' experience working on the farm did not play any role in influencing farm employees to use ICT, although they were expected to be major ICT use determinants in normal cases.

The general findings for emerging commercial farmers showed that the gender, capacity of the farmer as manager or owner, off farm income, farm size and the choice of mobile operator influences the use of ICT by them. It was found that a number of variables do not influence the use of ICT by emerging commercial farmers directly but may influence their management style and decision making. For example, the way ICT is purchased and the attitude towards the use of ICT were highly related to a number of variables and proved to influence the decision-making of the farmers on ICT use on the farms. Lastly, it was found that the income of the farmer and the advertisement of farm produce do not have an influence on ICT use by emerging commercial farmers.

8.4. Limitation of the study

The major limitation of this study is the fact that the number of respondents of both emerging commercial farmers and farm employees was very small. This could have caused the results to differ from expectations. The validity of the results would have been more strengthened with more responses. Since it is a preliminary study, a small sampling frame was used, but for more valid results in the future, studies like these need at least 100 respondents for both emerging commercial farmers and the employees.

Time constraints and lack of resources had many limitations on producing quality primary data for this study. One of the other limitations of the study is that the case study area is in a predominantly Afrikaans community and the process of translating data from English to Afrikaans caused misinterpretation or change in meaning of certain words. Organisational functions and community activities were unforeseen events that influenced the data collection time frame.

Unfortunately, in this study the sample was limited because it was difficult to find willing farmers in the Western Cape Province. A lot of interviews could not be done due to busy farm schedules. The few who were cooperative could only spare a few minutes.

Since this study focused on a case study, the results may not be accepted at face value to be representative of all South African emerging commercial agricultural communities. More research and investigation is needed in this area to reach a general conclusion.

8.5. Concluding remarks

The present study solicited information from emerging commercial farmers and employees. To enrich the interviews secondary sources of information were used to provide an understanding on ICTs that can satisfy the real needs of emerging commercial farmers and exploit opportunities that address the issues and challenges identified. To achieve sustainable emerging commercial agriculture in South Africa, an integrated approach is crucial. The present study tried to identify gaps on ICTs and emerging commercial agriculture and provides answers from literature globally.

Through a literature review in Chapter 2 it is shown that the innovative use of ICTs play a key role in improving agricultural production and the value chain. Food traceability systems using ICTs have become very important risk management tools. This allow food business operators or authorities to contain food safety problems and promote consumer confidence. ICT-enabled marketing and access to markets plays a major role, especially for information on market prices and demand. ICT-enhanced marketing and certification strengthens the capacity of emerging-commercial farmers to increase revenue by improving their position on local and international markets. ICTs have been introduced into programmes for various purposes including land -use planning, crop forecasting and early warning systems to monitor threats. In addition, the use of mobile phones has become more common for exchanging information through a growing use of ICT solutions for the later stages of the agricultural value chain such as post-harvest, transport and storage.

In summarizing developments this research identified a number of positive trends, including mobile applications for agricultural information, mobile financial services and stronger integration of ICTs into agriculture and e-agriculture strategies. However, challenges may limit gains as it is not only concerned with technological infrastructure and connectivity. Challenges are also characterized by ineffective knowledge exchange and management of information content due to limited human and institutional capacity. As a result, development actors need to better address the availability of appropriate and adapted content, the affordability of access, the development of farmers' capacity to use ICTs and available information plus the inclusion in ICT initiatives of women, youth, older farmers and those lacking literacy and educational skills.

8.5.1. The key conclusions of the present study include:-

1. Although improving emerging commercial agriculture was central to poverty alleviation in South Africa, the challenges faced by emerging commercial farmers have not received much attention.
2. Interest in ICTs has steadily grown in South Africa and ICT policies have been rolled-out. It is acknowledged that there are still constraints and a lot more still need to be done.
3. Training, information and knowledge are important ingredients for increasing production and productivity, value addition and improving access to markets. Agricultural information and knowledge, therefore, need to reach emerging commercial farmers in South Africa. Farmers need to be trained and need knowledge and information on agriculture, forestry, fisheries, nutrition, inputs, markets, credit and new improved technologies such as high value crops, commercial farming as well as other aspects of rural development.
4. While emerging commercial farmers cannot afford some of the technologies government has a role to play in ensuring improved and efficient agricultural production.
5. Through this study emerging commercial agriculture in South Africa expressed the need:-
 - for the provision of affordable and accessible ICTs,
 - for interventions to improve ICT infrastructure,
 - to address the prevailing inadequacy in ICT skills and capacity,
 - to develop local content that is relevant to the needs of farmers,
 - to address the high cost of technologies and low bandwidth,
 - to provide an enabling institutional, policy and legal framework for the development of microfinance and e-commerce
6. There is great potential in using ICTs to restructure extension and other government services. However, there is low capacity and usage of ICTs and the ICT infrastructure in rural areas remains a major problem. Addressing some of these issues would require policy intervention and supportive legal frameworks.

Farmers need to be trained and need knowledge and information on agriculture, forestry, fisheries, nutrition, inputs, markets, credit and new improved technologies such as high value crops, commercial farming as well as other aspects of rural development. While there are many valuable initiatives on the use of ICTs for agriculture, the sustainability of pilot initiatives is an issue. Too often after the pilot phase, projects cease because of many financial, human and other constraints. Scaling up should be integrated in the formulation and implementation of initiatives. Costs of ICTs need to be reduced, and the use of ICTs needs to be made financially sustainable, a goal in which Public-Private Projects can play an important role.

8.5.2. FAO and ITU role in developing E-agriculture strategies

This thesis also highlighted the work done by Food and Agriculture Organisation (FAO) and International Telecommunication Union (ITU) in support of developing in developing their national e-agriculture strategies. They launched a guide during 2016 that assist in developing a national e-agriculture vision, action plan and a monitor implementation framework to manage associated risks of the strategy. To embrace the benefits presented by this, the South African government needs to formulate ICT strategies and policy that provides direction and guidance for the development and application of ICTs. The guide launched by FAO and ITU can assist to develop policy support, standards, norms, methodologies and tools to develop individual and institutional capacities that are all key components of an e-agriculture strategy.

Addressing some of these issues would require policy intervention and supportive legal frameworks. An E-agriculture strategy is an area of application of Information and Communication Technologies (ICTs) that ensure the systematic dissemination of information using ICTs in order to provide ready access to comprehensive, up-to-date and detailed knowledge and information, particularly in rural areas. It seeks Public-private partnerships (PPPs) that seek to maximize the use of ICTs as an instrument to improve production quantity and quality.

The development of an e-agriculture strategy provides the basis to monitor development and validation of good practices on the use of ICTs in agriculture and rural development and their dissemination. An e-agriculture strategy would continue to examine emerging trends and the evolving role of ICTs, and the challenges faced in reaching scaled, sustainable information service models.

8.6. Proposals

ICT is playing an important role in the agriculture sector, especially in the commercial sector. However, some farmers are left out in this technological revolution. Opportunities of the digital age are not equally accessible and the gap is even greater in some developing countries. In South Africa, there is a digital divide between the commercial and the small-scale emerging commercial farmers. Equitable access to information is one of the most vital principles in the emerging global information economy but this is lacking in the agriculture sector of South Africa. For agricultural development to be achieved at a national scale there is a need for small-scale emerging commercial farmers, especially the black counterparts, to be incorporated into this ever-growing information society. As discussed earlier there is need for infrastructural development in South Africa to facilitate efficient transfer and flow of information to all agricultural role players. Some areas are still under-serviced in terms of access to telecommunication and are lagging behind in technological development. Major setbacks in infrastructure development include inadequate network connections and unreliable telecommunication infrastructure. For the effective improvement of ICT use in agriculture and to increase the number of ICT use beneficiaries, the following general suggestions need to be taken into consideration.

Government can play a major role by providing necessary support to the majority of small scale farmers to also use ICT on their farms. This can be done by facilitating ICT training of small scale farmers, improvement of telecommunication infrastructure in poorly developed agricultural communities and providing subsidies to small scale farmers who purchase ICT for farm use. In summary, access to ICT is not only a question of connectivity, but also of capability to use the ICT and provision of relevant content in accessible and useful forms. This entails the need for provision of necessary ICT facilities, technical support and relevant content.

The study recommends a paradigm shift with respect to the conventional extension services in the South African emerging commercial agriculture sector. Given the unique needs for emerging commercial farmers in South Africa there need to be a better alignment of ICT products and services to the development of emerging commercial agriculture extension. To some extent it is not only about providing an acceptable level of ICT services but conditions under which it can be accessed that are not appropriate to emerging commercial farmers. The

following are proposed for consideration by government to improve access to ICT services for emerging commercial farmers in South Africa.

- A high level co-ordination of policy is needed to create a conducive institutional environment for emerging commercial farmers
- Piloting ICT services models that are tailored to the specific needs of emerging commercial farmers should be undertaken that can assist production systems, climatic conditions, etc. Some pilot schemes could be implemented in partnership with strategic partners who can provide technical skills and training.
- ICT models that can be beneficial for emerging commercial farmers could be considered within the framework of co-operative legal registered businesses in order to improve economies at scale.
- Setting standards of how ICT use could be improved. This can improve the management of knowledge and information with regards to agricultural potential land, land ownership status, monitoring and evaluation of public farmer support programmes, and annual production yields.

In general I believe that there is a great need for an agricultural information services sector that works on a basis of 'technology as a service'. This can enable managed information systems infrastructure and services in rural areas that requires data pumps, data pipes, set standards, controllers, data engineers, trainers and technical support. This is similar when expanding irrigated agriculture that requires water pumps, water pipes, set standards, controllers, water engineers, trainers and technical support.

Addressing some of these issues would require policy intervention and supportive legal frameworks. An E-agriculture strategy is an area of application of Information and Communication Technologies (ICTs) that ensure the systematic dissemination of information using ICTs on agriculture in order to provide ready access to comprehensive, up-to-date and detailed knowledge and information, particularly in rural areas. It seeks to maximize the use of ICTs as an instrument to improve production in quantity and quality.

Discussed above are some of the necessary steps that need to be considered in order to accomplish success and development in the use of ICT in agriculture for the benefit of all agricultural role players. The next section would thus conclude this chapter looking at areas for further research.

8.7. Areas for further research

This section presents some key questions that need to be addressed through a research agenda in support of emerging commercial farmers. Based on the findings of the present study a number of research questions are suggested to determine how we can use ICTs to address the challenges that emerging commercial farmers in South Africa face. Some key questions that could be address in the research agenda in support of emerging commercial farmers include:-

- **Baseline studies / surveys / needs assessment**
 - What are the best practices for ICTs and emerging commercial agriculture?
 - What are the agricultural knowledge and information needs of emerging commercial farmers?
- **Markets and market research**
 - What is the pathway for information flow through the value chain?
 - How can farmers be linked to markets (standards, requirements and certification)?
 - Which is the most effective way of reaching farmers with timely agricultural information and knowledge (indigenous and external)? (Is it telephone, radio, FM radio stations, print, SMS, or internet, among others?)
- **Institutional building and infrastructure development**
 - What is the role of public-private partnerships in promoting ICTs to emerging commercial farmers?
 - How is national agricultural information and knowledge for emerging commercial farmers communicated in the respective provinces and districts?
 - How could the participation of women and the youth in initiatives on ICTs within the emerging commercial agriculture sector be improved?

- **Training, capacity building and strengthening**

- What is the minimum literacy level required by emerging commercial farmers to use available ICTs?
- What ICTs can we use to share and exchange agricultural information, knowledge and innovation among illiterate emerging commercial farmers?
- What is the role of distance learning in improving uptake of new and improved agricultural technologies?

- **Impact studies**

- What is the impact of ICTs in emerging commercial agriculture?

- **Policies**

- In regard to supporting emerging commercial agriculture, what gaps exist in the available ICT policies and how could these be improved to cater for the needs of emerging commercial farmers?
- How could the voices of emerging commercial farmers in South Africa be heard at the policy making table?

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APPENDIX 1: SURVEY QUESTIONNAIRE FOR FARMERS



Survey questionnaire to be used for interviews with emerging commercial farmers

A research survey investigating the use of ICT in agriculture

This survey's aim is to investigate and assess the use of ICT (for example, computers, global positioning systems, precision farming, tracking equipment, Internet, fax, printer, e-mail, websites, landline/mobile phones, e-commerce and other computerized agricultural systems) in agriculture. It will focus on the use of different forms of ICT, ICT access and factors influencing the use of ICT among emerging agricultural communities in the Western Cape on the West Coast.

The results of the study will portray how ICT is deployed for agricultural purposes. This will help us better to understand the ICT needs of emerging agricultural communities in South Africa. With the final output from the survey, a Master's mini-thesis will be developed and submitted at the end of the academic year 2016.

The questionnaire is expected to take approximately 25 to 30 minutes.

Informed consent

Participation of farmers in this survey is completely voluntary. Participants are assured that all their information will be strictly confidential and anonymous. No references will be made to specific individuals. All the responses will be used for academic purposes only.. Your honesty and cooperation is greatly appreciated..

Sponsor: Institute for Social Development (Centre for Food Security) at the University of the Western Cape

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Key definition

Information and Communication Technology (ICT) - A set of activities that consists of hardware, software, networks and media that facilitate or make it easy to collect, store, process, transmit, present and communicate information (voice, data, text, images) using electronic means. This includes computers, printers, telephones, fax, Internet, email, mobile phones, landline phones, e-commerce, etc.

Section 1: Farm activities

Q1. Which of the following enterprises do you have on your farm?

- [1] ☐ Livestock
- [2] ☐ Fruits
- [3] ☐ Dairy
- [4] ☐ Field crops
- [5] ☐ Other (specify)

Q2. What is the size of your farm in hectares?

Q3. Which of the following assets do you have on your farm? Please tick the appropriate options

Tractors	
Combine harvesters	
Pre-cooling and cold storage facilities	
Others (specify)	

Q4. How many minutes do you take to drive to the nearby town?

Section 2: ICT use patterns

Q5. Do you use the following ICT at your farm? Tick the ICT that you use. Also indicate when you started using each ICT

		Year
Computers		
Internet		
Fax		
Printers		
Photocopiers		
Landline telephones		
Mobile phone		
Two-way radios		
Personal digital assistant (PDA)		
Other hardware (specify)		

		Year
Computerized irrigation system		
Bar code system		
Email		
Precision agriculture system		
Global positioning systems (GPS)		
Tracking /tracing software		
Other software (specify)		

Q6. Do you have your own website? If yes, indicate it

[1] ☐ Yes

[2] ☐ No

Q7. Do you have any business goals with regard to ICT?

[1] ☐ Yes

[2] ☐ No

Q7.1 If yes, state them

[1].....

[2].....

[3].....

Q8. How do you purchase ICT for your farm use?

- [1] ☐ Personal decision
- [2] ☐ Expert advice
- [3] ☐ Extension service recommendations
- [4] ☐ Response to advertisements on TV/ radio & other media
- [5] ☐ Other e.g. combination of the above

Q9. Do you use the following ICT for personal or business purposes?

	[1]=Personal	[2]=Business	[3]=Both
Computers			
Internet			
Email			
Website			
Fax			
Printers			
Photocopiers			
Landline telephones			
Mobile phone			
Personal digital assistant (PDA)			
Two-way radios			
Television			
Radio			

Q10. How many hours do you spend using the following ICT per week?

Assign [1] = 0 - 3 hours, [2] = 4 -6 hours, [3] = 7+ hours

	Hours
Computer	
Printer	
Internet (worldwide web)	
Email	
Landline phone	
Mobile phone	
Other (specify)	

Q11. Which mobile operator do you use?

- [1] ☐ Vodacom
- [2] ☐ Cell C
- [3] ☐ MTN
- [4] ☐ Virgin mobile
- [5] ☐ Telkom mobile

Q12. How is your sim card classified?

- [1] ☐ Prepaid
- [2] ☐ Contract
- [3] ☐ Borrowed
- [4] ☐ Other (specify)

Q13. Which Computer-Mediated Communication (CMC) services do you use? Please tick

Internet	
Email with customers and suppliers	
Online banking	
E-commerce (transactions online)	

Q14. Which ICT do you use for the following functions?

- [1] Traceability of the produce to the consumer
- [2] Security & emergency management
- [3] Pre-cooling, storage and safety of produce.....
- [4] Other (specify).....

Q15. Select the ICT that you use for the following stages along the supply chain

Technology	[1]=Input procurement	[2]=Production	[3]=Packing	[4]=Marketing	[5]=Sales
Global positioning system					
Precision farming					
Bar codes					
Computer					
Mobile phone					
Internet					
E-commerce					
Fax					
Email					
Printer					
Landline phone					
Computerised irrigation system					

Q16. What are the advantages and disadvantages of using ICT in the following stages?

	Advantages	Disadvantages
Input procurement (e.g. orders)		
Production		
Packing		
Marketing & distribution		
Sales		
Other (specify)		

Q17. What purposes do you use the computer for?

- [1] ☐ Preparing farm budgets
- [2] ☐ Accounting
- [3] ☐ Keeping farm and payroll records
- [4] ☐ Tracking system
- [5] ☐ Irrigation scheduling and water budgeting
- [6] ☐ Other (specify)

Q18. Are your computers connected to the Internet?

[1] ☐ Yes

[2] ☐ No

Q19. Where do you access the Internet?

[1] ☐ Nearby Internet café

[2] ☐ Community telecentre

[3] ☐ In town

[4] ☐ At home

[5] ☐ Nowhere

Q20. What do you use the Internet mainly for?

[1] ☐ Accessing agricultural information

[2] ☐ Communication purposes

[3] ☐ Online transactions (e-commerce)

[4] ☐ Other (specify)

Q21. Do you advertise your products?

[1] ☐ Yes

[2] ☐ No

Q21.1 If yes, which ICT do you use?

[1] ☐ Website

[2] ☐ Television

[3] ☐ Posters, newspapers

[4] ☐ Radio

[5] ☐ Other (specify)

Q22. Indicate the ICT that you mainly use for the following duties?

	[1]=L/line phone	[2]=Mobile phone/PDA	[3]=Digital radio	[4]=E-commerce	[5]=Online banking	[6]=E-mail	[7]=Fax
Communication with customers							
Customer care							
Communication with input suppliers							
Supplier care							
Communication with marketing agent							
Communication with your bank							
Communication with other farmers							
Communication with your family							

Q23. Do you use ICT specifically for decision- making? If Yes, for which decisions

.....

.....

.....

Q24. What benefits have you gained from using ICT on your farm?

.....

.....

Q25. Which of the following ICT are convenient to use?

Cell phone	
Land line phone	
Computer	
Internet	
Email	
Fax	
Television	
Personal Digital Assistant (PDA)	
Radio	

Q26. Which ICT do you mainly use for weather report updates and forecasts?

.....

.....

Q27. From which sources do you get ICT related information?

Assign [1] = sources mostly used, [2] = sources sometimes used, [3] = sources least used/ not used at all

Source	Use
ICT suppliers/ vendors	
Internet	
Newspapers, magazines, journals	
Government departments	
Other (specify) _____	

Q28. Where do you sell the bulk of your produce?

Produce	[1]=Export	[2] =Local	[3]= Both

Q29. Are you in a contract with any marketing agent?

[1] ☐ Yes

[2] ☐ No

Q29.1 If yes, for how long have you been in that contract?

Marketing agent	Duration (years)

Section 3: ICT costs and constraints

Q30. On average how much do you spend on the following ICT services per month?

Assign [1] = <R3 000, [2] = R3 000- R6 000, [3] = R6 000 +

- [1] ☐ Landline phone/Internet
- [2] ☐ Fax
- [3] ☐ Printer
- [4] ☐ Mobile phone
- [5] ☐ Other (specify).....

Q13. What are the major problems that you encounter when using ICT, in general?

- [1] ☐ Language and content limitations
- [2] ☐ Poor network and reception
- [3] ☐ Time consuming
- [4] ☐ Expensive to use
- [5] ☐ Other (specify).....

Q32. What are the constraints that limit you from adopting ICT?

- [1] ☐ High cost of ICT
- [2] ☐ Poor ICT infrastructure
- [3] ☐ Lack of ICT awareness
- [4] ☐ Lack of ICT training
- [5] ☐ Other (specify)

Section 4: Employees and ICT

Q33. Do you communicate with your farm employees using ICT?

[1] ☐ Yes

[2] ☐ No

Q34. Do you provide formal training to your employees on how to use ICT at work?

[1] ☐ Yes

[2] ☐ No

Q34.1 If No, why?

Q35. If Yes in question 34, to which employees?

[1] ☐ Permanent employees

[2] ☐ Seasonal employees

[3] ☐ Administrative employees

[4] ☐ Other employees

Q36. Which source do you use to train your employees?

Assign [1] = sources mostly used, [2] = sources sometimes used, [3] = sources least used/ not used at all

Source	Use
Experts within the farm	
Internet	
Private sector specialists	
Government departments	
Other (specify)	

Section 5: Perceptions and attitudes

Q37. Which ICT do you intend to buy in the future? Rank in order of importance.

[1].....

[2].....

[3].....

Q38. Which new technology do you feel is needed to support and improve agriculture? Rank in order of importance

[1]

[2]

[3]

Q39. The benefits of ICT are greater than the costs

[1] Strongly agree

[2] Agree

[3] Neutral

[4] Disagree

[5] Strongly disagree

☐

Add any comments or motivation for your answer.

Q40. Adoption of ICT improves agricultural development

[1] Strongly agree

[2] Agree

[3] Neutral

[4] Disagree

[5] Strongly disagree

☐

Add any comments or motivation for your answer.

Q41. ICT facilitates the easy flow of and access to information

[1] Strongly agree

[2] Agree

[3] Neutral

[4] Disagree

[5] Strongly disagree

☐

Q42. ICT could enhance the profitability of farm enterprises

[1] ☐ Yes

[2] ☐ No

Q43. ICT can be used to form farming business partnerships

[1] Strongly agree

[2] Agree

[3] Neutral

[4] Disagree

[5] Strongly disagree

☐

Q44. Which ICT do you need as a farmer for the improvement of your work?

[1] ☐ Computers & computerized systems

[2] ☐ Landline & mobile phones

[3] ☐ Internet and emails

[4] ☐ Data projectors

[5] ☐ Other (specify).....

Q45. What agricultural information do you consider relevant to your needs? Tick the appropriate options

Market information	
Input and output prices	
Weather forecasts	
General agricultural news	
Latest agriculture practices and technologies	
Warning systems about diseases and pests	
Radio question and answer service	
Farm business and management	
Other (specify)	

Section 6: Demographics

Q46. What is your gender?

[1] Male

☐

[2] Female

Q47. What is your marital status?

[1] Married

☐

[2] Single

Q48. State your age

[1] 20 and below

[2] 21 - 40

☐

[3] 41 - 60

[4] 61 and above

Q49. What is your household size?

☐

Q50. How many years of experience do you have in fruit production on your farm?

☐

Q51. Please indicate your highest level of education

[1] Primary

[2] Matric

[3] College

[4] University

☐

Q52. Do you have any formal agricultural qualification?

[1] ☐ Yes

[2] ☐ No

Q52.1 If yes, indicate its category:

[1] ☐ Certificate

[2] ☐ Diploma

[3] ☐ Degree

Q53. Are you the owner of the farm or the manager?

[1] ☐ Farmer

[2] ☐ Manager

[3] ☐ Both

Q54. What is your average farm income per month?

[1] Less than R100 000

[2] R100 000 – R300 000

[3] R300 000 +

☐

Q55. What is your average personal salary per month?

[1] Less than R10 000

[2] R10 000 – R30 000

[3] R30 000 +

☐

Q56. Do you have any permanent off-farm income?

[1] ☐ Yes

[2] ☐ No

Q56.1 If yes in question 56, which of the following is the main source of off-farm income?

[1] ☐ Pension fund

[2] ☐ Remittances

[3] ☐ Government grants

[4] ☐ Investments

[5] ☐ Other (specify).....

Q61. What is your average off-farm income per month?

[1] Less than R50 000

[2] R50 000 – R100 000

☐

[3] R100 000 Any other comments

THANK YOU FOR YOUR COOPERATION. MAY GOD BLESS YOU!!!!

APPENDIX 2: SURVEY QUESTIONNAIRE FOR FARM EMPLOYEES



Survey questionnaire to be used for interviews with farm employees

A research survey investigating the use of ICT in agriculture

This survey's aim is to investigate and assess the use of ICT (for example, computers, global positioning systems, precision farming, tracking equipment, Internet, fax, printer, e-mail, websites, landline/mobile phones, e-commerce and other computerized agricultural systems) in agriculture. It will focus on the use of different forms of ICT, ICT access and factors influencing the use of ICT among emerging agricultural communities in the Western Cape on the West Coast.

The results of the study will portray how ICT is deployed for agricultural purposes. This will help us better to understand the ICT needs of emerging agricultural communities in South Africa. With the final output from the survey, a Master's mini-thesis will be developed and submitted at the end of the academic year 2016.

The questionnaire is expected to take approximately 15 to 20 minutes.

Informed consent

Participation of farm employees in this survey is completely voluntary. Participants are assured that all their information will be strictly confidential and anonymous. No references will be made to specific individuals. All the responses will be used for academic purposes only. Your honesty and cooperation is greatly appreciated.

Sponsor: Institute for Social Development (Centre for Food Security) at the University of the Western Cape

Hermanus Smidt Masters in Development Studies Research student Faculty of Economics and Management Sciences University of Western Cape maniesmidt@gmail.com / 8403164@myuwc.ac.za 083 445 4680 /	Dr Ina Conradie Supervisor Institute of Social development University of Western Cape
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Key definition

Information and Communication Technology (ICT) - A set of activities that consists of hardware, software, networks and media that facilitate or make it easy to collect, store, process, transmit, present and communicate information (voice, data, text, images) using electronic means. This includes computers, printers, telephones, fax, Internet, email, mobile phones, landline phones, e-commerce, etc.

Section 1: ICT access

Q1. Do you have access to a computer? (Tick as many options as possible)

- [1] ☐ Yes, at home
- [2] ☐ Yes, at work
- [3] ☐ Yes, at Internet café
- [4] ☐ Other (specify)
- [5] ☐ None

Q2. Do you have access to the Internet? (Tick as many options as possible)

- [1] ☐ Yes, at home
- [2] ☐ Yes, at work
- [3] ☐ Yes, at Internet café
- [4] ☐ Yes, at community centre
- [5] ☐ None

Q3. Do you have an email address?

- [1] ☐ Yes
- [2] ☐ No

Q4. How long do you take to travel to the nearby town using the following options?

	Minutes
Walking	
Taxi ride	
Driving	

Q5. Which of the following ICT do you have at home? Please tick the options

Cell phone	
Television	
Radio	
Two-way radio	
Landline phone	
Computer	
Personal Digital Assistant (PDA)	
E-mail	
Fax machine	
Printer	
Internet	

Q6. Which mobile operator do you use?

- [1] ☐ Vodacom
- [2] ☐ Cell C
- [3] ☐ MTN
- [4] ☐ Virgin mobile
- [5] ☐ Telkom Mobile
- [6] ☐ More than one

Q7. How is your sim card classified?

- [1] ☐ Prepaid
- [2] ☐ Contract
- [3] ☐ Borrowed
- [4] ☐ Other (specify)

Section 2: ICT awareness and use patterns

Q8. Do you use ICT on your farm to support farming activities?

[1] ☐ Yes

[2] ☐ No

Q9. Do you know how to use the following ICT and indicate where you were trained formally?

Please tick the appropriate options.

	Use	Training
Computers		
Internet		
Fax		
Printers		
Photocopiers		
Landline telephones		
Mobile phone		
Two-way radios		
Personal digital assistant(PDA)		
Other hardware (specify)		

	Use	Training
Computerized irrigation system		
Bar code system		
Email		
Precision agriculture system		
Global positioning systems (GPS)		
Tracking /tracing software		
Other software (specify)		

Q11. Do you know how to access Internet on your own?

[1] ☐ Yes

[2] ☐ No

Q12. Do you use the following ICT for personal or business purposes?

	[1]=Personal	[2]=Business	[3]=Both
Cell phone			
Television			
Radio			
Two-way radio			
Landline phone			
Computer			
Personal Digital Assistant (PDA)			
Email			
Fax machine			
Printer			
Internet			

Q13. Indicate the ICT that you have difficulty using? Tick the appropriate options

Computers	
Internet	
Fax	
Printers	
Photocopiers	
Landline telephones	
Mobile phone	
Two-way radios	
Personal digital assistant (PDA)	
Other hardware (specify)	

Computerized irrigation system	
Bar code system	
Email	
Precision agriculture system	
Global positioning systems (GPS)	
Tracking /tracing software	
Other software (specify)	

Q14. How many hours do you spend using the following ICT per week?

Assign [1] = 0 - 3 hours, [2] = 4 -6 hours, [3] = 7+ hours

	Hours
Computer	
Printer	
Internet (worldwide web)	
Email	
Landline phone	
Mobile phone	
Other(specify)	

Q15. What do you use the following ICT for? Please tick the appropriate option

	[1] = Input Ordering	[2]=Produc tion	[3]=Packing	[4]=Marketing	[5]=Sales
Computer					
Email					
Internet (worldwide web)					
Telephone					
Mobile phone					
Bar code system					
Computerized irrigation system					
Tracking software					
Global positioning system					
Two-way radio					
Fax					
Precision agriculture					

Q16. Which of the following ICT do you find easy to use?

Cell phone	
Land line phone	
Computer	
Internet	
Email	
Fax	
Television	
Personal Digital Assistant (PDA)	
Radio	

Q17. Indicate the ICT that you mainly use for the following duties?

	[1]=L/line phone	[2]=Mobile phone	[3]=Digital radio	[4]=E-commerce	[5]=Online banking	[6]=E-mail	[7]=Fax
Communication with the customers							
Customer care							
Communication with your employer							
Communication with your bank							
Communication when there is an emergency							
Communication with your family							
Communication with your relatives & friends							

Section 3: Perceptions and attitudes

Q18. ICT promotes access to banking

[1] Strongly agree

[2] Agree

[3] Neutral

[4] Disagree

[5] Strongly disagree

☐

Please add any comments or motivation for your answer.

Q19. ICT makes work easier

[1] Strongly agree

[2] Agree

[3] Neutral

[4] Disagree

[5] Strongly disagree

☐

Add any comments or motivation for your answer.

Q20. The use of ICT saves time

[1] Strongly agree

[2] Agree

[3] Neutral

[4] Disagree

[5] Strongly disagree

☐

Add any comments or motivation for your answer.

Q21. ICT is not affordable because of high costs

[1] ☐ Yes

[2] ☐ No

Q22. I am satisfied with the services offered by ICT

[1] ☐ Yes

[2] ☐ No

Q23. The use of ICT in agriculture leads to improved productivity

[1] Strongly agree

[2] Agree

[3] Neutral

[4] Disagree

[5] Strongly disagree

☐

Q24. Adoption of ICT is important for agricultural development

[1] Strongly agree

[2] Agree

[3] Neutral

[4] Disagree

[5] Strongly disagree

☐

Q25. ICT would be more effective if local language is used

[1] Strongly agree

[2] Agree

[3] Neutral

[4] Disagree

[5] Strongly disagree

☐

Q26. Does ICT help to increase your income?

[1] ☐ Yes

[2] ☐ No

Q27. Is it important to educate your children about ICT?

[1] ☐ Yes

[2] ☐ No

Q28. Which local language would you prefer being used in ICT related information?

[1] ☐ Afrikaans

[2] ☐ Xhosa

☐

[3] ☐ English

[4] ☐ Other (specify).....

Q29. What are the major problems that you face when using ICT in general?

[1] ☐ Language and content limitations

[2] ☐ Poor network and reception

[3] ☐ Time consuming

[4] ☐ Expensive to use

[5] ☐ Other (specify).....

Q30. What are the constraints that limit you from adopting ICT?

[1] ☐ High cost of ICT

[2] ☐ Poor ICT infrastructure

[3] ☐ Lack of ICT awareness

[4] ☐ Lack of ICT training

[5] ☐ Other (specify)

Q31. Which ICT do you need as farm employees for the improvement of your work?

[1] ☐ Computers & computerized systems

[2] ☐ Landline & mobile phones

[3] ☐ Internet and emails

[4] ☐ Data projectors

[5] ☐ Other (specify).....

Section 4: Demographics

Q32. What is your gender?

[1] Male

☐

[2] Female

Q33. State your age

[1] 30 and below

[2] 31 - 40

[3] 41 - 50

[4]. 51 and above

☐

Q34. What is your marital status?

[1] Married

[2] Single

☐

Q35. Indicate your race

[1] Black

[2] Coloured

[3] White

[4] Indian

[5] Other (specify)

☐

Q36. What is your current occupation on the farm?

[1] Seasonal employee

[2] Permanent employee

[3] Administrative employee

[4] None of the above

☐

Q37. For how many years have you been working on a farm?

☐

Q38. What is your average salary per month?

[1] Less than R4 000

☐

[2] R4 000 – R8 000

[3] R8 000 +

Q39. Do you have any permanent off-farm income?

[1] ☐ Yes

[2] ☐ No

Q40. If yes in question 39, which of the following is the main source of your off-farm income?

[1] ☐ Pension fund

[2] ☐ Remittances

[3] ☐ Government grants

[4] ☐ Investments

[5] ☐ Other (specify).....

Q41. What is your average off-farm income per month?

[1] Less than R2 000

[2] R2 000 – R4 000

☐

[3] R4 000 +

Q42. What is your highest level of education?

[1] Primary

[2] Matric

☐

[3] College

[4] University

Q43. What is your household size?

☐

THANK YOU FOR YOUR COOPERATION. MAY GOD BLESS YOU!!!!

APPENDIX 3: ETHICAL CLEARANCE LETTER FROM THE UNIVERSITY



OFFICE OF THE DIRECTOR: RESEARCH RESEARCH AND INNOVATION DIVISION

Private Bag X17, Bellville 7535
South Africa
T: +27 21 959 2988/2948
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E: research-ethics@uwc.ac.za
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10 August 2016

Mr H Smidt
Institute for Social Development
Faculty of Economic and Management Sciences

Ethics Reference Number: HS/16/4/8

Project Title: Use of ICT by emerging commercial farmers in the Western Cape, SA.

Approval Period: 10 June 2016 – 10 June 2017

I hereby certify that the Humanities and Social Science Research Ethics Committee of the University of the Western Cape approved the methodology and ethics of the above mentioned research project.

Any amendments, extension or other modifications to the protocol must be submitted to the Ethics Committee for approval. Please remember to submit a progress report in good time for annual renewal.

The Committee must be informed of any serious adverse event and/or termination of the study.

A handwritten signature in black ink, appearing to read 'Josias'.

*Ms Patricia Josias
Research Ethics Committee Officer
University of the Western Cape*

PROVISIONAL REC NUMBER - 130416-049

APPENDIX 4: INFORMATION SHEET FOR SURVEY QUESTIONNAIRE



INFORMATION SHEET (Questionnaire Edmerging Commercial Farmers and Employees in the Matzikama and Cederberg Municipalities in the West Coast District)

Project Title: The use of Information and Communication Technology by emerging commercial farmers in the Western Cape, SA.

What is this study about?

My name is Hermanus Jacobus Smidt, a student at the University of Western Cape in South Africa.

I am conducting a research to explore the use of Information and Communication Technology by emerging commercial farmers and their employees in the Western Cape, South Africa. It is believed that the results of this study will assist policy makers, development practitioners and other interested stakeholders with information that might improve the development of small-scale agriculture and food security. In view of this, I am inviting you to participate in this research project because you are an emerging farmer or a farm employee on the West Coast District and your ideas and opinions will be of great value to this study. Your participation and input will be highly appreciated.

What will I be asked to do if I agree to participate?

If you agree to participate in this research project, you will be asked to fill in a questionnaire aimed to evaluate the use of Information and Communication Technology (ICT) by emerging commercial farmers or the employee and the factors that either facilitate or impede the use of ICT. It will take about 30 minutes to 1 hour to fill in the questionnaire.

Would my participation in this study be kept confidential?

All your personal information, including your name will be kept confidential and will not be disclosed to anyone. Only pseudonyms will be used in the final report and in all published reports to protect your privacy. Your identity will be protected to the maximum extent possible. This research project involves making audiotapes and photographs of you. All information obtained from the interview will be treated with strict confidentiality and will be used for research purposes only. The questionnaires will be kept securely in a locked filing cabinet in my research room that will only be accessed by me. Furthermore, you and I will be asked to sign a consent form that binds me to keep to what we would have agreed upon.

What are the risks of this research?

There are no known risks associated with participating in this research project.

What are the benefits of this research?

This research is not designed to help you personally, but the results may help the researcher to learn more about the level of use of ICT by emerging commercial farmers or the employee and the factors that either facilitate or impede the use of ICT. It is hoped that this study will allow policy makers, development practitioners and various stake holders to have a deeper knowledge and understanding of the challenges facing the level of use of ICT by emerging commercial farmers or the employee that might impact the development of small-scale agriculture and food security, hence this study seeks to bring about informed and better ways of improving policies developing small-scale agriculture and food security.

Do I have to be in this research and may I stop participating at any time?

Your participation in this research is completely voluntary. You may choose not to take part at all. If you decide to participate in this research, you may stop participating at any time. If you decide not to participate in this study or if you stop participating at any time, you will not be penalized or lose any benefits to which you otherwise qualify.

Is any assistance available if I am negatively affected by participating in this study?

This research will not expose you to any harm as a result of your participation.

What if I have questions?

If you have any questions feel free to contact Hermanus Smidt, the researcher, at 14 Liner Close, Strandfontein, 7798, Cape Town South Africa. My phone number is +27834454680 and my e-mail address is maniesmidt@gmail.com

If you have any questions about the research study itself, please contact my supervisor Dr Ina Conradie OR Dr Stephen Devereux at The Institute for Social Development (ISD), University of Western Cape. Her telephone number is +2721 959 3845

Should you have any questions regarding this study and your rights as a research participant or if you wish to report any problems you have experienced related to the study, please contact:

Dr Sharon Penderis
Acting Head of Department: Institute for Social Development
Economic and Management Sciences Faculty
University of the Western Cape
Private Bag X17
Bellville 7535

This research has been approved by the University of the Western Cape's Senate Research Committee and Ethics Committee.

APPENDIX 5: CONSENT FORM INTERVIEWS



UNIVERSITY OF THE WESTERN CAPE
Private Bag X17, Bellville 7535, Cape Town, South Africa
Telephone : (021) 959 3858/6 Fax: (021) 959 3865
E-mail: pkippie@uwc.ac.za or spenderis@uwc.ac.za

Letter of consent:

CONSENT FORM FOR INTERVIEWS

I **Hermanus Smidt**, have had the opportunity to ask any questions related to this study, and received satisfactory answers to my questions, and any additional details I wanted.

I agree to take part in this research.

I understand that my participation in this study is voluntary. I am free not to participate and have the right to withdraw from the study at any time, without having to explain myself.

I am aware that this interview might result in research which may be published, but my name may be/ not be used (circle appropriate).

I understand that if I don't want my name to be used that this will be ensured by the researcher. I may also refuse to answer any questions that I don't want to answer.

Date:.....

Participant Name:.....

Participant Signature:.....

Interviewer name:.....

Interviewer Signature:.....

If you have any questions concerning this research, feel free to call :

(Hermanus Smidt, Ph: 083 445 4680) or my Supervisors (Dr Ina Conradie and Dr Stephen Devereux ph.+27 (0)21 959 3845).