`

A STRATEGY FOR SUSTAINABLE ICT DEVELOPMENT IN DEEP RURAL ENVIRONMENTS

Thesis

By

Tsietsi Jacob Medupe

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In accordance with Rule G5.6.3, I hereby declare that the above-mentioned treatise/ dissertation/ thesis is my own work and that it has not previously been submitted for assessment to another University or for another qualification.

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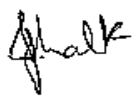

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Abstract

This study provides a strategy for sustainable Information and Communcation Technology (ICT) development in deep rural environments and describes a case study conducted within the community of the AmaJingqi traditional council. It investigates the sustainability of the ICT services within a rural environments, the income profile and affordability of different members of the community and the strategy formulation model.

The study's main focus is on creating a strategy to be used as a guideline for the successful development and implementation of sustainable ICT development in deep rural environments and on defining ICT Sustainability. Furthermore, the different ICT users are profiled based on affordability and access to services, and deep rural environments are also defined. Moreover, the study describes the complete composition of sustainable ICT.

It discusses design science research methodology and the reasons why the method is used is motivated and advanced. The study also outlines various research paradigms and philosophies and a number of research strategies are also discussed.

The literature review focuses on various policies and frameworks which have been formulated to advance the universal access of ICT services by rural communities. It also outlines some of the ICT initiatives which have failed and the reasons for the failures and what will be corrected for similar mistakes not to be repeated.

The study discusses the concepts of a strategy framework that outlines the theoretical foundation of the strategy formulation model, strategy implementation and control. It also discusses the diagnostics and outlines the various strategy guiding polices.

The strategy is validated, expert reviews are solicited and the strategy is revised and finalised.

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Abbreviations

ADSL	Asymmetrical Digital Subscriber Line
CIS	Critical Infrastructure Sites
CSIR	Council for Scientific and Industrial Research
DBE	Department of Basic Education
DED	Department of Economic Development
DOC	Department of Communications
DOI	Digital Opportunity Initiatives
DSD	Department of Social Development
DSR	Design Science Research
DRDLR	Department of Rural Development and Land Reform
DTPS	Department of Telecommunications and Postal Services
DTT	Digital Terrestrial Television
DTV	Digital TV
EFT	Electronic Fund Transfer
ICASA	Independent Communication Authority of South Africa
ICT	Information and Communication Technology
IMT	International Mobile Telecommunications
INeSI	Ikamva National e-Skills Institute
IRU	Indefeasible Rights of Use
IS	Information Systems
ISP	Internet Service Provider
ITA	Invitation To Apply
GDP	Gross Domestic Products
IRMA	Information Resources Management Association
ITU	International Telecommunication Union
LTE	Long-term Evolution
LED	Local Economic Development
MDGs	Millennium Development Goals
MTN	Mobile Telephone Network
MTR	Mobile Termination Rate
MVNO	Mobile Virtual Network Operator

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NDP	National Development Plan
NEMISA	National Electronic Media of South Africa
NYDA	National Youth Development Agency
NGP	New Growth Path
NPC	National Planning Commission
NMU	Nelson Mandela University
OECD	Organisation for Economic Co-operation and Development
PESTEL	Political, Economic, Social, Technological, Environmental and Legal
PICC	Presidential Infrastructure Coordinate Commission
POP	Point Of Presence
PPP	Private-Public Partnership
R&D	Research and Development
ROI	Return on Investment
SADC	Southern African Development Community
SAPO	South African Postal Services
SDG	Sustainable Development Goals
SMME	Small, Medium and Micro Enterprises
SIP	Strategic Infrastructure Project
SWOT	Strengths, Weaknesses, Opportunities and Threats
TVWS	Television White Space
UHF	Ultra High Frequency
USA	United States of America
USAASA	Universal Service and Access Agency of South Africa
USF	Universal Service Funds
USOF	Universal Service Obligation Funds
VHF	Very High Frequency
WSIS	World Summit on the Information Society
21CLD	21st Century Learning Design

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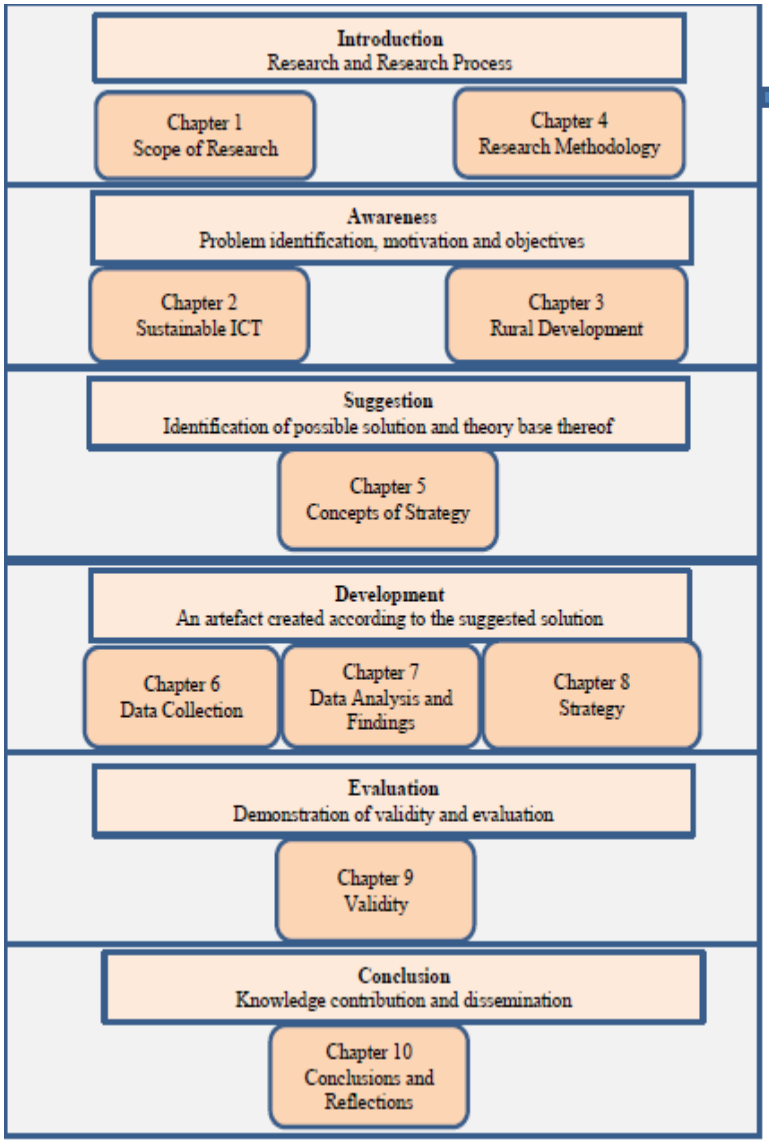
CHAPTER 1: BACKGROUND AND INTRODUCTION



Chapter 1 Background and Introduction

1.1 Introduction
- 1.1.1 The necessity for Sustainable ICT
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1.1 Introduction

The challenges to equitable Information and Communication Technology (ICT) access is mainly due to:

- a lack of appropriate infrastructure,
- inadequate policy and regulation within the country,
- lack of affordability due to low level of incomes,
- high levels of e-learning illiteracy, and
- insufficient relevant content.

The efforts which are needed to overcome these challenges are quite considerable and will require a lot of commitment. A large-scale implementation of ICT infrastructure is required, enabling policies and regulations for the availability and affordability of services, broad ICT literacy programs, and efforts for relevant and appropriate content (Mathison, 2005).

It needs to be stated that ICT initiatives which were suitable and earmarked for eradicating poverty more often than not utilised examples that depend on the provision of access to the latest technology. They also depend on improved skills, and better ICT technology with the expectation that ICT will mainly stimulate economic development and output efficiency.

Therefore, it is important to point out that the latest technologies create new conditions and opportunities for human development. The way in which communities in certain societies do not improve or change until technology is integrated into development projects and is widely used to enhance the social order. The role of ICT must be clearly defined and established for the relevant audience (Kwaku Kyem, 2010).

It is, thus, important that a study about the strategy for sustainable ICT development in deep rural environments is conducted within the community of the AmaJingqi traditional council using a case study approach. The study investigated the sustainability of the ICT services within the environments, the income profile and affordability of different members of the community and a sustainable invention through strategy formulation. This chapter provides the background for the study and briefly outlines the problem statement with a set of objectives which need to be achieved at the end of the study. The next section gives a background to the scope of the research.

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Chapman and Slaymaker (2002) explained that to determine the part played by ICT developmental aspects, the components of information sharing must at first be evaluated in the local relevance where the rural community gets involved. Therefore, this requires inclusive cooperation in planning ICT interventions to build up the most suitable content and interface and the organisation in charge of the operation of the underlying network infrastructure. This will guarantee feasible and sustainable ICT development in deep rural environments.

However, there were a number of challenges such as the escalated cost of the deployment of the ICT intervention that the Government experienced when rolling out the ICT Infrastructures. Labelle (2005) proposed that a funding model to match the funding of universal access has to be discussed and negotiated with the regulators and the government departments in charge of the implementation of the ICT infrastructure. The current model established by the Department of Telecommunications and Postal Services (DTPS) is the Universal Service Funds (USF) which seemed to be not working due to lack of planning and capacity of various entities under the Department (ECA, 2005).

To maximise the total implementation of ICT, it is important to face the challenges of the urban and rural poor. It is critical to mention that the deep rural communities comprise of scores of individuals with a significant low income This requires an analysis of the affordability of services for vulnerable and poorer societies (OECD, 2011). Lack of affordable services has proven to be another hindrance to the adoption of ICT services.

There are low population densities with relatively low-income streams which pose some serious economic outputs as the return on investments is not guaranteed. Von Braun (2010) states that models in different countries reveal that the ICT infrastructure has a non-linear effect on economic development with lower and higher average incomes. These results require the ICT infrastructure to reach a critical mass with a noticeable impact on the economic product. In particular, the effects of growth are more pronounced in areas where ICT represents between 5 and 15%.

Kwaku Kyem (2010) mentioned that the delay of benefits from ICT usage is because the rural communities have not had prolonged use of technology to enable them to become familiar with its use in general. For this reason there is a need to create the behaviours which align with the sustained adoption of technology before the end users can benefit from its deployment. Equally, digital illiteracy proves to be one of the challenges that inhibit the use of ICT adoption in deep rural environments. Labelle (2005) also established that the absence of human resources with the technical and managerial

expertise for the uptake and use of ICT is a severe constraint which hinders the ICT roll-out in the rural communities. There is a similar pattern in the rest of the world where the industrialised countries do not have enough trained ICT experts and specialists.

It is equally important to highlight that policy directives have been pivotal to successful ICT interventions throughout the world. Thus, the lack of sound ICT policies has proven to be a major challenge in ensuring that there are successful ICT interventions in most of the rural communities in South Africa. One of the major policy bottlenecks is the frequency spectrum management policy that will enable the awarding of the digital dividend spectrum for the roll-out of affordable ICT services.

The frequency spectrum management could also allow Television White Spaces (TVWS) to be utilised to link the number of people who are currently without affordable access to the ICT services. This would enable a facilitation of a market in machine-to-machine interaction and promote strong networks during natural and man-made disasters (Thanki, 2012). Spectrum policy is yet to be formulated and passed concerning the use of the TVWS in South Africa.

The affordable expansion of ICT services is fully dependant on the acquisition of additional spectrum below 1 GHz, which in practice means the harmonisation 790 – 862 MHz band. The relatively low level of availability of fixed information and communication technologies, the lack of broadband access and the government's commitment to rural wireless broadband access in the ICT strategy will contribute to the liberalisation of the harmonisation of the digital dividend (AEGIS, 2009). The study and the policy on the use of the digital dividend spectrum are yet to be completed in South Africa.

1.1.1 The Necessity of the Strategy for Sustainable ICT

Some aspects needed to be considered from a strategic planning standpoint. One of these is the prominence of keeping a rural development perspective and concentrating on attaining benefits for rural people using ICT appropriately. The Millennium Development Goals (MDGs) captured the primary goals and outcomes needed from a development point of view. Thus, ICT visions, agenda and plans need to consider MDGs (Labelle, 2005). ICT strategies and all its concerted efforts, which incorporate and include e-learning and e-readiness, can lead to novel, working and important interventions. In the poorest communities, it is important to make sure that the ICT strategy takes into account measures to eradicate poverty and other developmental initiatives (Labelle, 2005). This will make sure that whatever intervention is executed will then be relevant to the needs of the targeted end users.

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Labelle (2005) pointed out that the visualisation and creation of information and communication technology strategies are crucial for strategic thinking around ICT in terms of human development. It is equally important to observe how improved information access can develop people's lives, promote the government's financial position and streamline processes.

The ICT strategy will:

- Make sure that the requirements of the people who are to benefit from the initiatives are understood;
- Make sure that the market assessment and environmental scanning are undertaken to understand the circumstances of the affected users;
- Focus on Capacity Building for ease of adoption;
- Identify and highlight the development priorities and challenges facing the country;
- Explore the integrated approach to ICT development and deployment;
- Address the lack of technical and managerial skills to use and apply ICT services; and
- Be in line with the country’s poverty reduction plans such as the National Development plan (NDP) blueprint.

1.1.2 The Benefits of Sustainable ICT

The rapid improvement, which the country has widely experienced within the sector, has not improved expectations for economic growth and financial gains for the rural communities. In addition, the advent of technology has set in motion a sense of innovation and economic development, which is subject to control and technical capacity, but this has had no impact on the rural poor whose situation remains the same (Kwaku Kyem, 2010).

It is equally important to note that the ICT projects aimed at eradicating poverty have often used models based on the availability of new technologies, new skills and better ICT infrastructures. They expect that ICT will mainly promote economic growth.

Kah and Kah (2008) also stated that technology can help improve efficiency and effectiveness of public sector entities by developing an enabling environments for the rural community to improve its competitiveness. Enhanced frameworks of ICT have a double function. The first is to provide the information needed by the poor to seek feasible livelihood methodologies, and the second is to give

information required by establishments in charge of settling on choices that influence those vital livelihood choices.

According to Von Braun (2010), furthermore, studies have shown that ICT intervention has benefits such as:

- increased economic development,
- more employment opportunities,
- reduced relocations from rural to urban migration,
- improved farming activities and industrial manufacturing,
- increased services,
- easier diffusion of technological innovations, and
- better public administration.

Kumara and Kumar (2017) highlighted that the beneficial use of ICT lies with the improvement in market efficiency and that using it will increase rural development by addressing the lack of information and knowledge gaps. Moreover, equally making information available and improving the decision making ability for the rural poor communities. This will, in particular, assist in increased openness, responsible reporting, financial transparency and the administrative efficiency of the rural entities of governance. It will also promote the participation of the rural poor in decision-making processes and ensure increased efficiency and quick response around rural service delivery.

1.2 Problem Description

1.2.1 Overview

One of the significant challenges in crafting an ICT strategy for successful interventions has been to develop laws and policies that deal with the barriers to ICT access and development. These barriers apply specifically to those with limited experience of ICT use, limited digital literacy and interest in the use of ICT. This presents a need for the government to develop a number of new programmes and interventions to complement the economic benefits and measures for infrastructure roll-out (OECD, 2011).

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Much literature has established that most of the implemented ICT initiatives are not sustainable due to the lack of ICT Strategy. The ICT Strategy for sustainable ICT interventions will make sure that the following challenges are covered and addressed adequately:

- An absence of policies which favour the poor and relevant regulatory framework;
- The widely sparse population as a significant challenge for optimum network coverage;
- Uneven landscape which will make installations expensive;
- Low investment initiatives due to the perceived small return on investment;
- Reliable supporting infrastructure such as electricity;
- Lack of technical expertise and managerial skills;
- Rampant and undesirable levels of computer illiteracy; and
- Absence of innovation, which results in minimal local content.

1.2.2 Problem Statement

Much literature has established that most of the recently implemented ICT initiatives are not successful due to the lack of a strategy for sustainable planned and implemented interventions. Based on the findings in the literature and observations, the problem statement of this research can be formulated as:

There is a lack of Strategy for Sustainable ICT Development in Deep Rural Environments

1.3 Research Questions and Objectives

1.3.1 Research Questions

The main question to be addressed by this research as we achieve our objective is:

What is the Strategy that will ensure Sustainable ICT Development in Deep Rural Environments?

1.3.2 Research Objectives

Primary Objectives

This research aims to develop a strategy that will ensure deployment of sustainable ICT development in deep rural environments.

Specific Objectives

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- To define a strategy that will result into the implementation of sustainable ICT development in deep rural environments;
- To clearly define the ICT sustainability;
- To profile different users and outline the definition of deep rural environments; and
- To describe the complete composition of the sustainable ICT Intervention.

1.3.3 Research Case Study

The case study will be the research strategy to be followed. The Stakeholders in the case study will be:

- Community members;
- Small, Medium and Micro Enterprises (SMMEs);
- Members of governing structures such as:
  - Traditional councils
  - Ward councillors
- Local Economic Development representatives (LED managers); and
- Provincial Government representatives.

1.4 The Relevance of the Research

The fact is that most of the developing countries are yet to explore the full benefits of access to ICT services despite the clear advantages in the utilisation of ICT in addressing the developmental issues. Some of the efforts to correct this fell short after the government initiated and implemented some ICT interventions in the deep rural communities. One of the causes of some of the intervention failures, such as the rural Telecentre model, was implementation without fully involving the local realities in the context. Lack of strategy for sustainable ICT has been one of the causes of the failures of interventions in deep rural communities. This is the relevant problem addressed by this research.

1.5 Scope Delineation

The focus of the study will be on creating a strategy that will be used as a guideline for the successful development and implementation of sustainable ICT development in deep rural environments. The strategy defined will result into the implementation of sustainable ICT for these environments. Different

users are profiled, and a definition of deep rural environments is outlined. Finally, the study describes the complete composition of sustainable ICT.

1.6 Ethical Considerations

Ethical considerations are required to make sure that the study conducted – collection of data, publication of findings, etc. – does not in any way harm the participants, animals or the environments. They also make sure that all work done is transparent and that participation was conducted truthfully and voluntarily by making the findings accessible (Hofstee, 2006).

The research provided in this thesis complies with the ethics policy of the Nelson Mandela University (NMU). The study includes extensive investigations through literature reviews and analysis, as well as interviews with various experts in the field of ICT.

Ethical consent is assured as the respondents were given an overview of the objectives of the study, and then made an informed choice to voluntarily participate in the interview sessions. The user's anonymity is secured; as the responses and the consent forms are stored separately from each other; and there is no link between the interview sheet and the consent form. No personal information was gathered; and thus, the privacy of the interviewees was not violated. The study does not involve any research on humans**,** animals or the environments.

It is important to note that a memorandum of understanding to enforce collaboration between the AmaJingqi and the NMU has been signed. This resulted into the team full access to the community to conduct the research.

1.7 Thesis Structure

The study is constituted of a number of chapters as outlined and mapped in Figure 1.1.
Chapter 1: Introduction –covers the motivation and relevance of the study.
Chapter 2: Sustainable ICT - deals with some of the elements of the strategy for sustainable ICT.
Chapter 3: Rural development and connectivity **-** seeks to explore these policies and establish their successes and failures. The chapter will also highlight areas of improvement arising from the shortcomings of the previous strategies.
Chapter 4: Research methodology - the researcher's philosophy and methods are outlined here. The data-collection process is also outlined; and a motivation is provided for using design science and its suitability for this study.

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Chapter 5: Concepts for strategy framework design - seeks to fulfil the core objective of this research, which is to devise an ICT strategy for the development of the deep rural environments.

Chapter 6: Data collection - outlines the data collection and the methods used to do so.

Chapter 7: Data analysis and findings - analyses the findings from the literature studies and the data gathered.

Chapter 8: Strategy - outlines the strategy based on the information gathered from the literature study and the findings of the gathered and analysed data.

Chapter 9: Validation of the strategy - evaluates the proposed strategy model and confirms whether the proposed strategy model presents a reasonable theory to experts in related disciplines.

Chapter 10: Overall research conclusion - offers a summative conclusion of the research work.

The chapters are clearly mapped out in Figure 1.1:

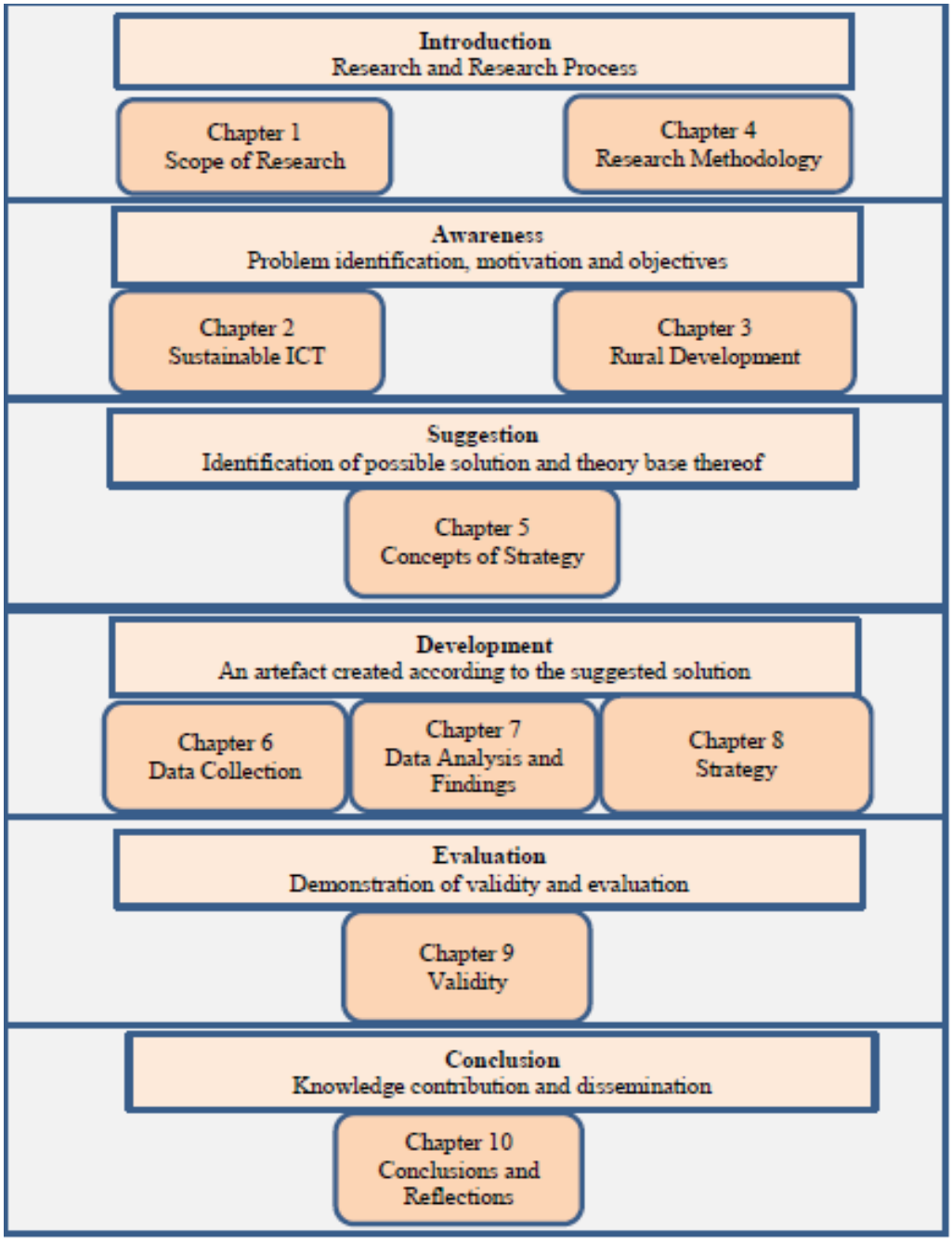

Figure 1.1: Thesis Structure (Source: Researcher's Design)

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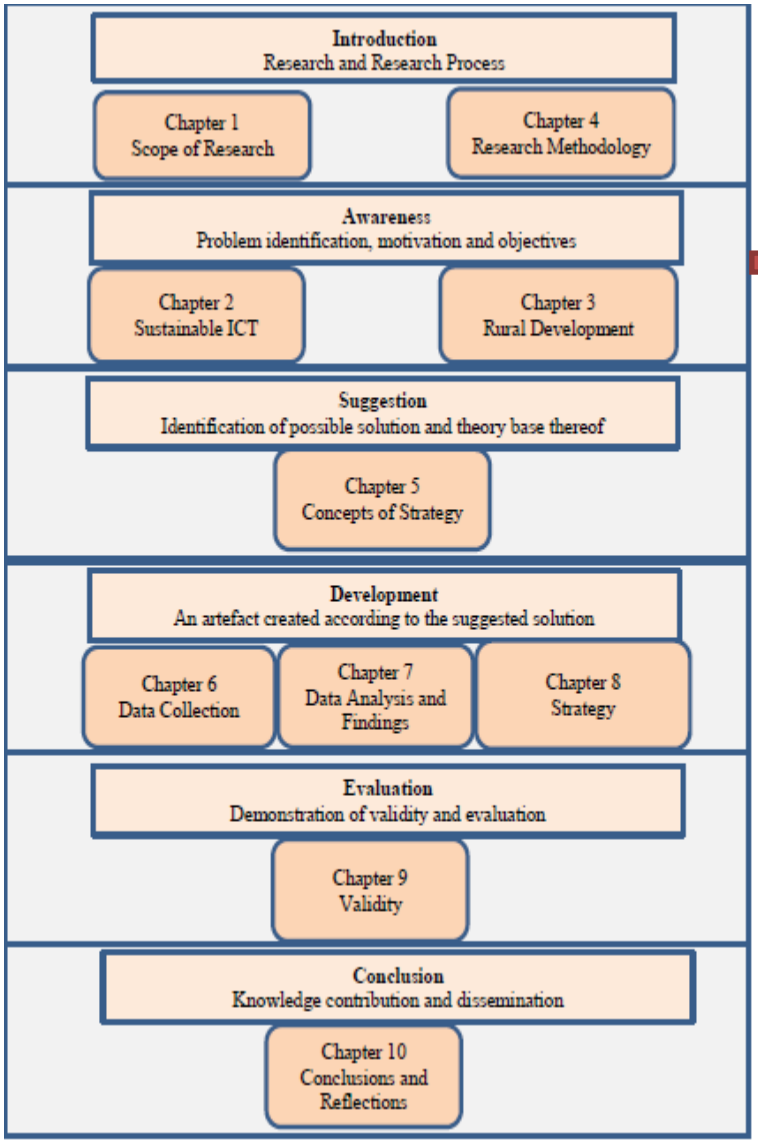
CHAPTER 2: SUSTAINABLE ICT



Chapter 2 Sustainable ICT

2.1 Introduction
2.2 Overview
2.3 Elements of sustainable ICT
2.3.1 Spectrum management
2.3.2 Technology and Service Neutrality
2.3.3 Market communication and cost to communicate
2.3.4 Backbone network and sustainable ICT
2.3.5 Supply-Demand-side ICT services
2.3.6 Change management and uptake of ICT
2.3.7 Gender digital divide
2.3.8 Television white space technology
2.3.9 Funding mechanisms
2.4 Conclusion
2.5 Summary

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2.1 Introduction

This chapter deals with the literature review, which started with background information on the various government policies within the sector. Section 2.2 gives an overview of the sector. Section 2.3 outlines what constitutes a strategy for sustainable ICT. Section 2.3.1 addresses the spectrum management and highlights the current allocation of the available spectrum. The chapter discusses technology and service neutrality as one of the concepts which will ensure sustainable ICT and this is covered in Section 2.3.2. Section 2.3.3 looks into the impact of market competition and the cost of communication is also highlighted. The chapter explores the importance of the backbone network to ascertain an effective strategy for sustainable ICT and this is outlined in Section 2.3.4. The chapter looks into the supply and demand of the ICT services and this is covered in Section 2.3.5. In Section 2.3.6, change management and the ICT service uptake is also explored to ascertain that the ICT services benefit the rural community. The literature review explores the issue of gender balance within the sector to result into a strategy for sustainable ICT and this is covered in Section 2.3.7. Finally, the Television White Space (TVWS) is also explored in Section 2.3.8 as one of the technologies to be used to roll-out cost-effective rural ICT services.

The main purpose of the chapter is to address the research objectives and the elements needed to implement sustainable ICT development in deep rural environments.

2.2 Overview

The e-Skill Institute (e-SI, 2012) recognised the ICT's lack of ability to address the issues of inequality, lack of jobs and dire poverty. According to e-SI (2012), the experience of the last decade indicates that regular emphasis on technological advances, reductionist research and a view of ICT as a simple tool has put South Africa on a downward trajectory of "e-readiness". The critical issues of inequality, lack of employment, and poverty are calling for a new national approach beyond the current processes. For the same reason, the Government has undertaken various interventions although most, unfortunately, have not brought much improvement to the livelihood of the rural poor.

e-SI (2012) emphasised that the country must explore the ICT in ways that leverage the country's culture, independence, social identity, socioeconomic development, innovative thinking, job creation, world competitiveness and position in the continent. For this purpose, the sensible approach to the social leverage of the ICT for local benefit has to include the deep rural communities to address its needs.

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For the same reason, the South African Government adopted the NDP with its main objectives to address poverty and eliminate inequality by 2030 through a number of interventions including using and leveraging ICT. The National Planning Commission (2012) outlines the fact that the country's ICT infrastructure is way below standards in comparison with the some of the best international best practices. The National Planning Commission (2012) further highlighted that the effective ICT infrastructure which propels the economic development requires a stronger ICT network at cost-effective prices. It has to be noted that the financial and job creation benefits are far better than the cost.

The National Planning Commission (2012) clearly indicated that going forward the Government's main role within the ICT sector is to promote competition to encourage private investment with the intention to establish an effective regulatory framework where there has been a market failure. In its National ICT policy Green Paper, the DoC (2013b) emphasised a need for effective ICT policies to make sure that the most needed and limited State resources are channeled away from the well resourced urban areas to the neediest rural communities. This would help improve and stimulate the economic and financial sustainability of the country, assist in creating much-needed jobs, and get rid of systematic poverty in rural communities (Sutherland, 2014).

One of the Government's priorities is to create sustainable employment and, as a result, it formulated the New Growth Path (NGP) which serves as a mechanism for economic development and is a major driver for the much-needed job creation strategy. The target of the NGP, which is managed by the Department of Economic Development (DED, 2009), was to create a hundred thousand (100 000) jobs by 2020 in the development sectors such as ICT, institutions of higher learning, healthcare, mining industry, pharmaceuticals and biotechnology.

The New Growth Path identified three strategies for the ICT sector, namely:

- Effective programs and systems to easily allow the SMMEs access to new technologies;
- Improved support for research and development, assurance that the end product coming out of tertiary institutions is linked to growth potential, which can be achieved by developing the country as the higher education hub for the continent; and
- The cost of communication to be continually brought down for greater affordability of ICT services.

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The Government has developed an ICT strategy for the rural communities with empowerment and inclusive awareness programs to promote the usage and uptake of the ICT services using the implemented infrastructure. Thus, the involvement of the rural communities is very critical as this will guarantee that the right ICT solutions are designed and implemented for ease of adoption and use. This will result in sustainable job creation and the eradication of poverty within the rural communities (DoC, 2011).

Moreover, Provincial Governments will also be required to assist in raising the necessary funding for ICT interventions through their Provincial Growth and Development Strategies. This will also be achieved by encouraging partnerships in the implementation of the national strategies earmarked for the development of the rural communities. However, experience has shown that most of the plans that have been put together by the provincial government remain uncoordinated and, in the process, resources are duplicated and lots of money goes to waste. The Government will have to come up with and streamline existing polices and provide leadership to ascertain a coordinated and structured approach to the implementation of the ICT projects (DoC, 2011).

The DoC (2011) further indicated that municipalities, which provide basic services directly to community members, are an important tier of government. The department responsible for the local governments could therefore play a critical role in the strategies of coordinating local governments for the implementation of ICT networks. Intergovernmental relations will also be one of the mechanisms utilised as the institutional arrangements for coordinating the implementation of some of the major ICT projects.

The DED (2009) highlighted that the most remote areas of South Africa, with the highest rate of unemployment and the most negatively affected workforce, are from what is called the homelands and farming areas. The definition of the rural areas is those areas previously classified as impoverished, not necessarily viable as an economic zone, and with its labour reserved for the urban economic activities. DED (2009) further highlights that the farming value chain offered opportunities in these areas for job creation only through small-scale farming and the sale of farm products. Enriching livelihoods in the rural communities can, thus, be achieved by improving rural communities working conditions and assisting the rural households to increase production. This is clearly an indication of ICT gaps that will need to be adequately addressed with sustainable ICT interventions implemented.

The National Planning Commission (2012) highlighted that the country has lost its position as the continental leader in the provision of ICT connectivity. This is mainly because the cost of services and infrastructure remains a major obstacle to the expanded usage of the mobile services and fixed networks. This has a greater limit on the network competition and further exacerbation of the cost. The NDP mentions that policy imperatives, shortcomings in institutional arrangements, clashing policies between various departments, regulatory inefficiencies, and restricted competition all add to this problem.

The National Planning Commission (2012) also states that the capability of the regulator, the Independent Communication Authority of South Africa (ICASA), to enforce a more competitive market has been negatively affected by legal battles, constraints on human capacity, and skills. There is, therefore, a need for a multifaceted approach to make sure that a sustainable ICT strategy is adopted and implemented to develop the rural communities.

The Government has developed some strategies and policies highlighting the importance of the development of ICT services to the rural communities. However, a lot still needs to be done to guarantee that these policies get implemented efficiently and benefit the targeted communities. The diagnosis of some of the reasons for the failure of these strategies will have to be undertaken, and a proper analysis of the solutions will have to be recommended.

2.3 Elements of Sustainable ICT

It is important that the approach to information sharing is assessed within the local context as this will assist in establishing the appropriate role of sustainable ICT in supporting and building the capacity of the indigenous knowledge systems. This approach needs extensive involvement during the design of the ICT intervention solution to address and fit the needs of the end users. In the absence of an initial investigation of how the information is utilised locally, it is very unlikely that the ICT will serve the purpose it was earmarked for and in the process be unable to benefit the needs of those it was intended for (Tobgye, 2018). The emphasis has to be on the end users more than the dumping of solutions and technologies.

Richardson and Paisley (1998) have noted that what was clearly apparent from the literature and many other articles around the development of the rural communities, through the adoption of ICT, is the overwhelming need to concentrate on the rural people and not necessarily the technology. This has to be more about what the ICT can do to empower the rural people. Richardson and Paisley (1998) also

pointed out that this applies to the roll-out and utilisation of technology at both national and local levels within the rural communities with large or small numbers of people.

The idea of adopting this approach meant that all affected and important decision-makers are those with influence within the rural communities and who use the services with a clear understanding of the context in which they use it. Richardson and Paisley (1998) again emphasised that this means that communities will be facilitated to define their rural communication, information and training needs and in the process ascertain that sustainable and suitable ICT technologies are implemented and used effectively by the less privileged. People are therefore pivotal and need to be considered when determining the type of suitable ICT technologies.

Richardson and Paisley (1998) also stated that a clear understanding of the context in which ICT will be introduced in relation to the rural people's attitudes to ICT and its products is of serious importance. Once the needs have been determined, it is necessary to make sure that there is strong community involvement which will:

- Grant full backing to the introduction of the technology;
- Understand how the technology can benefit the rural communities;
- Appreciate those who interact with the technology on a daily basis; and
- Appreciate the value that the products and generate and create environments in which people are happy to use such products.

To achieve this, an efficient strategy for sustainable ICT needs to be developed. The Broadband Commission (2012) has pointed out that one of the factors for an effective strategy is the “marrying of strategy objectives to some of the national and international goals such as the Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs). Today, there is increasing evidence that ICT has a global impact on people's lives and accelerates the achievement of the MDGs and SDGs.

The other factor highlighted by the Broadband Commission (2012) was the need for legal and institutional frameworks to maximise the impact and use of sustainable ICT interventions. One of those Institutional frameworks is the government which can help bring down the capital investment in the focusing on underserved regions by assisting with the roll-out of supporting passive infrastructure such as the roads, electricity and the fibre ducts. Then again, it can give grants to subsidise capital ventures or to decrease the expenses of acquiring rights of way and ease of access to the much-needed frequency

spectrum. Thus, the progressive regulatory framework will also be very key in ensuring a successful strategy for sustainable ICT. There are also policy tools that can be explored to guarantee sustainable ICT.

The Broadband Commission (2012) has outlined some of the policy tools that can guarantee sustainable ICT for rural development:

- ***Bundled Demand***: An ideal approach to prompt private interest in the ICT foundation is to "bundle the demand". The legislation does not have to mediate artificially in the market, and the Government can go about as an “anchor tenant” to guarantee incomes amid the increase period of ICT roll-out. Local governments can proactively facilitate interest for ICT access from public organisations, public safety, neighbourhood schools, and medical services offices to constitute an "anchor tenant". Once the demand "consortium" is organised, the legislature will then need a discount rate and long haul contract with ICT service providers to generate a stream of income that facilitates the underlying financial weight and lessens risks.
- ***Subscriber Subsidies***: Subscriber endowments ought to be utilised sparingly on account of their contortion potential. Sponsorship focused at financially challenged supporters is one of the fitting uses of this approach. This type of assistance is intended for social consideration issues that face governments which are trying to guarantee universal access. Financial incentive measures are likewise a helpful type of sponsorship: reduced tax incentives for small and medium enterprises have been found to invigorate ICT appropriation in businesses that substantially contribute to the economic benefit.
- ***Infrastructure Sharing***: to decrease backhaul costs, network sharing must be permitted and promoted. Network sharing eases cost burdens for contending suppliers. In instances where the ICT administration suppliers are not economical, sharing may create ICT access to "utility" platforms. This enables operators to explore economies of scale and diminish financial risk, which is equivalent to bringing down expenses. There are a few different approaches to slice expenses for organised suppliers in a given region. National Regulators may also lessen the right of way or access costs to critical infrastructures.
- ***Government as a risk-taker***: In the final resort, if private venture does not stream in after reasonable motivators are given, governments can go as a risk-taker without any intention to play a competitor and stifle competition. One possibility is to finance the passive equipment and overhaul ICT access to the "utility" platforms. In Greenfield circumstances, governments can

contract for the development of an open access network. This may initiate an exceptional competition for government contracts and lower the underlying expenses of the operation.

The other factor that needs to be considered is intergovernmental coordination to make sure that all public resources are mobilised and consolidated for practical use.

The strengthening of the area of Research and Development (R&D) is another aspect that will guarantee sustainable ICT. Shadrach and Sharma (2013) have indicated that is important to promote R&D within the local rural communities to stimulate innovative ideas and contributions to guarantee sustainable ICT. They also mention that in earlier years two types of transformation had been witnessed due to the passive use of ICT tools at the grassroots level.

The first type of transformation is the plan of continuous transformation phenomena which got the attention of the global institutions which began to see ICT as a means for economic and social benefits since the mid-1990s. The second is the thinking of disruptive transformation that regards ICT as a tool to include the rural communities which are not that easily reachable and which include the rural poor. The demand stimulation by encouraging R&D is, therefore, essential to guarantee the uptake of ICT services. This will ensure a seamless integration of ICT into the rural communities making sure that the end users get developed and their livelihood improved.

Stratigea (2011) equally proposed that it is progressively critical to comprehend the local context into which information is to be made accessible and utilised when incorporating ICT into cross-sectoral deep rural communities. In spite of the fact that a radio play can conceivably accomplish the most ideal effect, it is critical that local institutions and existing frameworks create methods for enhancing information trade utilising ICT in a participatory way.

Chapman and Slaymaker (2002) further highlight that an excellent way of learning is to stimulate the demand for information from the local communities through training and capacity building. According to them, technical training may be necessary to make use of ICT through experiential learning in existing local organisations such as schools and community radio channels. This will assist local communities to build on what the technology should be used for and generate demand in the process. Locally applicable information, as highlighted, is destined to empower the need for information services that are necessary for ICT to be utilised to its maximum capacity.

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2.3.1 Spectrum Management

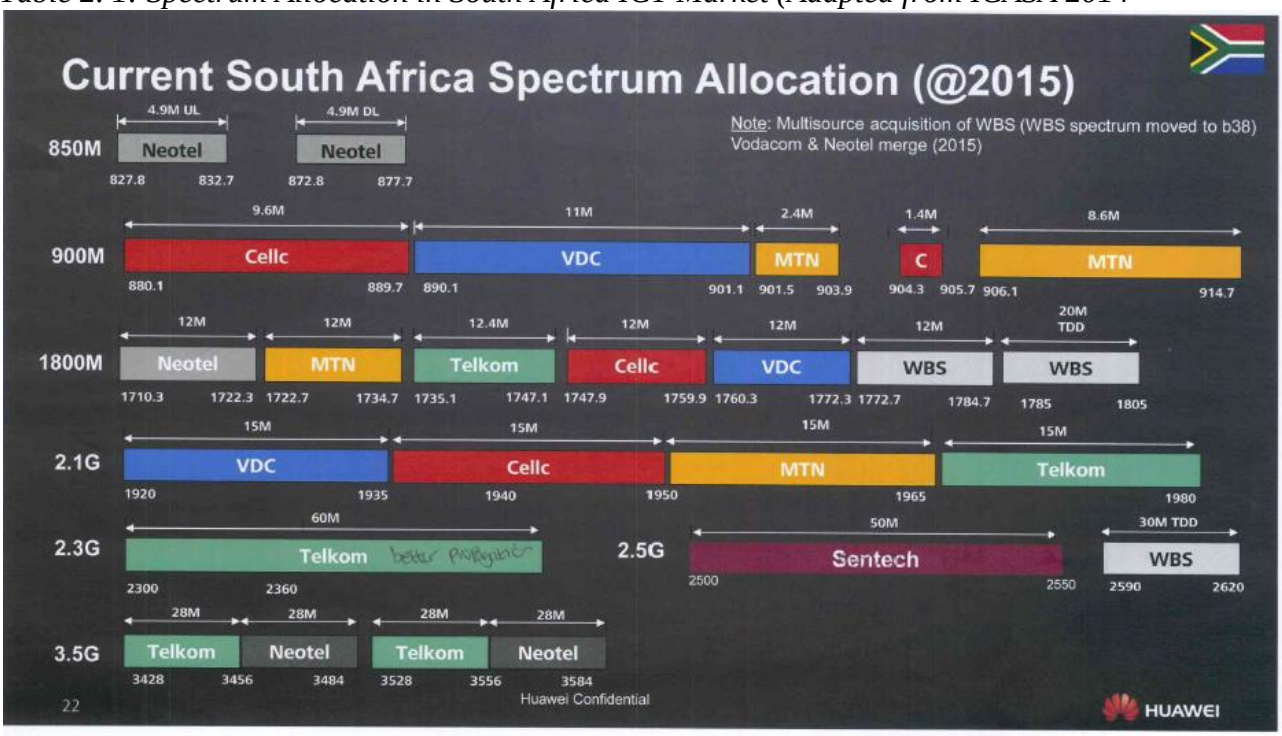
The Broadband Series (2012) equally highlights that spectrum availability has been a prerequisite for competition in the telecommunications market since the growth of mobile services, and that it remains necessary for the development of 3G/LTE and wireless ICT services. The Broadband Series (2012) also adds that wireless ICT services are the primary platform for reaching unserved and underserved geographic regions in a developing country such as South Africa. It is also widely recognised that wireless ICT is the main technology used to provide ample broadband coverage in developing countries.

By definition, the Broadband Series (2012) alluded that wireless requires broad spectrum bands to provide the capacity to give ICT access at sufficient quality levels, which is essentially a matter of download speeds. In this sense, national ICT strategies tend to centre, as a rule, on policies targeted at reassigning frequency spectrum bands, specifically apportioning the "released" spectrum because of the digitisation of broadcasting.

The release of spectrum for better use of technology and innovative thinking, such as cognitive radio, is also starting to appear on the agenda. However, the pace of e-development still remains slow. The freeing up of the spectrum will create a digital dividend. This presents an opportunity for service and technological innovations that can utilise the radio-frequency spectrum more efficiently while also introducing new services and opening up new digital media markets for content provision (ICASA, 2014).

Zimri et al. (2012) add that as the market in South Africa gets ready to take advantage of the digital dividend, the regulator will need to focus on both economic (market) and development (public value) needs. They also alluded to the fact that existing and proposed policy and regulation do not address the possibility of a spectrum licensing or leveraging the Digital Dividend spectrum in ways that enable the electronic communications market to meet the ICT needs for emerging service. These include e-education, though a recent policy draft has directed the regulator to prepare a licensing approach that will stimulate “broadband for all” and new market entry. The current situation of spectrum allocation in South Africa is highlighted in Table 2.1, and most of the operators are already in need of additional spectrum to be able to roll-out latest technologies such as LTE.

Table 2. 1: Spectrum Allocation in South Africa ICT Market (Adapted from ICASA 2014



The 470 MHz – broadcasters largely occupy an 862 MHz band in South Africa, and part of it will become available post digital migration. This is a safe space to release an unlicensed spectrum, encouraging multiple players to share the spectrum for future innovative uses. The specifics and considered value of such a spectrum licensing approach are vague and generalised and do not offer insight into the objectives of the proposed regulations beyond the standard, universal access and service idea (Zimri et al., 2012).

They Zimri et.al. (2012) add that, seldom, if ever, has spectrum regulation being considered from the perspective of the rapidly growing demand for ICT-enabled services and transition to an Internet-enabled services sector. Historically, the areas that have fuelled the ICT service use include commerce, trade, and banking, with social networking pushing through as a strong new area of demand.

It is important to note that due to the landscape the traditional wired solutions are not ideal for use in most of the rural communities and this makes the wireless solution the most effective to be deployed to cover the low populated areas. This will place a burden on the Regulators to make sure that enough spectrums are allocated for the deployment of wireless networks. Most of the high-speed ICT solutions are spectrum hungry and thus need large amounts of spectrum to provide high data rates (NTRA, 2011).

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Additionally, NTRA (2011) also indicated that to estimate the future spectrum requirements for ICT the following inputs will need to be taken into consideration:

- the geographical landscape of each rural community,
- the number of inhabitants in the spectrum usage, and
- the behavioural nature of the various users. Efficient spectrum management for any Regulatory body is therefore absolutely critical.

The ECC Report 224 (2014) reported that the spectrum is a finite, reusable commodity of greater benefit value for the public and rural market. It is thus in a community's interest that the spectrum is managed as efficiently as possible from a socioeconomic point of view. The ECC Report 224 (2014) also pointed out that in spectrum management the regulator will continuously make choices and prioritise how the spectrum resource can be optimally used even when the alternative has many uncertain effects with no obvious price money. The selections are seldom easy, but a well formulated cost benefit analysis can produce an improved decision, resulting in the increasing likelihood that the finite, reusable spectrum commodity is utilised effectively for the benefit of the whole rural community.

However, Ratkaj and Beutler (2014) note that the biggest problem of spectrum management by regulators has been the allocation of resources to the various service providers to be able to service a bandwidth hungry application such as data. They also indicate that projecting future innovative improvement is necessary for any business and this constitutes a critical pillar for decision-making with regard to future investment and the availability of important resources. This is particularly important when considering the availability of rare and highly demanding resources such as radio frequencies. However, forecasts will, at the same time, have to be taken with some scepticism.

Furthermore, Grunwald et al. (2011) say that revolutionising the approach used when the spectrum is managed is critical to cater for the future need of the high-speed ICT networks for seamless wireless applications. This encompasses exploring technologies that allow the frequency spectrum to be utilised on a demand and supply basis in different locations and frequencies for better efficiency.
Grunwald et al. (2011) further highlight the fact that regulatory mechanisms should better reflect the capabilities of new efficiency-enhancing technologies. Policymakers should simultaneously pursue several approaches which include allowing access to more spectrums, allocating a mix of spectrum bands, enabling a complementary shorter - range and wide-area networks, and increasing reliance on automated solutions.

Grunwald et al. (2011) added that it was important to get the relevant spectrum policies as demand for wireless solutions with greater bandwidth capabilities had soared and information in the current environments had become more interconnected. This means exploring innovative technologies with the capabilities for spectrum to be used at different times, locations, and frequencies for more efficiency. It also means allowing spectrum to be shared in a mixed-use environments and identifying underutilised spectrum bands.

It is, therefore, important that the regulatory mechanisms be designed to exploit the abilities of the recent technologies. These technologies included cognitive radios which have the capabilities of spectrum sensing and which will allow bands to be shared by the number of users. They also include online databases that automate spectrum allocations, and technologies which can regulate the transmission power dynamically, allowing frequency bands to support more efficient modulation (Grunwald et al., 2011). Spectrum management will, therefore, play a vital role in ensuring a strategy for sustainable ICT development in deep rural environments.

2.3.2 Technology and Service Neutrality

Technological neutrality is based on the fact that network operators must be allowed to use the technology that best meets the needs of their network and the demands of their clients, and governments should not make such decisions. In the licensing environments, technological neutrality means that different technologies can provide the same or similar services that must be granted and regulated in the same way (Kelly and Rosotto, 2012).

Therefore, NTRA (2011) mentioned that the use of the spectrum will have to be optimised as any type of technology should be able to use the most suited spectrums and this will make sure that the spectrum is for more productive uses through voluntary market mechanism. Some of the cases on the flexibility of the spectrum use might hurt the public interest and this will require the regulator to provide a framework to safeguard the interest of the rural population.

ITU (2014) also referred to service neutrality, which emphasise that network operators must be permitted to give whatever services their technological infrastructure can offer. Previously, because of the confinements of technological innovation, networks were "purpose built" as digital communications turned out to be progressively digitised. Be that as it may, it is practical for various networks to help comparative or substitute services. In this way, both cable and communications systems can now bolster

an expansive scope of voice, data, and video services. The introduction of more flexible licensing systems that allow companies to offer a wide range of services to a licensing mechanism, allows the operator to take into account the entry into the market of the most necessary and profitable services. This, therefore, calls for a total overhaul of the licensing regime by the regulators.

Together, technology and service neutrality recognise and facilitate the convergence of technologies. They promote new and innovative services by eliminating the number of licenses that a service provider should acquire and expand the variety and breadth of services which may be provided. Neutrality can also help minimise unnecessary and contradictory regulatory obligations, such as different information standards and specific service licensing requirements. However, the country's licensing system often requires significant reforms to move from traditional service licenses to a more uniform authorisation process capable of introducing technology and service neutrality (Kelly and Rosotto, 2012).

It is important for regulators to adopt technology and service-neutral platforms which will eliminate bottlenecks to market entry. This will avoid situations where a particular technology, which will later be overtaken by market trends, is enforced. Spectrum use technological capability limitations are likely to reduce the visibility of the business models of prospective operators, and this is likely to result in a reduced number of applicants. This could limit investments from existing operators as they might restrict their business models over profitability. This will, in turn, result in difficulties for prospective service providers to roll-out services in the most underserviced areas.

2.3.3 Market Competition and Cost to Communicate

In view of the fact that competition among service providers is the correct model to activate ICT supply, ICT plans, either certainly or unequivocally, have a tendency to characterise the most proper approach to create market competition in the arrangement of these services. This approach includes the underwriting of either facility-based competition (additionally alluded to as platform-based competition) between vertically-integrated players. An example is ICT incumbent or service-based competition through unbundling of the ICT network of the occupant operator and the sharing of the incumbent infrastructure (Broadband Series, 2012).

However, it has to be noted that according to Government Resolution No 136 (2011), the fundamental position of the regulatory framework includes the establishment of conditions for effective competition in the supply of the ICT network and services. If it is feasible from a practical and economic point of

view, regulation should mainly promote infrastructure-based competition, and in the case of access networks, the objective of the regulation would be the promotion of competition at the level of services.

It is, therefore, imperative to note that the primary goal of effective regulation is to facilitate the provision of quality information and communication services competitively, efficiently and effectively to guarantee widespread access and use by consumers. To achieve this, the regulator will have to guarantee the fostering of competitive ICT markets. The competitive ICT markets include the market-based spectrum allocation mechanism, the availability of ICT numbering and address resources, licensing of new service providers and ensuring that licensed service providers provide a broad range of services to widen consumer choice (CCK, 2013).

Thus, it is imperative that any state intervention, in terms of funding ICT networks, must be utilised to promote competition and not to give the existing operators an unfair upper hand at the expense of potential new players. The biggest risk to be managed is for the Government not to invest in the leading network operator as this will exacerbate the lack of competition in the market. The government's role will be to result into a fair competition in the market, which will lower prices and boost speeds while encouraging innovation (OECD, 2011).

To achieve this, the government should consider guaranteeing efficient open platforms and architectural requirements, and financing the passive infrastructure to promote the wholesale and retail trade of services to new networks financed with public funds. This is a means of guaranteeing fair competition in the market through public sector investment (OECD, 2011).

It is, therefore, important to note that the National ICT Integrated Strategy (2012) suggested that there will have to be a compelling case for the infrastructure-based competition to be encouraged within the areas which are financially viable and that also the service-based competition will be introduced in areas which are economically not feasible. However, there is a different perspective which advocates service-based competition, and this will result into a speedy delivery of services in deep rural environments.

The Broadband Series (2012) shows that these two competing models assume distinctive policy approaches regarding ICT advancement. Infrastructure-based competition is situated between vertically-integrated operators with access to a non-replicable passive framework. This model perceives, nonetheless, that ICT financial aspects do not take into account full competition in all

topographies and, along these lines, characterises standards for state aid and open backhaul in underserved poor rural areas.

On the other hand, the Broadband Series (2012) also indicates that ICT service-based policies foster competition among horizontally-integrated operators who have access to wholesale resources. It expected the presence of a single ICT infrastructure shared crosswise based on services and pricing. As a result of the colossal economies of scale in ICT access, a service-based policy may prompt the development of a single network transport player to accomplish national scope. Additionally, the Broadband Series (2012 elaborated that the economic aspects of innovation are generated by a single service provider supported by a state or national carrier that provides services in a deep rural setting and in the outermost regions of the nation. They state that this happens regardless of whether an expanded competitive framework is based on infrastructure or services.

According to De Bijl (2004), an infrastructure-based competition is better than service-based competition due to its ability to create environments with a levelled playing field between the new and incumbent market players. This allows for improved competitor innovation and does not jeopardise the benefits of the incumbent to be able to upgrade and maintain the infrastructure. As a result, the infrastructure-based competition leads to higher rural community livelihood improvements, especially in the long-term which will result in the dynamic efficiency increment.

The ICT infrastructure roll-out has a long lead time, so end users will not experience the benefits immediately. The valuable influence of new entrants in the market might take five years to evolve while the Schumpeterian process of "creative destruction" can lead to victims. Thus, it is critical that politicians, policy makers and regulators are patient. The regulators will be expected to commit to sunset clauses over time and actively make themselves less important. From a political economy viewpoint, this may not happen automatically (De Bijl, 2004).

It is noted that service-based competition resulted relatively fast in forcefully embedding the much-needed competition and a lower cost for consumers. This undertaking is good for static efficiency in the short-term. The most challenging issue is that little effort and lower commitment in both innovation and financial investment leave a lot to be desired and that competitors are heavily dependent on sound regulations. Access-based business models have limited scope for creative thinking of new market players since the current operators' existing infrastructure is restrictive in relation to a network assembled from scratch (De Bijl, 2004).

In conclusion, it is noted that the industrial community has moved into a period of cutting edge technological advancement, influencing the way progressive nations maintain their organisations, their establishments and their livelihood. One of the ways in which these technological advances are dramatically influencing people's lives is ICT, hence the assertion that we are in the middle of a digital evolution which drives us towards an information society. It is important to note that key technological innovations have occurred in market economies, and services are rolled out in response to emerging demands. Competition has spurred innovations in applications and technologies in equipment, service range, and in the pricing mechanisms including the use of pre-paid. Technological infrastructure and service innovations enabled by competition will, on the other hand, benefit universal service where technological innovations can allow telephone connections at a much lower cost. Market competition is, therefore, critical to the strategy of sustainable ICT for deep rural development.

Finally, the fundamental principles of the regulatory framework should include the creation of conditions for effective competition in the provision of electronic communication networks and services. These should be based on the principle of technological neutrality and also have the support of adequate investment in infrastructure. If it is feasible from both a practical and economic point of view, regulation should mainly promote infrastructure-based competition and, in the case of access networks, the objective of the regulation is to promote competition at the level of services (Government Resolution no 136, 2011).

2.3.4 Backbone Network and Sustainable ICT

According to Williams (2009), "Limited access to low-cost backbone network capacity is one of the factors that limit the development of the ICT connection in South Africa. The backbone networks are high capacity links that transport communications traffic between fixed networks and form a key part in the communication supply chain".

Calvo (2012) also states that there will still be a need for fixed-lines to remain playing a primary role within the ICT sector as the networks are continuously rolled out. The continuous development of the sophisticated wireless networks, which are able to support the voice and data applications, is unlikely to change the status quo. Calvo (2012) equally indicates that as the multimedia platforms grow and the data hungry applications became more prevalent to wireless, the platforms will likely depend on the fixed data networks for backhaul "heavy lifting" and eliminate the network congestion.

Williams (2009) indicates that two factors determine the economic significance of backbone networks. The first is the diminishment in general costs that happens when movement of traffic is diverted through a high - capacity network to bring down normal expenses. The second is the open door policy for up and coming players to enter the market by using the low-cost backbone network services without building their own system. Williams (2009) further indicated that these two variables are interrelated. By conglomerating the traffic generated by smaller players onto higher-capacity backbone networks, normal expenses are decreased.

Additionally, the OECD (2011 highlights that funding, which implements high-speed backhaul networks to a large population of rural communities, will be more efficient than implementations, which invest in last-kilometre connections end users within a limited number of areas. The OECD (2009) further indicates that governments who had made a commitment to fund the markets might have decided to invest in the high-speed backhaul network infrastructure in some rural communities. The investment in the backbone networks will be a mechanism to provide affordable, bandwidth extensive networks to the rural population and allow the last mile to be provided by the private sector.

The OECD (2009) also alludes that investment from the public purse can be used to target funding of high-speed, open-access networks to connect fast networks to rural schools, hospitals and other public facilities. Private Internet service providers can interlink one of these points and share direct access to their users using their facilities and services. It is important to note that high capacity fibre optics are the major determinant of the lower cost offering of affordable Internet access. The high capacity backbone fibres are used to connect towns to cities within countries with cross-border connectivity to the neighbouring countries as well as linking to the international submarine networks connecting continents (SADC, 2012).

Cost is one of the biggest inhibitors of ICT adoption with the backhaul as one of the most expensive portion of the ICT infrastructure chain. The Broadband Series (2012) suggests that to reduce backhaul costs, infrastructure sharing (e.g., backbone and towers) should be allowed and encouraged. The Broadband Series (2012) yielded that the infrastructure sharing cost weighs on contending suppliers. On the off chance that various ICT service providers are not practical, sharing or consolidation may create an ICT access "utility". It enables service providers to explore economies of scale and minimise the financial and investor risk, which is commensurate to bringing down expenses. Williams (2009) has outlined a number of options that need to be explored for expanding backbone networks:

a) Create suitable environments for competing infrastructure and services
    1) Eradicate the regulatory impediments for new business ventures and competition
        i. Eradicate restraints on the quantity of network licenses
        ii. Support the establishment of substitute alternative network infrastructure suppliers
        iii. Eradicate the bottlenecks on the uptake for the backbone network services
        iv. Improve the regulatory environments for the implementation of the backbone networks
    2) Minimise the investment cost structure
        i. Create environments for ease of access to infrastructure
        ii. Encourage the sharing of facilities and communications infrastructure
    3) Reduce the investment risks and guarantee political stability
        i. Establish an insurance for political risk with investment guarantees
        ii. Make sure demand aggregation for quicker uptake
    4) Ensure market competition in the downstream market
        i. Promulgate the regulations to create environments for effective downstream competition
b) Establish a conducive environments for an affordable roll-out of ICT in underserviced areas.
    1) Share communications facilities and ICT infrastructure
        i. Grant the operators incentives to work together in developing the backhaul infrastructure in areas where infrastructure competition is not commercially viable
    2) Supply tax and business subsidies to attract investment in the deep rural areas
    3) Provide the service providers incentives to roll-out and manage the backhaul networks in the deep rural areas for services to be rendered on a non-discriminatory basis
    4) Provide tax incentives and procurement levies
        i. Provide operators with subsidies and levies to develop and roll-out networks in deep rural areas and reduce the contribution to the universal service funds

It is, therefore, critical to emphasise that the backhaul networks play a critical role in the sustainability of the communications infrastructure and affect the business viability of ICT services, particularly ICT connectivity. Thus, the economic significance of backbone networks is determined by two factors. The first is the reduction in the total cost which occurs when traffic is directed through the high-speed networks with lower costs. The second is an opening for SMMEs to penetrate the market by procuring low-cost backhaul network services without building their networks (Williams, 2009).

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2.3.5 Supply-Demand-side for ICT Services

Countries are starting to consider ICT advancement not only as a challenge on the supply side of the ICT services but also as a problem on the demand-side. As a result, demand provisioning is becoming an important element of ICT development strategies and policies (Kelly and Rossotto, 2012).

Kelly and Rossotto (2012) further emphasise that as legislators and regulators think about ways to deal with invigorating and advancing ICT improvement, they expect to perceive the full extent of the difficulties that must be tended to. These difficulties have a tendency to be multi-layered and include empowering both the supply of ICT networks and interest in ICT applications and services.

The Government will need to consider ICT as an ecosystem made of both supply and demand if the development of its deployment is to be successful. It will have to come with up aggressive policies to generate demand and reach underserviced areas and deep rural communities. Supply-driven policies tend to focus on promoting the introduction of network infrastructure, which allows the use of information and communication services. Demand-driven policies encourage the introduction and adoption of services offered by ICT, so that there can be more rural communities that use them. The policies of supply and demand are crucial for information and communication technology services so that the highest penetration and use is achieved (Kelly and Rosotto, 2012). This interaction is clearly highlighted and briefly explained in Figure 2.1.

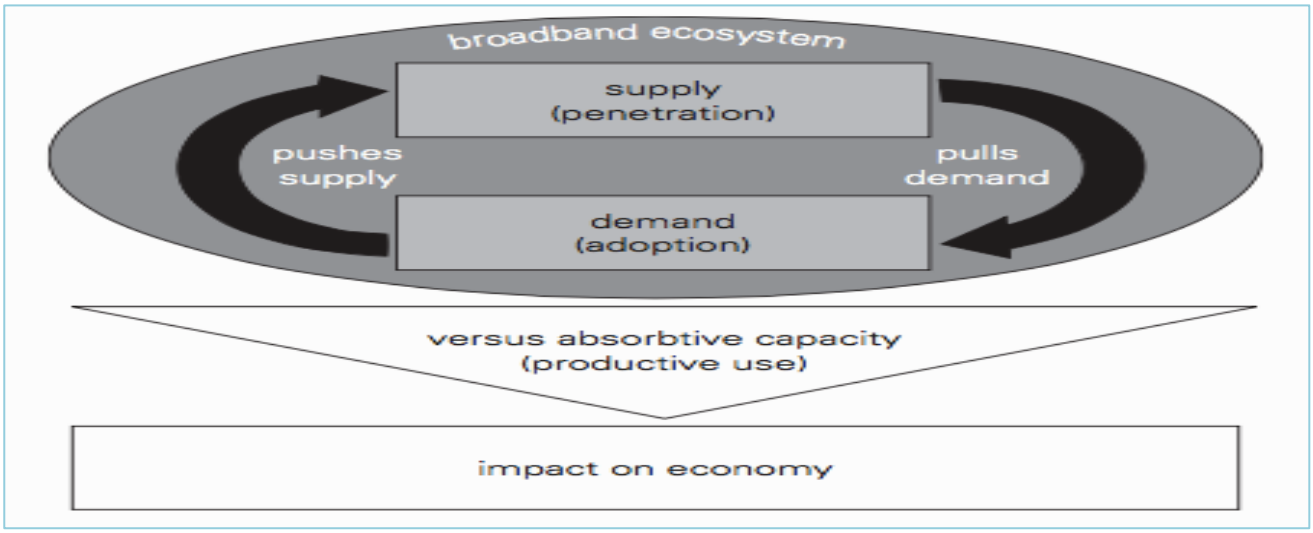

Figure 2.1: Framework for Government Intervention for sustainable ICT (Source: World Bank Group 2010)

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Kelly and Rossotto (2012) further indicate that the availability and supply of the ICT infrastructure is the fundamental condition of the ICT services to be made available. Moreover, the demand of the ICT services is equally important to make the necessary investments worthwhile. The ability of non-ICT users is also important to use and create ICT-enabled services and this will promote demand and encourage the expansion of the network roll-outs.

The primary elements of supply in the ICT ecosystem comprise four levels:

- International backbone network;
- National backbone;
- Metropolitan backbone; and
- Local networks

These policies are highlighted and explained in Figure 2.2.

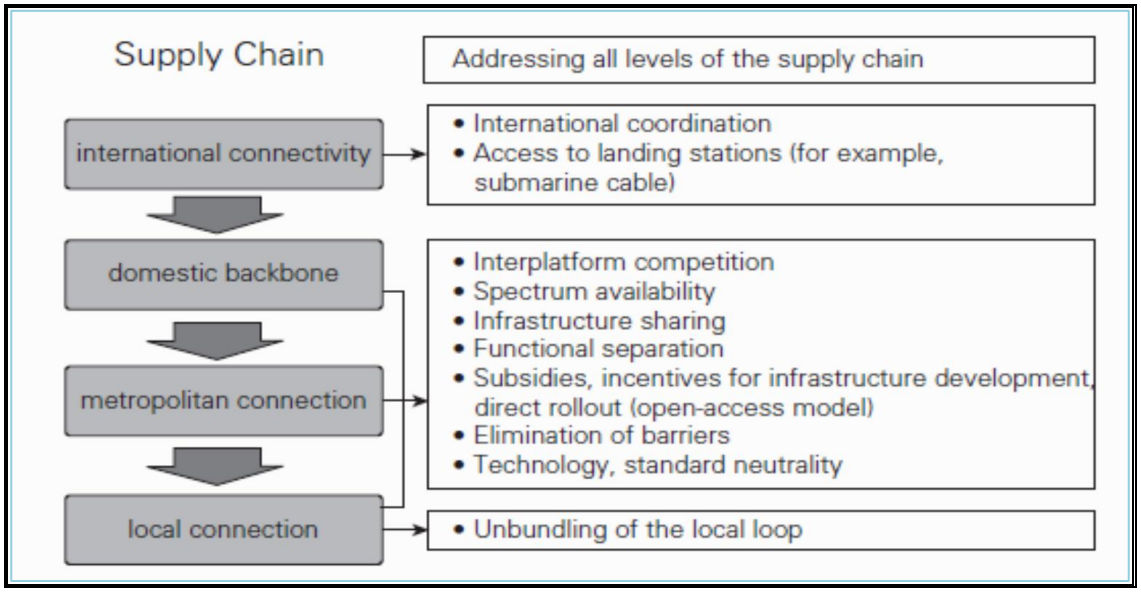

Figure 2.2: Policies on the supply-side (Source: Adapted from World Bank Group 2010)

According to the ITU Broadband Report (2013), one of the Cisco's analyses identified a number of policy options for both the demand- and supply-sides and then developed an ICT strategies taxonomy enforcing market competition and capital investment;

- Assigning the much-needed frequency spectrum;
- Creating the environments for affordable infrastructure deployment;
- Ease of investment on the network expansions and ICT business growth; and

- Compressive policies to encourage open access and ease of adoption of services.

A different set of policies on the ICT supply-side is outlined and discussed in Table 2.2.

Table 2.2: Checklist of policies for supply-side (Source: Telecommunications Management Group, Inc. 2012)

Goal	Policy
Promote competition and investment	• Implement policies or regulations to create conditions to attract private investment in broadband networks
	• Implement technology- and service-neutral rules or policies giving operators greater flexibility
	• Promote effective competition for international gateways and possible policies for service-based competition for gateway operators to provide access to their facilities on a wholesale nondiscriminatory basis
	• Develop policies to facilitate interplatform competition
Encourage government coordination	• Adopt common technical standards and facilitate the development of international, regional, and national backbones
	• Incorporate broadband planning into land use and city planning efforts
Allocate and assign spectrum	• Assign additional spectrum to allow new and existing companies to provide bandwidth-intensive broadband services
	• Allow operators to engage in spectrum trading
Promote effective competition and encourage investment	• Encourage multiple providers to share physical networks (wireline and wireless), which can be more efficient, especially in low-density areas
Facilitate access to rights-of-way	• Facilitate access to public rights-of-way to ease the construction of both long-distance (backbone) and local connections
	• Develop policies that provide open access to government-sponsored and dominant-operator networks to enable greater competition in downstream markets
Facilitate open access to critical infrastructure	• Develop policies that provide open access to government-sponsored and dominant-operator networks to enable greater competition in downstream markets
	• Consider implementation of LLU if necessary to facilitate competition

Demand-side initiatives include:

- Create environments for ease of access to end user devices;
- Encourage the government to avail of online content for quicker ICT adoption services;
- Train and develop ICT technicians and users;

- Create online and local content;
- Make sure that consumers' needs are well taken care of; and
- Make sure that customers are fully empowered.

Table 2.3 discusses and outlines policies that enable the effective demand-side of the ICT network.

Table 2.3: Checklist of policies for demand-side (Source: Telecommunication Management Group, Inc. 2012)

Focus	Policy
Infrastructure	• Connect schools to broadband networks • Make government an anchor tenant • Expand access to underserved communities with universal service fund support • Construct community access centers • Consider expanding universal service to include broadband
Services, applications, and content	• Undertake government-led demand aggregation • Provide e-government applications • Promote creation of digital content • Implement reasonable intellectual property protections • Ensure nondiscriminatory access
Users	• Provide low-cost user devices in education • Develop digital literacy programs for citizens • Address content and security concerns • Facilitate affordability of broadband devices • Monitor service quality • Support secure e-transactions • Provide training to small and medium enterprises

The supply and demand-side of the ICT are very critical for the uptake of the ICT services but important to note that they might be sufficient by themselves to guarantee that ICT can reach its full potential. This can only be guaranteed when the end users had the capacity to learn, understand and apply the lessons learned about the benefits of ICT and their capacities across the economy and society (Kelly and Rossotto, 2012). This is what is referred as absorptive capacity.

Absorption capacity alludes to the potential of a rural community to understand the value of information, to comprehend that information and then able to apply that information and knowledge for the development and benefit of that particular community. This ability is important to that rural community innovative capability for the new technologies to be assimilated by the community to create,

improve, and transform the means to access and use of available knowledge and services to improve the lives of the people (Paul, 2008). This will assist the communities to become co-creators of content and ICT users led innovations will also be enabled within those communities. Thus, it will be very critical for the rural community to have the capacity to acquire, assimilate and exploit the capabilities enabled by the ICT infrastructures.

Kelly and Rossotto (2012) further highlighted several components that can determine that the Country has the absorptive capacity.

These elements are:

- The environments of macroeconomic,
- The business environments,
- The quality of human development, and
- The governance environments

Finally, Kelly and Rossotto (2012) highlight that policymakers can promulgate policies which promote the capacity to understand and implement the many benefits of ICT which can be complementary to its build-out. The private sector can also be co-opted for ease of adoption of ICT services as an input to drive productivity, innovation and welfare throughout the economy and the rural community.

2.3.6 Change Management and Uptake of ICT

Change can only be successfully executed after understanding the processes of change management. The definition of change management is the application of a well-structured approach and mechanisms to capacitate individuals or groups to be able to move from the current state to a better future state to achieve the set outcome (Prosci: Change Management Learning Centre: 1996-2013). Figure 2.3 shows different stages that are needed to make sure that change is introduced and effectively implemented.

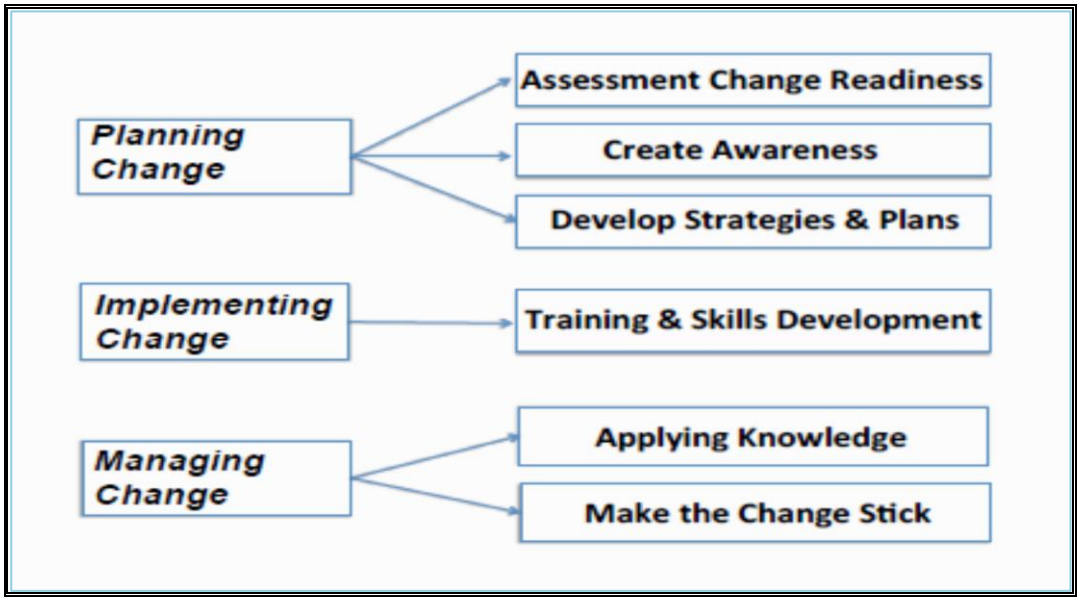

Figure 2.3: Different stages of change management (Source: Mashapa et. al. 2013)

Kwaku Kyem (2010) mentions that the delay of benefits from ICT usage is partly because societies have not had a long exposure to technology in general. This fact also indicates the need to develop behaviours that are in line with the sustained adoption of technology before users can derive the full benefits of ICT deployment. Digital illiteracy has thus proven to be one of the challenges that inhibit the use of ICT adoption in the deep rural environments.

An example of where technology has been introduced and embraced with a smooth transition is the dramatic transformation of teaching and learning at the Crescent Girl School in Singapore. It has integrated online resources and learning in every aspect of its curriculum. This initiative is called the 21st Century Learning Design (21CLD). It mainly assisted educators to formulate and design academic lessons which included the privilege for students to develop 21st Century expertise such as collaboration, knowledge construction, and the effective use of ICT for education (Shear, Tan, Patel, Trinidad, Richard, Koh and Png, 2014).

Shear et al. (2014) indicated that school leaders deliberately facilitated the change process at Crescent and that the educators took ownership to draw theories of efficient and broad-based leadership. Subsequent to the initial series of 21CLD symposiums, school educators led the conversations on 21CLD at various levels starting from middle management to departmental educators. These interactions took advantage of fundamental structures such collaborative groups to effect changes on the teachers' way of thinking and doing things. Leaders of the projects were also selected from the group of teachers and this formed what is called the "21cld Think Tank" to pilot various packages of

lessons for the various subject matters. Teachers further engaged in various aspects of the 21CLD approach and this helped enforce the collaborative formations.

One of the biggest aspects that need to be considered when introducing a new technology is the involvement of the local community. The role of community participation cannot be underestimated as this will guarantee ease of adoption and acceptance of change. This does not just relate to the planning and design of the technology intervention which will take place, but also to the design of the applications and relevant systems. Carroll and Rosson (2007) states the following:

> *"Participatory design, integrated two radical propositions about design. The first is the moral proposition that people, whose activities and experiences will ultimately be affected by a design outcome, should have a substantive say in what that outcome is. The second is the pragmatic proposition that the people who will need to adopt, and perhaps to adapt to an artefact or another outcome of design, should be included in the design process. Thus, they can offer expert perspectives and preferences regarding the activity that the design will support, and most likely transform".*

Community participation extends over the design and the development of relevant artefacts. Community involvement is a critical element of sustainability.

It is important to note that people respond to change differently and go through the process at different paces. It is thus key to concentrate on individual changes in the beginning as in the absence of that, change in the community level will be very difficult to execute (Moore, 2006). These changes are:

- ***Awareness****:* This is the phase during which people accumulate the initial knowledge with the possibility of getting in touch with the technology for the very first time.
- ***Assessment:*** This phase is all about the potential adopters who made the decision to accept or turn down the technology. The most important factors during this decision will include how readily available is the technology and its usability.
- ***Acceptance:*** All the potential users have now reached the important stage. They have assessed all the evidence and executed their decision.
- ***Learning to use it:*** Those who have adopted it will have to learn to utilise the technology. Part of the group can have learnt enough during the acceptance phase.

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- ***Usage:*** At this point people are using the technology very actively to reach their goals. The new task for the companies in the process of introducing technology is to transfer their base for the latest generation of technology which will often include the new interface.

Figure 2.4 shows four phases that the authors have experienced in communities where technology is deployed as an enabler for individual and community upliftment. The development through these phases is initiated by external interventions that served as catalysts for change.

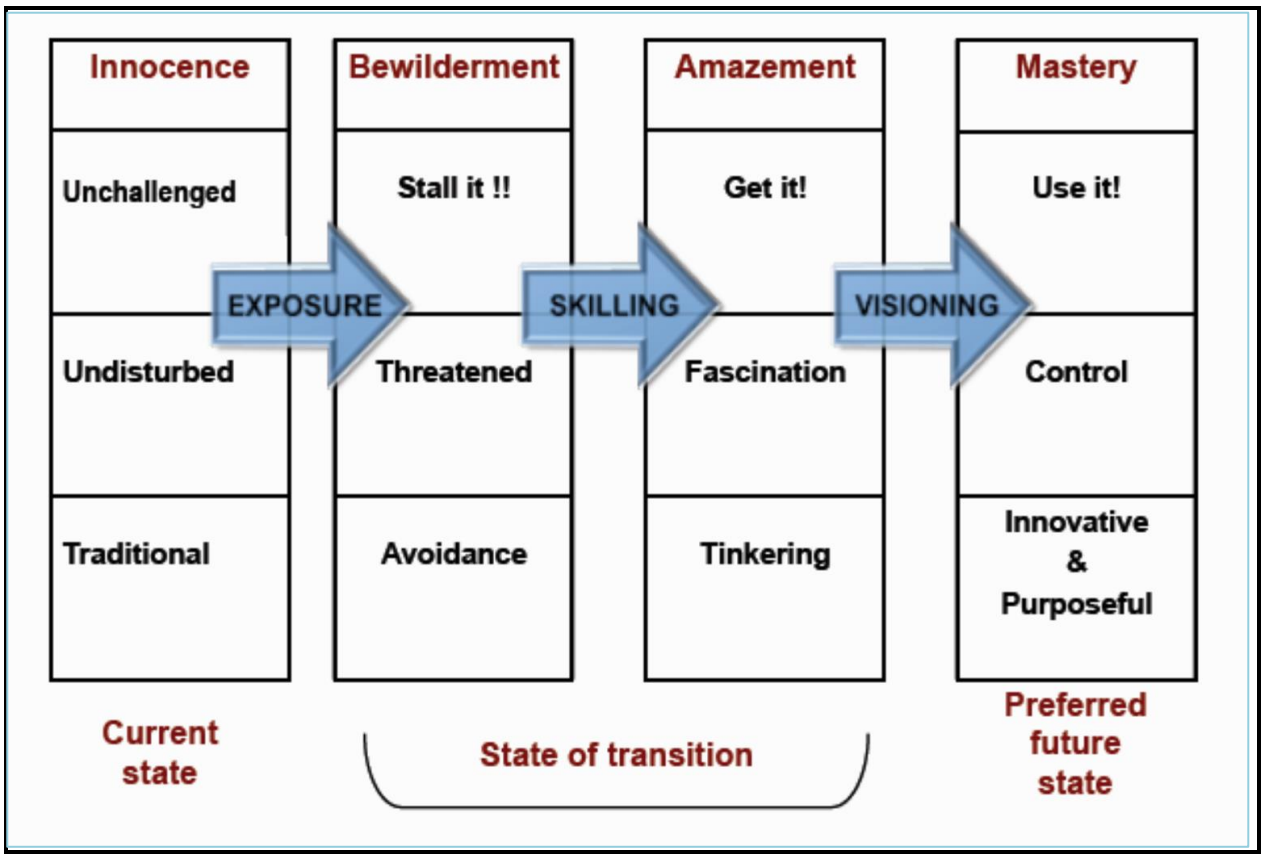

Figure 2.4: Phases of Technology Adoption (Source: Veldsman and Van Greunen 2013)

According to Veldsman and Van Greunen (2013), prior to the introduction of technology, the thinking of many is unchallenged, their emotions are equally not affected much, and most of the action is very primitive. Once people have been exposed to technology, one often finds a sense of improvement in the way of doing things. Their initial reaction is to avoid utilising the technology and to stay with what seems to be familiar and not much of a threat. It is when people learn to work with newly acquired tools that they are amazed at what they can do with the latest acquired knowledge. This is also a phase where the group play and experiment with the technology and is a critical part of the transitional phase.

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Referring to the adoption phases in Figure 2.4, it is important to note that the national ICT strategy has an important policy view for articulating a plan of why all-inclusive ICT service represents a basic societal challenge from a financial development point of view. The advancement of this plan includes four consecutive phases. Initially, the government is expected to reaffirm the aggregation of rolling out ICT as a method for supporting social and economic improvement objectives freely. This requires characterising an agreement around goals and qualities that connected the use of ICT to financial and social improvement. When this vision is developed, it is basic to building agreement among policymakers and civil society around the criticality of ICT utilisation. This ought to be a piece of an open level headed discussion among all parties that have an effect on deployment and assimilation of ICT adoption. Utilising this common vision as an establishment, the objectives ought to be characterised in light of thorough analysis of social and financial returns including policy tools. The objective gave the setting to the advancement of particular tasks and projects. Utilising the incorporated vision as a general target advancement objective, proactive, multi-year government arrangement speaks to the subsequent stage (Broadband Series, 2012).

2.3.7 Gender Digital Divide

Human development is about creating environments where people can develop their full potential and lead a productive and creative life through their needs and interests. Development is, therefore, expanding the choices that should lead to the lives that they value (UNDP, 2007).

Joseph (2012) states that the increase in the capabilities of the rural women relies on the opportunities the ICT services provide them with to alter their living conditions. The ability and functioning of the rural women will depend on their freedom to choose the life they aspire to. Commodities and functioning are very important for the rural women's development and empowerment. The skills of rural women increasing through the use of ICT will have a direct impact on the development of both the women and their entire rural communities. Thus, the access of rural women to information and communication technology will allow their development in South Africa.

Joseph (2012) makes a further assertion that the traditional laws subjected the rural women to be considered as minors. Their critical decisions are mainly made by their husbands as dictated by tradition. Rural women are also discriminated against when it comes to accessing ICT services.

Although it has been seventeen years since the dawn of democracy, South Africa still faces many challenges in empowering rural women. The majority of rural women still lack socioeconomic

opportunities and come from the female-led rural households. This group is deprived of access to land mainly due to cultural shortcomings and they live in poverty (Joseph, 2012).

Samsuddin, Omar, Samah and Bolong (2017) state that ICT can be an enabler that can empower various groups of women with knowledge and expertise for economic and social participation for sustainable food security and livelihoods. ICT will provide access to personal development such as training material and market information for women in small businesses. Women are deprived of their democratic rights of access to information to enable them to have the capacity to participate in democratic decision-making such as voting. ICT can provide environments for engagement and deliberation in electoral processes for all people including those in the rural areas, and this is concretely critical in contexts where access to independent media and expression is inhibited.

Figure 2.5 indicates some of the factors which need to be dealt with to make sure that the Strategy for Sustainable ICT can enhance the development of rural communities and particularly women within those communities.

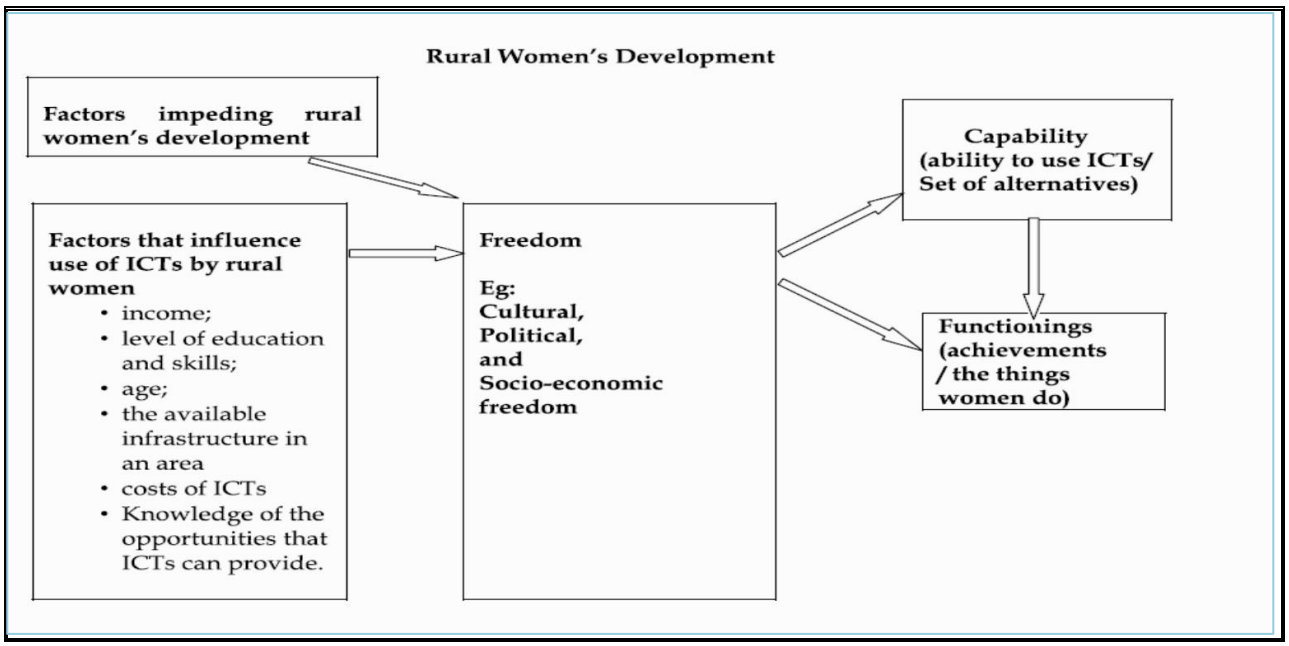

Figure 2.5: Capability approach to the use of ICT for rural women's development (Source: adapted from Alampay, E. 2006)

It has been noted that women's talents depend, among other things, on socioeconomic and political arrangements. The political arrangements, living conditions and socioeconomic situations in rural South Africa affect the ability of rural women to use ICT. The cultural freedom, political freedom and social and economic freedom depend on factors that affect the use of ICT by rural women (Joseph, 2012).

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Factors such as adequate infrastructure, low-cost information and communication technologies, and reliable ICT have also influenced the use of information and communication technologies.

Attwood, Diga, Braathen and May (2013) indicate that the gender perspective acted against women's participation and freedom of choice. This is because these norms dictate that women should not use ICT or that ICT should not be part of women's lives as this could interfere with their traditional reproduction roles in the home.

Evans (2002) proposes that there is a thinking that is associated with a position which recommended that women are in a disadvantaged position with respect to innovative advances through two related processes. Firstly, the structure of information and communication technology work being strongly dominated by men has been used to suggest that innovation is likely to emerge from a male point of view and without thinking about the use of legitimate technology by women. Secondly, they propose that the assignment of women's work as incompetent has implied that women have been situated in occupations that have not required the utilisation of technology, or that technology has not been brought into the working environments where women prevailed. Also, women are seen as particularly vulnerable to loss of employment through the introduction of ICT into the workplace. This has brought about a recognisable proof of technology with the male. Women have been underestimated with regard to technology or considered technologically inept and "stepping out of role" should they find technology interesting or enjoyable to use.

However, while it is accepted that some women learn to use ICT to benefit themselves and their communities, this happens to be the "educated and political elites in their countries". In the poorest and marginalised sectors of the country, it is often assumed that women are less inclined to use technology. They are more likely to be left out of using technology and have less time or resources to take advantage of the digital revolution than their male counterparts (Evans, 2002). Labelle (2005) adds that one of the main objectives of the ICT policies and plans is to make sure that greater penetration of ICT services is possible. The course of ICT development is not only shaped by market forces but also by laws, many of which fail to address the gender imbalances.

The ICT policy for rural development needs other sets of policies such as learning and education, government, industrial development, rural development policy, women empowerment, other marginalised groups, and research and development. This will then make sure that Internet content is relevant and reflects the national specificities while protecting the Intellectual Property Rights (IPR).

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The strategy to deliver ICT policies will also need to address operational and institutional issues. The action plan outlines the framework of what is required to implement the strategy (Labelle, 2005).

Ramilo, Cinco, and Thas (2007) indicate that there are genuine objectives to incorporate the sexual orientation plan within the framework of the national ICT policy and establish a basic delegation of this procedure. Regardless of the development of sexual orientation and the promotion of ICT in the area of general policy, most countries do not appear to have sexual orientation as part of their policy.

Nonetheless, the expanding enthusiasm of some state actors to work in the human asset improvement and advancement strategies in existing national ICT structures can encourage governments' enthusiasm for sexual orientation proactive ICT policies. Among non-government associations, including women's groups, there is a developing enthusiasm to assume a more active part in influencing national policy formulation that has an effect on women and their relationship to ICT (Ramilo et al, 2007).

Ramilo et al. (2007) highlight some of the sustainable aspects inadequately addressing the gender ICT disparity that needs to be considered to make sure that there are clear points of interventions such as:

- ***Creating gender and ICT success indicators:*** Recognising gender indicators in ICT activities, regardless of whether in policies, programs, projects or tasks can be a viable method for guaranteeing that women-specific needs are considered in planning processes. Sexual orientation indicators are valuable devices for measuring or assessing the effect of advancement activities in general and can be implemented in the ICT field.
- ***Integrating gender analysis in national ICT policy frameworks and policies:*** The huge gender gap and in several cases, the complete non-existence of gender consideration are noticeable hindrances in creating the gender-based policies and strategies which are gender- responsive at the national level.
- ***Establishing government's commitment to promote women in ICT access:*** Gender sensitisation development has been an initial step in gender mainstreaming with a proven track record to help advance the women agenda imbalances. Legislation and policymaking needs to take cognisance of the specific issues that have had an impact on gender imbalances and an impact on women. The emphasis on the involvement of various state-owned companies relevant to the development of telecommunications is necessary. These are important entities to ensure implementation of programs and agenda for rural women's development with the help of national ICT policies and strategies. The strengthening of the gender mainstream within the

relevant entities assigned to the execution of the implementation of such plans and policies, should be prioritised and executed

- ***Promoting responsive gender e-governance:*** For women to have meaningful participation within the mainstream of decision-making for transparency and accountability, there is a need for responsive governance. Thus, women's representation is crucial to creating the conditions and laws that will enable them to improve the possibilities of reaping the benefits of ICT. This will make sure that regulators create conditions that will enable women to maximise ICT benefits.
- ***Dealing with Universal access issues:*** ICT accessibility should be widespread and reachable by all the marginalised groups. This has to be the strategic point of departure for intended policies to address universal access. It is important to make sure that the ICT strategy must not be generic. Thus, a viable business model should be tailored to respond to the different needs of the rural communities.

Finally, it is critical that policies which are pro-rural women be incorporated into all the National ICT plans with clear objectives and milestones that are achievable and measurable. This will go a long way to make sure that there are sustainable ICT services within the affected rural communities.

2.3.8 Television White Spaces Technology

Masonta (2013) states that the Television "White Space" (TVWS) is the low power, not licensed portion of the communications services in the non-reserved portions of the radio frequency spectrum that falls within the television radio frequencies in South Africa. This is localised within the most lucrative spectrum allocated to over-the-air television frequencies. Even though the number of the less utilised channels differs from location to location, there are a white space frequency band available in the South African market. The use of TVWS is hugely dependent on the Government of South Africa releasing a policy directive on the digital dividend spectrum currently used by the Analog Broadcasting Television.

Cambridge White Spaces Consortium (2012) made mention of the fact that mobile connectivity has never been in massive demand. ICT and wireless access to the web are far ahead, but there are a number of other applications. This need has been exacerbated by developments within the ICT and devices which granted access to brand new services in a way that previous technologies can only have dreamt

of. The increase in the demand for wireless services has placed a great demand on the network infrastructure.

According to the Cambridge White Spaces Consortium (2012), operators are deploying the fibre network closer to the end users to provide a superfast wireless ICT network, to bring access to the growing range of connected consumer devices. The latest technologies together with macro cells have helped to provide better use of the available spectrum allocations for enhanced performance than the wireless networks delivered, and this can also add to spectrum capacity.

Silva, Alves and Gomes (2011) made an assertion that "With the Switch-Off of analogue TV and the adoption of Digital TV (DTV), portions of the spectrum of the Ultra High Frequency (UHF) band will be released and interleaved according to the geographical region, creating what is known as TVWS. Due to the excellent propagation conditions of this band, the TVWS is seen as an opportunity for new services and business."

Kumar (2010) explains that, traditionally, TV broadcast transmission took place in UHF and the Very High Frequency (VHF) range in a 6-8 MHz band per channel. However, these bands of frequencies, which occupy different positions in the frequency range from 470-698 MHz, remain highly underutilised. Their occupancy pattern changes with geolocation and, in deep rural environments and semi-city-based areas, they are mostly started because of fewer broadcasters and licensed microphone users. Apart from these, there are protective bands of unused radio frequency spectrum between bands utilised by TV signals serving the purpose of avoiding interference. These guard bands will not be needed for the latest digital technology which will substitute older analogue TV signals.

The favourable propagation characteristics of TV bands support cost-effective network coverage over larger distances and enable wide area networks to reach indoors to a greater extent than higher frequencies permit. In this way, the UHF bands are complementary to other bands in supporting broadband Internet access via a range of fixed, portable and mobile devices (Cambridge White Spaces Consortium, 2012).

According to Silva et al. (2011), one of the technologies which can be deployed using the TVWS is long range Wi-Fi with benefits. The effective use of the spectrum on demand will allow mobile wireless providers to “offload” more than a third of the data traffic, increasingly reducing the number of sites which had to be deployed and operated and this substantially enhances the value.

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It is vital that the UHF bands be opened with as much flexibility as possible to encourage innovation and allow the market to respond more rapidly to advances in technologies and changing consumer requirements (Cambridge White Spaces Consortium, 2012).

The TVWS, being the below-1GHz frequency spectrum, has predominantly great propagation characteristics. There will be greater benefits for the operators using these bands which will make sure that the technologies used are able to cover long distances without line of sight, or at short range distances using very minimal power. This makes the band ideally suitable for some areas which need the seamless low power range connectivity (Thanki, 2012).

> *"Certainly, bridging connectivity gaps between rural and urban areas is of high priority on the strategic agendas of regulators. Connectivity, as an enabling platform for rural economies, can integrate the rural business into national and global markets. Through this, it is possible to empower rural enterprises, providing them with the tools to explore and benefit from ICT*" (ITU, 2013).

Thanki (2012) made an assertion that the TVWS spectrum has the ability to be the global first available broadband capable license exempted frequency in the optimal functioning sub-1GHz spectrum. In the urban areas, which are not connected, and the rural communities, small start-up businesses can utilise the less expensive but dependable Wi-Fi and other types of radio equipment that can operate on a TV band white spaces spectrum to deliver cost-effective ICT services.

Thanki (2012) further indicates that the license-exempt technologies that TVWS is part of are cost-effective, power-efficient and provide users with a number of technologies and control over the networks and infrastructure deployed. These include hospital in-patient cardiac monitoring systems or a multi-million node smart metering mesh network. However, it has to be noted that some uses might compete with this cost-effective spectrum.

In a case where the requirements are competing for similar spectrum, it is important to think about how much they can produce value for society and not only for producers and users. Certain uses, such as broadband and television, have proven to be of great benefit to a wider society by promoting larger political objectives, such as the promotion of social cohesion and the promotion of cultural identity and education.

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It can also be highlights one of the main policy goals of the state which is to encourage access and inclusion for the rural communities to important services. Universal access is broadly considered as developing a sizable public value. This can happen, for instance, through the contribution in education and social inclusion. Universal access mainly means the availability of critical services at affordable cost to rural communities that might be deprived of these as they are in isolated areas or communities that are not economically viable.

According to ITU (2013), one of the challenges of low-income users is the low number of people in regions which also have challenging geographical landscapes and which contribute primarily to the cost-effective network deployment in such regions. Access to these regions using the fixed-line technologies is much more expensive and less return on investment levels will keep prospective investors away from these rural communities. ITU (2013) further highlights wireless solutions as a practical alternative option, especially those which can achieve huge coverage with a small number of base stations. Such alternatives can include wireless networks in lower frequency bands as well as satellite-based solutions, and lower-frequency fixed ICT wireless access.

Therefore, according to Bazelon (2009), wireless technology is an effective option for better coverage for ICT services with an optimum uptake. Wireless solutions supply the ubiquitous connectivity and this will ensure an increase in data services, more so with the increase in access of smart devices. Moreover, the wireless ICT solution is the most cost-effective solution to reach the sparsely populated rural communities. The benefits of ICT, according to the literature, indicate that wireless is the only amplified solution with the mobile network deployments because of the inherent mobility characteristic nature of such services. Consequently, the prominent availability of the frequency spectrum of ICT networks can be expected to have far-reaching benefits.

It is for this very reason that ITU (2013) conceded that as an increased number of users utilise the increased amount of mobile data, this will result in an increased demand on the spectrum for mobile allocations. The spectrum remains a finite commodity, and the auctioning approach can only be due to the need to meet the ever increasing demand for this commodity. The database controlling spectrum sharing made sure that the utilisation of the commodity shouldn't remain fallow while protecting the existing customers. A huge part of this spectrum is residing on the lower-frequency spectrum.

The World Bank Group (2016) indicated that the major benefit of the low-frequency spectrum over the higher frequencies for the mobile networks is that greater coverage can be achieved with less base

stations and handsets for similar transmitted levels of power. One of the technologies that can be used by lower-income users is the TVWS Wi-Fi, which can give benefits to a lot of rural communities, which are difficult to serve using the current technologies due to the uneven landscape and topological challenges. The TVWS technologies have the ability to override these challenges and limitations. The solution offers the coverage of the biggest range using approximately the similar power and deliver more bandwidth with more consumer benefits using the lower network costs.. Consumers will also be able to feed the edge of the forever increasing need for more bandwidths as the Internet will be able to provide increased throughputs in the most remote rural areas.

In conclusion, various literature studies have indicated that the most viable last mile for the ICT services roll-out within the low-income communities is the wireless solution. One of the biggest challenges in rolling out affordable ICT solutions within these communities is the lack of cost-effective wireless solutions due to the sparsely populated target communities. One of the proven benefits of the TVWS spectrum band is that it can cover larger distances due to the favourable propagation characteristics of the lower frequency blocks.

One of the solutions to the South African problem to roll-out the cost-effective solution for the Low-income community is the use of TVWS technology. The adoption of the TVWS will make sure that the much-needed ICT services reach the low-income users and this, in turn, will make sure that people within the underserviced communities will receive the much-needed services. This will make sure that the communities become economically active.

2.3.9 Funding Mechanisms

The State resources are very limited and it has become very difficult to allocate additional resources to the roll-out of ICT infrastructures. It would be ideal for the state to source donor funding and also explore public and private partnerships (PPPs) to make sure that enough funding is available. The investment requirements for the ICT projects is minimal compared to other infrastructures such as roads and the bulk of the funding for the projects is expected to come from businesses. It will, therefore, make sense to channel investments into the ICT projects to ensure an enabling environments is in place to maximise private sector investment.

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However, Zhen-Wei Qiang (2012) indicates that there are a few key issues to consider before and when public funding is utilised for ICT connectivity to expand financial and social benefits, either as a major aspect of an economic stimulus or as a separate plan:

- ***Ensuring that markets work first:*** Before making public funding in the implementation of the ICT networks, governments should first take a look at the regulatory frameworks that might have the capacity to promote new entrants and market competition, and thus amplify what the market can deliver on its own.
- ***Open Access:*** When the State makes a decision to make an investment in the market as part of an intervention due to market failure, the roll-out infrastructure should be available through the open access rules so all the users will have access to services on equal and non-discriminatory terms and conditions.
- ***'Crowding in' private capital:*** The ICT sector had selected a market-based funding approach. The PPPs remained the most effective means of funding as it can source the investment resources and technical skills of the private sector to meet the universal access and service objectives.
- ***Public Sector investment in passive infrastructure:*** This is another important space where the state can quickly assign people to do some work and build a platform for future economic development with very little market distortion.
- ***Rural Strategy***: One of the effective investments in the developing countries might be in the high-speed backbone networks in the most rural communities and the last mile can then be left to the private sector.
- ***Demand-side stimulation:*** The demand-side stimulation policies are important for ICT adoption and uptake and for the robust development of ICT infrastructure in the long run. The supply of online information by the government will be ideal to provide business and citizens incentives for the adoption of ICT.

Kelly and Rossotto (2012) outline different funding mechanisms that can be considered to finance ICT services deployment. Types of fiscal support include:

- ***Private Investment:*** This is the initiative where private individuals are involved heavily in ICT infrastructure investment. Some of this investment has been heavily experienced in the roll-out

of the undersea cables linking Europe to Africa. There is also a greater need for the Private Sector to invest on the last mile connectivity.

- ***Direct government intervention:*** The private sector should be the main investor for the deployment of the ICT infrastructure with public sector intervention only needed where there is market failure and within areas considered not to be economically viable.
- ***Public-private partnership models****:* The use by the public sector to promote ICT development by sharing financial, technical, and operational risks with the private sector should be encouraged.
- ***Local efforts, bottom-up networks***. There are some great examples of how local efforts within the rural communities or the bottom-up approach networks had turned out into the financing of the ICT network implementation. The development of the municipal ICT networks supplied an additional source of financial investments for the municipalities for the implementation of the ICT networks.
- ***Universal service funds for ICT.*** The definition of the universal service funds is previously defined for the offering of voice services and there is a need for the strategy to be refined to cater for the roll-out of data services. This should cover the whole range of ICT services.

It should be noted that the funding of the backbone infrastructure will have to be through the private sector with the public sector only required to fund the civil works and the ducting to secure the arrangement of the open access and reinforce the sustainability of investment.

Additionally, it has to be noted that other sources of funding for major projects within the ICT can be summarised as follows (SADC, 2012):

- ***National and International Operators funding their network and service development* –** This remains the main source of ICT funding for the organic growth built on revenue streams from the customer base.
- ***National Operators channelling funding in shared ICT facilities* –** This arrangement is normally some sort of a consortium which is made by a number of prospective investors to co-build a submarine cable or masts in a remote location. There is also a different approach where the wholesale open access carrier and mast provider offer services to local retailer operators. Equally, there is also a virtual network operator called the Mobile Virtual Network Operator (MVNO) model which is also a form of shared network financing. Local operators are currently

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considering the deployment of the fourth generation networks, particularly in the deep rural communities.

- ***Premium user groups*** –these are some of the prominent users such as the ISPs, government departments, national research networks and big national companies who might pre-procure bandwidth on a planned network as Indefeasible Rights of Use (IRUs) at lower rates. This is the alternative source of funding for the operators and has been used to finance the roll-out of some of the private submarine cables in the continent.
- ***Central governments*** **–** The state might finance the measures to improve the enabling environments such as rolling out of the fibre networks and passive infrastructure such as ducts and right of way. The state might also use public coffers to finance open-access backbone networks often supported by grants.
- ***Co-government funding*** – This arrangement is usually for capacity building, including studies and institutional start-ups but also concessional finance lending. It is a common form of vendor funding with the loan linked to the equipment supply.
- ***Other national and international non-ICT private players*** - These include commercial banks or pension funds that might channel funding for a selected project, often based on their relationship with those who are funded.

One of the major challenges on some development project is not lack of funding but lack of structured projects which are economically viable (SADC, 2012). According to SADC (2012), the complication on the return on investment on the full economic and social returns may not be directly clear within the ICT sector but might be experienced on the indirect impact on other areas.

A detailed analysis conducted since the 1990s has culminated in the World Summit on the Information Society (WSIS. It shows that there is a clear-cut case for targeting each citizen, including rural communities that had access to ICT services (SADC, 2012). This resulted into a relatively well defined set of requirements around the international, national and local governments' connectivity. There is, therefore, a little argument about the scope of finance required since the major costs is on the civil works and masts.

According to SADC (2012), the major intervention will come up with a decisive plan on how the deep rural is going to be reached and the public sector budget needed to fill the gap left by the market failure. The two are linked as the market may get to the rural communities but as a very last resort and at a very

late stage of the infrastructure roll-out. This could be the most needed motivation for obtaining development and public funding.

Finally, Labelle (2005) highlights that the dedication to ensure universal access is the primary effort to cover and include everyone in the digital economy and is the initial step in bridging the digital divide. A funding model to cover the cost of the universal access will have to be negotiated by the regulator and the government department responsible for the sector. Network operators are expected to pay license fees and contribute to the universal access fund to cover the cost of rolling out the ICT infrastructure.

2.4 Conclusion

The Policy Paper Series (2011) highlights the need for a suitable ICT infrastructure that encourages economic development and more inclusion for a stronger ICT network at cost-effective pricing. ICT must be considered as an enabler to deliver data and encourage innovation rather than a specific network speed. Thus, the definition of ICT has to be regarded as an ability that is "fit for purpose" and not just in the immediate market context but equally in the dynamic context which allows capabilities to expand around the user requirements and changes in relative prices. The Policy Paper Series (2011) further emphasises that the economic and employment benefits of ICT access, particularly in the underserved areas, outweigh the costs.

However, one of the biggest problems is the continued investment in the ICT infrastructure in urban areas. The Integrated ICT Policy Green Paper emphasised the need to rechannelling funding away from some of the urban infrastructure to the rural underserved areas. This should be done through financial incentives and subsidised arrangements, together with open access wholesale laws to ensure service-based competition. This will appear to be another way of ensuring affordable access to ICT services for all the rural communities.

Another key highlight of the literature study is that important spectrum needs to be released by the broadcasters and made available to the cellular operators. There will be a need for effective regulation to address the lack of sufficient spectrum to cater for the ever increasing demand for data services from the cellular networks. The spectrum policy in the developing economies is largely driven by short-term quick revenue generation by governments and this results in policies such as "warehousing" spectrum

and spectrum caps. The demand for spectrum will also exacerbate the restriction, but this will ultimately limit the growth rate and increase the prices for the users.

The Department of Telecommunications and Postal Service (DTPS) has also emphasised that municipalities are an important component of government and is a layer where services to citizens are provided directly. The Department of Cooperative Government and Traditional Affairs will play an important role in the plans for coordinating the local governments in the implementation of ICT interventions. It suggested that to incorporate ICT into cross-sectoral deep rural development plans, it is progressively vital to comprehend the local needs and context into which information is relied upon to be made accessible and utilised.

Change Management is critical for the seamless adoption of the new technology introduced into the rural community. The study emphasised that the delay of benefits from ICT usage is partly because societies had not had prolonged exposure to technology in general, which is a fact underlying the need to develop behaviours which are supportive of sustained adoption of technology before the consumers can experience the full benefits of ICT deployment. Thus, change management is critical to ensure the seamless introduction of new technologies to deep rural areas.

Cost efficient and working technology is also essential to ensuring a strategy for sustainable ICT development in deep rural environments. According to Thanki (2012), license-exempt technologies, of which TVWS is a part, are cost-effective, power-efficient and provide users with a range of technologies and excellent control over the infrastructure deployed, whether it is a hospital in-patient cardiac monitoring system or a multi-million node smart metering mesh network. However, it has to be noted that some users might compete with this cost-effective spectrum.

2.5 Summary

The National Planning Commission (2012) also noted that the costing of services and the infrastructure remains a significant hindrance to the increased use of the mobile devices and the fixed-lines, with a limited network competition further escalating the costs. The policy blockages, limitations in the institutional arrangements, duplication and conflicting policies between a number of departments, regulatory limitations, and the constraints competition contributed to this challenge. The ability of the regulator, the ICASA, to create environments for a more open market has been hindered by legal constraints, limited capacity, and skill sets.

There are several critical factors that will drive affordability in emerging markets. The first is an innovation by service providers and content generators regarding their price structure and business case. There will have to be innovative means which will afford lower income users to have ease of access to the much-needed services. The regulators will have to come up with the mechanisms which allow flexibility and not inhibit it by preconceived notions of the correct pricing structure. The market competition also has an important role to play for the service to be affordable and accessible. The introduction of market competition within the ICT sector reduces the cost of communication (The Policy Paper Series, 2011).

The second is the power of relevant content. The extended availability of the relevant content and services which are highly considered by the rural communities, and this can be watched from the smart devices using the local languages, will be a catalyst to greater demand for access to data services. The initiatives that improve the economic development and social dividends of the rural communities will help improve job creation, sell the most needed goods, provide access to health facilities, and all this can drive the demand across a wider range of income levels. Over and above, the social collaborations are already emerging as a prominent solution (The Policy Paper Series, 2011).

The third factor is the cost of communication and the cost-effectiveness of ICT services for the rural market within the remote areas. One of the models called the "calling party pays" with other highly innovative pricing structures is necessary for the wide spread of the mobile devices. However, the data services have not yet been implemented for the data markets for both fixed and mobile. Furthermore, creative thinking around data structure is required for the possible delivery of services to lower income rural users. This is a tricky approach in a particular competitive market and creates difficulties for the policymakers to ensure access to data services (The Policy Paper Series, 2011).

Many other challenges have been highlighted and need to be addressed to make sure that a strategy for sustainable ICT is achieved. Technology and service neutrality have to be enforced by the regulators to ensure maximum utilisation of scarce resources and spectrum. The service-neutrality is based on the premise that service providers are able to offer any type of services over the seamless network infrastructure. This will be contrary to the past where networks had limitations and were purpose-built. This configuration changed as the information and communications became more digitised and it became possible for networks to support similar or substitute services. The robustness should tolerate any use of technology to utilise the spectrum which is most suited to it and, hence, will allow a spectrum move to productiveness which will include ICT services using the voluntary market mechanisms.

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Technology and service neutrality facilitate and promote network convergence and encourage innovative services by reducing the number of licenses required by operators for the variety of services over a single network. Neutrality is also able to eradicate and deal with contradictory regulatory frameworks such as the different standards of reporting and the requirements provided under service specific regimes. Thus, a need for the reform of the licensing regime from traditional service specific licensing to a more consolidated and unified licensing framework which will cater for technology and service neutrality is required.

It is equally important to note that the main principles of regulatory framework cover the establishment of conditions for effective competition in the supply of the ICT and the relevant services based on the technological neutrality as well as for the promotion of effective investments in the network infrastructure. If it is feasible from both practical and economic views, regulation should particularly promote the infrastructure-based competition, and in the case of access networks, the objective of the regulation is the promotion of competition at the level of services.

Lastly, to make sure that the highest number of users, regardless of income should benefit from the next generation technologies, it is important for the policy framework in the developing market to be adapted. The current approach dominating the policy discussion is one of the fibre optic cables reaching the rural communities. However, the discussion about the many critical matters should also take account of the comparative costs of various technologies. The significant investment in fibre can ultimately prove expensive and inefficient. Thus, a cost and practical connectivity solution will have to be identified.

The literature study also highlighted that there will need to be a focus on people and not technologies, on what technology can do for the people, if the Strategy for Sustainable ICT is to be successful. This type of focus means starting all the thinking and decision-making with the people who will use the technologies in the context in which they will use it. One other important aspect which needs to be considered when introducing a new technology is the involvement of the local community. The role of community participation cannot be underestimated as this will ensure an ease of adoption and acceptance of change.

The other important factors for the strategy for Sustainable ICT are the need for legal and institutional frameworks to maximise the impact and use of sustainable ICT interventions. One of those institutional frameworks is the government which can help lower the capital expenditures in the targeted underserved areas by providing real low-cost infrastructure for central facilities.

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Governments also need to reaffirm the aggregate basis of rolling out ICT as a method for supporting social and monetary advancement objectives openly. This requires characterising an accord around goals and qualities that link technology uptake to economic and social advancement. When this vision is created, it is critical to build accord among policy creators and common society around the criticality of ICT utilisation. Utilising this common vision as an establishment, the objectives ought to be characterised in view of thorough analysis of capital investment and social and financial returns, and policy tools.

The literature review also highlighted the fact that the custodian of the strategy for sustainable ICT will be required to provide direction in assessing the impact of ICT on the livelihood of the rural communities, both in quantitative and qualitative terms. This requires systematic data collection, monitoring and evaluation review efforts to make sure that the funding has been properly channelled and achieved the results anticipated at the beginning of the program. The ICT can contribute to the vision enshrined in the strategy.

It was also identified that strategy for sustainable ICT for deep rural development can be achieved by reducing the gender digital divide within rural communities. ICT can be instruments that enable diverse classifications of women with data and aptitudes for political, financial and social interest, practical nourishment security, and employment. It can give access to prepare and market knowledge for women business visionaries and a modest and speedy method for gathering information for women's associations.

Rural women empowerment is a tricky issue that requires involvement in the development which changes and shapes their lives. The women maintain a good livelihood for the rural communities through ploughing and harvesting. ICT has the potential to empower them in the development of important projects to reduce poverty and provide them with education and development as well as other informal employment opportunities within the rural communities. The adoption of ICT in the rural communities together with education liberates women from the discrimination due to the Bantu education system. These are very important elements that form the building blocks of empowerment. Empowering Women using ICT will make sure that the most needed skills and expertise remain within rural communities as women are expected to stay at home and raise the children and thus the chances of migrating to urban areas to seek employment are very slim.

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Women's role in ICT can be further entrenched by effective political arrangements, living conditions and the socioeconomic situation in rural parts of South Africa. The liberation from cultural norms and the social and economic empowerment are dependent on the areas that influence the utilisation of ICT by rural women. Initiatives similar to effective infrastructure such as affordable and dependable ICT have promoted the development of rural women.

There is a notion that is linked to a position which proposed that women are minimised from technological development due to two related processes. Initially, the vigorously male-dominated work structure of the ICT business has been summoned to recommend that technology is prone to be created from a male viewpoint and without thinking about women's appropriate utilisation of technology. Secondly, it proposed that the assignment of unskilled women's work has implied that ladies have been situated in occupations which had not required the utilisation of technology, or that technology had not been brought into the work environments where women prevailed. The policy that advance and upheld the gender digital divide must be proclaimed and established.

Various funding mechanisms have also been highlighted and discussed. The study indicates that the state has significant resource constraints, and it is unlikely to be possible to allocate substantial resources to all the projects. The ICT projects normally require the least amount of funding in comparison to most of the other infrastructures with a significant portion of the funds expected to come from the private sector (Hammond, 2016).

This has placed the responsibility for funding of soft projects on government for an enabling environments which will ensure a maximised private sector investment. However, it has to be noted that the major problem is not the availability of funding, but structured projects which can make the case for the investment (SADC, 2012). This can present challenges for the social ICT projects on full economic and social returns of investment as this might not be directly clear within the ICT sector but can show up as an indirect impact on other areas.

Some of the suggested funding mechanisms are the public-private partnership and joint funding. The joint funding can be between the government and state-owned entities and also private players. The Government can act as guarantor and also offer incentives to promote and encourage private investment.

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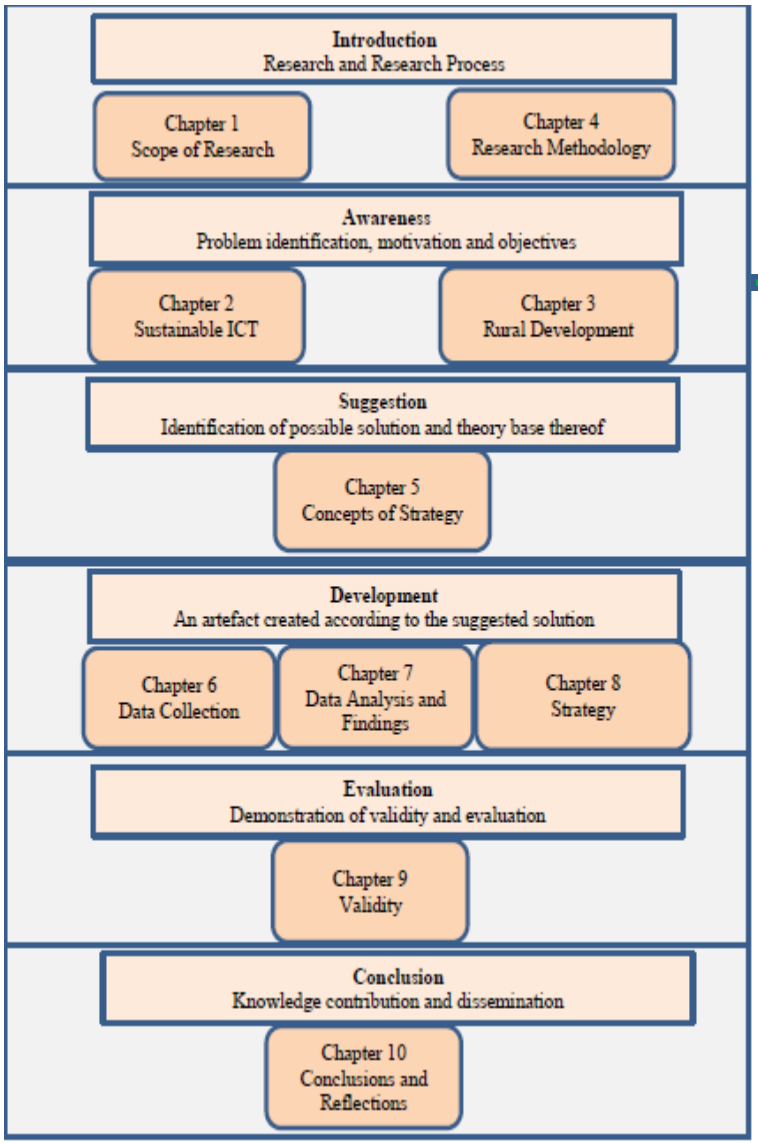
CHAPTER 3: RURAL DEVELOPMENT AND CONNECTIVITY



Chapter 3 Rural Development and Connectivity

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3.1 Introduction

The government of South Africa and the relevant departments have formulated ICT policies over the years and this chapter will explore these policies and establish their successes and failures It will highlight areas of improvement arising from the shortcomings of the previous strategies and will address the gaps in the existing policies which are necessary for the strategy for sustainable ICT development in deep rural environments. Section 3.2 of the chapter provides an overview which covers the background of ICT while Section 3.3 looks into the Integrated Rural Development Plan which is one of the government's blueprints of rural development. Section 3.4 looks into the aspect of rural connectivity and what it takes to have the rural communities fully connected and Section 3.5 deals with the challenges and failures experienced when addressing rural development. Section 3.6 looks into the considerations which are important when establishing policies for rural development. Section 3.7 looks at various strategies previously implemented by the government. Sections 3.8 and 3.9 provide a conclusion and summary respectively.

3.2 Overview

ICT is largely considered to be a vehicle for the improvement of the livelihood of the rural poor and not only a means of understanding the complexities of rural livelihood strategies through improved data collection. The convergent nature of ICT, which is characterised by a level of flexibility, must be used as a benefit for crafting the rural development strategies with the decentralisation of control over the technological platforms and the information system permitted down to the local level. The rural communities must be able to explore the possibility of using information through the potential offered by the ICT. It is for this reason that information can be referred to as a public good when its flow is not restricted and its values kept by individuals (Chapman and Slaymaker, 2002).

One of the major problems with the deployment of the ICT infrastructure is the uneven deployment and roll-out of the networks between the rural and urban areas. Greater collaboration is needed between the development practitioners and the technical experts to promote the full participation of the design of the appropriate networks for the rural communities (Chapman and Slaymaker, 2002).

There is a need to develop relevant rural e-government content to offer citizens easy access to services and improved interaction between the government and the people. This could demonstrate the commanding power of ICT within the rural context and become a reference model for future offerings of Government services. These types of projects can also yield considerable benefits with a reduced

cost on the end user devices which could make it much easier to reach the remote locations. They will utilise the present ICT infrastructure and Internet access through the Internet service providers as a cost-effective connectivity solution. The information will be packaged in practical formats as a single point of access, such as the kiosks connected to the Internet service providers, for the use of a rural community. Some of the service providers in rural areas have implemented the proof of concepts using wireless technologies. Some of the technologies include the wireless mesh which has been implemented by the Council for Scientific and Industrial Research (CSIR) in Limpopo. It suffices to say that some of the piloted projects have not yielded their intended purpose for a number of reasons which includes the lack of funding for the continuing operations and support.

A number of issues need to be considered when technologies are being piloted in rural communities and these include the following:

- Development of user-centric services and reliable service delivery platforms;
- Informed choice of suitable technologies for rural accessibility and information dissemination solutions;
- Cost-effective access platforms such as kiosks, which will promote an uptake by the local small businesses;
- Full participation of the local communities during the design of a suitable ICT solution with a building of trust in the process;
- Involvement of all the relevant stakeholders with much-needed skills and expertise as this will enhance the speed of the implementation and offer a better value proposition to the rural community;
- The appointment of a project champion with full accountability to deliver the projects on time and with a smooth handover to the communities at the end of the project.

The rural ICT platforms may also be offered through the Internet portal hosted on a server which provides access to the local community through an affordable Internet solution. The delivery of the information between the servers will be through an Intranet or LAN platform with servers for the particular department (Rao, 2010).

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3.3 Integrated Rural Development Plan

The National Planning Commission (2012) articulated that by 2030 rural communities in South Africa should have the capacity to participate in economic activities, social programs and political status within the mainstream of the country. The platform must be able to afford the rural communities a means to access high-quality basic services which will enable them to be nourished with good health and increased skills. The vision advocates an integration process for the rural communities, which has to be achieved through successful land reform, ICT infrastructure development, employment creation and poverty elimination. Agricultural development is always an ideal approach when developing the rural communities; however, this will need to be supplemented by technologies which can assist in the marketing and sales of goods online.

The implementation of strategy for sustainable ICT will be an enabler to improve the low economic potential, the standard of education, healthcare, and social security to support the development of human capital. The economic development of the rural community will also be boosted by sound economic growth, which is not necessarily agricultural activities to improve the development but can also explore the capabilities of the ICT. Access to basic social and infrastructural services was a high priority for many rural households as articulated in the NDP. The major concern was that ICT as an enabler does not feature as one of the vehicles to ensure integrated development of the rural communities.

One of the major opportunities in providing ICT to the rural communities would be the reduction of poverty. It would also empower the local SMMEs to help serve the poor. The local agencies can contribute to the well-being of the local citizens by productively utilising the information on the viable systems running over the ICT infrastructure. A typical example is the Chilean's electronic rural information system which was used to connect farmers' organisations, rural municipalities, NGOs and local government extension agencies to the Internet. Balit, 1998 estimates that credit facilities will cost 40% less than the traditional methods when transmitting information around prices, markets, inputs, weather and social services. Similar projects have been applied in Mexico as well (Hanna, 2010).

ICT plays a pivotal role in addressing some of the challenges and in developing the rural communities to improve their livelihood. It offers an opportunity to introduce innovative ideas and relevant applications to the rural communities. This could help curb the urbanisation drive. Since 1995, rural individuals have migrated to the urban areas in huge numbers, and in 2016 the population increased

from 54.5% to 63.9%. This is mainly attributed to the lack of development and service improvements within the rural poor.

ICT is able to play a crucial role in eradicating poverty and promoting sustainable development by using information-rich societies and supporting the lives of the rural communities. ICT has powerful tools for economic, social and political empowerment if properly implemented (Kumar and Sigh, 2010).

Rural development is an important and critical agenda for the government and will require some focused areas. It is important to note that the role of ICT has not featured very prominently in most of the rural development projects. The primary reason for this is the lack of proper ICT infrastructure due to the lack of a strategy for sustainable ICT. The agricultural sector is the most important one with more than 36% of citizens living within the rural communities. The biggest challenge is for this sector to enhance production due to the competing nature of the resources.

The DoC (2011) indicated that the South African rural communities have a unique dynamic, while the rest of the country has some challenges in common with other countries. The DoC (2011) further highlighted that rural development is the term used to highlight the actions and programs implemented by the government in non-urban areas, rural areas, to improve the standard of living of peripheral populations. The standard definition of the rural communities is used in several countries. It is used in reference to the small number of residents in open spaces, sparse population and where the manufacturing base is weak due to poor development or the unavailability of necessary information and communication infrastructure. Agriculture, commercial farmers, small farmers, small towns and villages, including nature conservation areas and other resource-based activities, are the cornerstone of many rural livelihoods. These differences are based on a number of other variations, including ecological and natural resources, human approaches, differences in language and culture, lifestyle differences, proximity of large urban and industrial conglomerates, all of which affect the rural image disadvantageously.

Chapman and Slaymaker (2002) highlighted that information and communication technology is an essential part of the development of rural communities. These rural areas are often characterised as knowledge weaknesses and the dissemination of information has always been the focus of rural development. Chapman and Slaymaker (2002) further assert that the rural poor generally do not have access to the vital information they need to live or for their livelihoods. A combination of a deep understanding of the challenges of rural development and an understanding of the existing ICT skills

could enable the government to develop ICT skills more effectively to support rural development strategies.

The poor are not just deprived of basic services; they also lack access to information to do with market prices, health, public service and their rights that are vital to their livelihoods. They have no political voice in the institutions and power relations that affect their lives. They do not have access to information, education and skills development that can improve their livelihoods. They have no access or information about income creation opportunities (Blake and Garzon, 2010).

According to Blake and Garzon (2010), as noted in many literature studies, knowledge is a decisive resource for informed decision-making and can affect the extent to which a person can access different services, goods and markets. It is the source of opportunities, so the challenges of obtaining information or lack of access are sources of inequality in the various areas of human development. Therefore, information is considered to be the main asset necessary for the survival and liberation of people.

Research on the relationship between ICT and development has changed the question of whether the relationship between technology and development is trying to understand how to maximise the benefits that ICT and adoption can provide for the developmental agenda program. (Brown and Grant, 2010). Blake and Garzon (2010) considered ICT to play an important role in the eradication of poverty when the benefits of knowledge are considered as strategic development. Therefore, the rural development strategy could never be completed without obtaining information about the development of the deep rural communities.

The Department of Rural Development and Land Reform (DRDLR) is the custodian of development and improvement of rural communities. The DRDLR outlines its mandate as:

> *"To create and maintain an equitable and sustainable land dispensation and act as a coordinator and catalyst for rural development to ensure sustainable rural livelihoods, decent work and continued social and economic advancement for all South Africans."*

A brief analysis of the department's mandate gives a sense that the major developmental focus in rural communities is a land development and no other economic drivers such as ICT.

ICT is one of the role players in a broad-based, cross-sectoral poverty reduction plan and universal access strategy which can be promoted to improve rural ICT access. However, the potential of ICT as

an enabler for rural development strategies needs to be assessed to inform the developmental policies in a more effective manner. It is necessary to scrutinise very closely how the specific opportunities presented by the new and converging ICT can be harnessed to support the processes of rural development (Chapman and Slaymaker, 2002).

Chapman and Slaymaker (2002) further indicated that ICT activities are a fundamental element of any rural development activity. Rural communities are characterised as having very little information and this has always been a key element of rural development. Poor people in rural areas generally lack access to information that is vital to their lives and well-being.

ICT should be seen both as a means to understand the challenges of rural business strategies to improve data collection and to facilitate differentiated approaches to achieve rural development objectives. The fact that ICT is so flexible means that it can be used in future rural development strategies if its decentralisation and independence of information systems reach the local level (Chapman and Slaymaker, 2002).

3.4 Rural Connectivity

ICT activities are a major component of any rural development plan. While education and development created subjective abilities, information offers substance to learning. The significance of information for advancement is undoubted. However imperative issues encompass whose reality the information actually reflects, and who can utilise the information and for what reason (Chapman and Slaymaker, 2002).

One major challenge is the fact that acquiring rural consumers is financially unattractive for the network providers. This is due to low purchasing power and sparse population density which leads to limited returns on investment in the infrastructure for the service providers. Implementing universal access for an individual user and household might not always be practical, particularly in rural or difficult to reach areas. Therefore, it may be advisable to pay more attention to institutional solutions that provide information and communication technology to consumers, particularly in the remote areas. These projects are often financed, at least in part, with the funds of the universal service obligation Funds" (USOF) (TRAI, 2015).

TRAI (2015) has further highlighted that ICT has great prospects for ensuring inclusive growth through the promotion of education, health and economic inclusion in rural areas and low income groups.

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Providing these services with viable and sustainable results requires full coverage and practical goals for networks with greater data speeds. These, in turn, require a focus on critical factors in both the supply and demand-sides. On the supply side, decision-makers and service providers must respond to the availability of limited frequency spectrum, the affordability of the devices and the lack of quality network performance. On the demand-side, when the government has to solve problems regarding the delivery of e-government, the industry must guarantee that it can develop its services and receive new markets with new models of viable business.

It is important to note that a large part of the cost of building the network is generated by civil works. To reduce costs, delays and disadvantages, the introduction of major infrastructure requires a clear approval process from local municipalities, roads, railways and energy supply. This is an area in which the intermediate milestones of the process are crucial and not simply the achievement of objectives. It requires cooperation from a number of interested parties, identification of specific obstacles, development of cooperation procedures, possible changes to regulatory arrangements and protection of the interests of network builders and owners (TRAI, 2015).

The high cost of public works and passive infrastructure in relation to total investment in information technology and communications requires that the shared use of infrastructure be promoted to reduce the total cost of financing and investment. Obstacles should not be imposed in the same way as commercial infrastructure exchange agreements, since there are cases in which competitors need regulatory measures to be able to eradicate bottlenecks.

The European Commission (2004) estimated that new measures to reduce the cost of using the infrastructure can significantly reduce investment costs.

One of the most important areas is the potential for cooperation to share the infrastructure on the backhaul networks which should be encouraged. Competitive service providers often want to maintain independent backbone networks, but regulatory agencies should facilitate cooperation in the exchange of passive facilities and the construction of common core networks when it is the most cost-effective way to extend the reach of ICT networks to the underserved areas.

3.5 Challenges and ICT Failures

Some noticeable ICT failures were high profile initiatives such as Microsoft's digital villages, large scale projects such as Gauteng online and, recently, the Telecentres, which failed to have a significant impact

on their respective communities. The schools universal service license obligation is also proving to be a challenge, and the initiative is facing what looks like surmountable inefficiencies.

Cave (2008) noted that Bill Gates visited the black township of Soweto on March 9, 1997, an area made prominent by the mass youth uprising 20 years prior. This city symbolises, above all, the oppressive system, unequal opportunities and extreme poverty. When Gates visited in 1997, the spokesperson's review reported that in Soweto "a computer can cost as much as a home" and that few people had the privilege to have access to the Internet.

This was South Africa's first free-access "digital village," an initiative facilitated by Microsoft in collaboration with local ICT companies and the USA developmental organisation, Africare. The plan was that by providing a 100,000 dollar computer package, accommodated in the Chiawelo Community Centre, it would give the rural poor residents a link to the information era. As part of the grand launching, and before addressing a crowd of 200 learners, Gates observed a class from the local Elsie Ngidi primary school using computers for the first time: "Soweto is a milestone. There are major decisions ahead about whether the technology will leave the developing countries behind (Cave, 2008).

Today there is little evidence of the "digital villages" across South Africa. The concept of Digital Village worked well for a while, but then failed as soon as the sponsors stopped funding the operations – the community had failed to utilise the self-sustaining technology.

Cave (2008) further highlighted that some of the contributing factors leading to the failure of the digital villages are:

- ***Technology*** - The technology is donated by Bill Gates and other leading ICT companies. Even though the technology was up to date at the time, it soon became outdated and obsolete. This meant that the community was learning outdated operating systems and software. A significant problem for the initiative is to cover operational costs and thereby keep the place running.
- ***Socioeconomic*****:** Out of the six digital villages that were started, three were dysfunctional within a short space of time. People had vandalised one of them, and the other two did not have the financial sustenance. As with so many other Telecentres, Chiawelo Digital Village continually lost its staff members with core competencies. They saw this as part of their progress in that they had targets of getting jobs for those unemployed. However, in day-to-day terms, it meant

that they spent time training some of the new personnel and developing their skills, only to have them leave and find a better job soon after.

- ***Security*:** One centre in Soweto, which was set up in the year 2000, was robbed at gunpoint within the first two months and then they had three more minor robberies over the subsequent nine months.

It is important to note that the regulator has enforced a license obligation for all the Telecommunication Operators to roll-out services to underserviced areas including rural schools. One of the previous presentations of the operators to the Telecommunications and Postal Services Parliament Portfolio Committee highlighted some challenges experienced by the schools' ICT connectivity. Some of the problems highlighted by the Mobile Telephone Network (MTN) in 2014 during the roll-out of the Universal Service Obligations are:

- In many schools visited after implementation, the computers and servers had been stolen or were not operational (faulty and with no technical support provided by school);
- In most cases, no dedicated ICT educators were available. Therefore, the facility was under-utilised or not used at all;
- Educators did not utilise some of the equipment provided as part of the solution such as whiteboards and data projectors citing inadequate training;
- Laboratories were always locked; only the Principals had keys and as a result there was limited access; and
- In one school, the principal removed all equipment immediately after installation and locked it in a strong room for safety; as a result, learners were not aware that there was a computer laboratory.

MTN (2014) emphasised that security and vandalism had proven to be major problems. These are some of the challenges that frustrate the roll-out of a sustainable ICT service for development in deep rural environments:

Vandalism and copper theft are the most problematic areas. The impact on the industry due to the theft and vandalism of copper is significant, e.g.:

- Security cost
- Replacement cost
- Service denial to the community

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Some of the Figures quoted by MTN on the impact of vandalism between January and September 2014 are indicated in Table 3.1 below:

Table 3.1: Number of Break-ins and vandalism (MTN Presentation to the PPC (2014)

Months	Total break-ins
January	3
February	7
March	6
April	4
May	9
June	1
July	13
August	21
September	2
Totals	**66**

The Department of Basic Education (DBE) (2013) presented a status report on the implementation of sustainable ICT in the South African rural schools to the Parliamentary Portfolio Committee and highlighted the following challenges:

- The absence of a **dedicated ICT** implementation budget;
- The absence of provincial ICT **implementation plans** in some provinces;
- The absence of **alignment** between the provinces and the national strategies;
- The absence of **competent human resources** dedicated to ICT implementation at provincial and local levels;
- Limited **connectivity network** coverage in rural communities where most schools are situated; and
- Exorbitant **cost of connectivity**.

One of the other initiatives was the Gauteng online which is an equally disastrous project belonging to the Gauteng provincial government. The Finance Ministry of Gauteng conducted an internal audit and stated that the main objectives of Gauteng Online will not be met. Schools are not able to effectively implement a technology-based learning environments, students do not have opportunities to develop,

school ICT networks are not fully used and departments do not get return on investment for project effectiveness. There is also no follow-up, and periodic feedback on the effectiveness of the project and the service provider has not met contractual obligations.

Telecentres are also a failed initiative regardless of the injection of funding from the Universal Service and Access Agency of South Africa (USAASA). The factors attributed to the failure of the Telecentre concept will be discussed extensively in Section 4.6.

3.6 Practical Considerations to Establish ICT Policies

According to Kelly and Rossotto (2012), there were certain elements to be considered when governments are creating strategies and policies. Some of these are:

- Develop and implement relevant plans and policies with solid, measurable objectives which can be utilised to create specific strategies for success and support the ICT development;
- Ascertain that the developed plans address the requirements for promoting the supply of the ICT infrastructure as well as for increasing the demand for ICT services;
- Create environments to allow ample opportunity for stakeholders to provide input in establishing the plan;
- Set achievable objectives with recognition and taking into account that the implementation of the plan will take time;
- Focus on successes with longevity by developing sustained efforts for the future;
- Adopt a "one shot" solution which can be achieved in a short space of time. As minimal resources might not produce the best solution, this approach should be discouraged; and
- Ensure the appointment of a coordinating agency responsible for the implementation of the plan.

Furthermore, one of the fundamentals in developing an ICT policy is to make sure that there is a structured approach to the formulation and adoption of the policy and plan. The New Jersey Broadband Plan, Connecting NJ (2014) pointed out that policymakers can include ICT in their plans by determining where you are, where you want to be and how you want to get there. This is shown in Figure 3.1:

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Figure 3:1: ICT Planning Framework (Source: New Jersey Broadband Plan Connecting NJ 2014)

The New Jersey broadband plan connecting NJ (2014) has provided some guidelines on number of things to undertake when implementing a strategy for sustainable ICT in an area. Some of the elements to consider when assessing where **the community is** at the moment are:

- The current situation in relation to network availability;
- The existing ICT reach and coverage;
- Equipment inventory and database on the current status quo on the running ICT community networks;
- The current network speed and the present anchor tenants;
- The users' requirements and services;
- The composition of the constituency and characteristics of the end users;
- Recent undertakings and prospective demands and plans;
- Regulations and policies which may be hindrances to growth;
- Current Franchise and leasing arrangements; and
- Prospective investors.

Aspects to evaluate in assessing where **the community want to be**, includes

- Recent trends in ICT use and best practices;
- ICT future trends and discoveries;
- Expected and anticipated future growth;
- Policies which are likely to be changed;
- Tax rebates and prospective government funding;
- Bundling of demands and demand aggregation possibilities;

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- Public/private partnerships;
- Opportunities and likely future growth; and
- Visions and objectives.

In determining **how to get there**, you can consider the following:

- Identify competent project champions within the local community followed by their appointment in the respective sectors and rural regions;
- Determine the governance framework through the ICT Advisory Members to enforce collaborations;
- Finalise the shared values and strategic vision with the relevant contributors;
- Identify the requirements, opportunities and hard pressing issues;
- Craft a national ICT strategy and objectives which are integrated into provincial plans;
- Craft an ICT developmental plan;
- Devise a funding plan;
- Craft a roll-out plan and awareness raising framework;
- Implement and monitor plans; and
- Determine the team project meeting occurrences to give feedback on the work done and to share the challenges and potential ways to resolve these.

South Africa has developed some ICT strategies which include the recently adopted South Africa Connect. Some of these strategies and policies are briefly highlighted in Figure 3.2. South Africa Connect is the roadmap for SA broadband implementation which was adopted by Cabinet in December 2013. The plan advocates the development of a predictable regulatory environments conducive to investment. It also indicates that the main aim of leveraging should be in the governance of the sector and the competency of the government to arrange the activities across the ICT ecosystem. One of the outcomes of the policy is to develop the road map that guides the actions of the public and private sector players over the next ten (10) to twenty (20) years (DoC, 2013a).

It is equally important to note that the ICT promotion in deep rural environments showed that private-led investments are very low due to the economic returns on financial investments. This called for the sector-reformed initiatives to encourage rapid development and implementation of the much-needed

ICT infrastructure within the rural communities. There are a number of policies which have been developed and adopted by the Government and some of these are discussed in Figure 3.2.

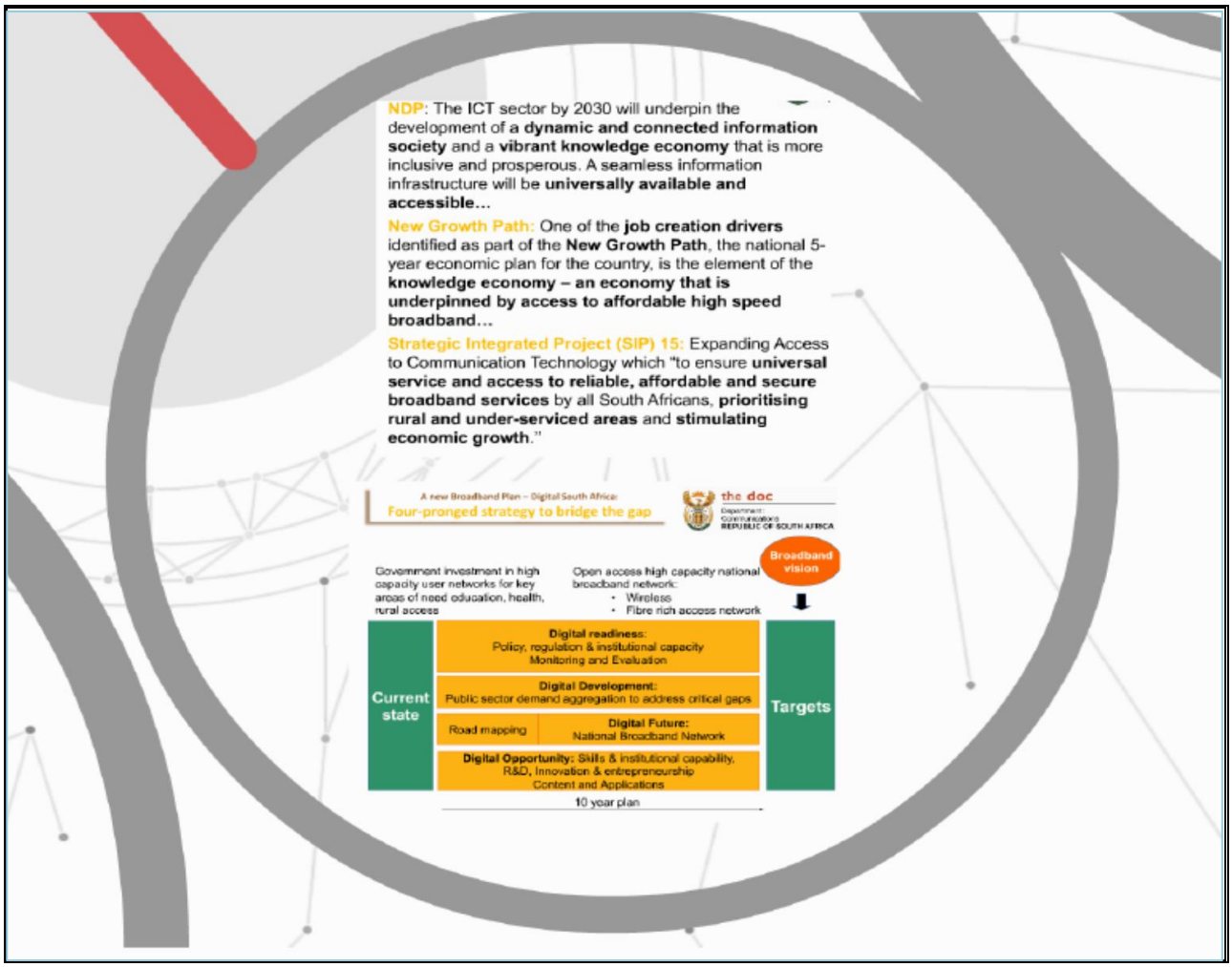

Figure 3.2: Various ICT Policies (Source: Gillwald et.al. 2012)

One other existing strategy is the integrated rural development plan. The plan from the DRDLR promoted an improved integration of the rural area, which can be achieved through a successful rural development strategy together with infrastructure development for employment creation to ensure poverty alleviation. The strategy does not put emphasis on the use of ICT to enable development of rural communities.

The National Planning Commission (2012) is yet another framework that has been adopted by the government as a guideline for economic and infrastructural development in South Africa. The NDP promotes the following amongst others:

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- Connected vibrant information society;
- Underpin nation-building; and
- Strengthen social cohesion.

The National Planning Commission (2012) vision of 2030 authorised a "transparent" ICT infrastructure by 2030, which supports a dynamic, connected and vibrant information society and a knowledge-based economy that is inclusive, fairer and more prosperous.".

Finally, the Strategic Infrastructure Projects (SIPs) are the roll-out infrastructure projects to promote the development of the South Africa's economy. SIP 15 is the communication intervention, which increases access to ICT technology to provide accessibility to the whole country including the rural communities. It does this by implementing Points of Presence (POPs) in the district municipalities, and also extends the new Broadband Infraco fibre coverage across the various provinces, linking districts and establishing the PoPs and the fibre networks in the deep rural communities. The plan says: Although the private sector invests in ICT infrastructure in urban and corporate networks, the government will invest in infrastructure for access by commercial and rural areas, e-government, schools and health. The schools connectivity initially focused on 125 Dinaledi (science and math focus) and 1 525 district schools. Some of the digital connections to all South Africans include the transition from analogue to digital television.

3.7 Some of the strategies implemented by Government

3.7.1 Telecentres

A common definition of the Telecentre is a physical space that provides the public access to ICT for educational, personal, social and economic development (Bailey & Ngwenyama, 2010). This can be further defined as a generic term for all types of arrangements which sees to provide shared and communal access to information and ICT-enabled services in rural areas through the latest technologies for Internet access. The initiative on the shared access emerged as a result of the perceived constraint that individual members of the community in the rural areas cannot afford such technologies (Mukerji, 2009).

In South Africa, which is a predominantly middle-income country, the number of the population categorised as individual 'Internet users' moved from five point four (5.4%) per cent in 2000 to just eighteen (18%) per cent in 2010. To overcome these low percentages, government intervention is

frequently adopted, especially in rural areas where it is not profitable for cellular operators to build infrastructure to achieve the uptake of Internet use in the rural communities. In South Africa and elsewhere, government funded Telecentres are a common non-profit mode of delivery; however, there is much evidence of recurring problems around that model. Telecentres have many structural components (human, political and technical) which need to support each other to create a functional Telecentre (Attwood et al., 2013).

The National Planning Commission (2012) noted that some of the interventions have focused on these ICT failures since 1994 and these had included deploying Telecentres, which worked as ICT Digital Hubs in rural communities. They provided Internet kiosks at Post Office centres, setting up digital research centres at schools, and other related measures. Be that as it may, the execution of most state interventions in the ICT sector has been frustrating. These strategies and approach failed to yield the desired results.

Kapondera and South, 2016 state that ICT has had the potential to increase seamless access to information, to improve skill sets which will enable knowledge to be shared, and help build the societal capital for the rural communities in developing contexts.

The Information Resources Management Association (IRMA) (2006) indicated that ICT had the ability to promote better access to healthcare and education facilities, to improve community dialogue, and participation in the rural community social development agenda. Telecentres have been established in the rural communities with the intention of promoting and improving social development and the upliftment of people in the rural communities. A typical Telecentre solution provided by Sentech to USAASA is shown in Figures 3.3, 3.4 and 3.5.

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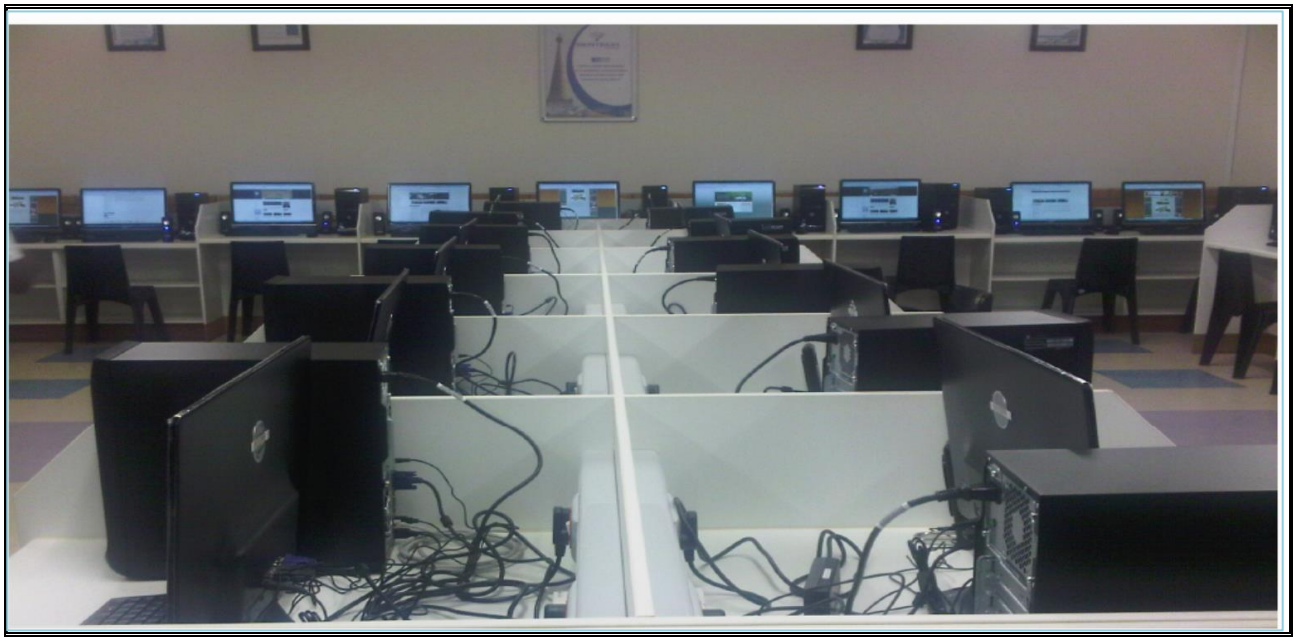

Figure 3.3: Typical Telecentre Computer Lab (Source: Sentech, 2013)

It comprises:

- 10 x Desktop PCs
  - Mouse
  - Keyboard
  - Screen 20 inch LED Monitor
  - MS Office 2010
  - Anti-Virus
- Router
- Switch
- Network Cabling

The access technology used is VSAT (Very Small Aperture Terminal) which is made up of two main components:

- Outdoor unit (ODU): The outdoor unit consists of a 1.2m dish (antenna), and other radio components.

Figure 3.4: VSAT Satellite Dish (Source: Sentech, 2013)

- Indoor unit (IDU): The indoor unit consists of a network terminating unit that acts as the network interface to the LAN.

Figure 3.5: Linkstar Modem Unit (Source: Sentech, 2013)

The Telecentre sustainability has emerged as a topic of interest in the development discourse. Sustainability can be described as "the ability of a project or intervention to continue in existence after the implementing agency had departed" (Harris, 2004).

Harris (2004) added that Telecentres are developed to assist the rural communities to achieve a level of development by utilising ICT services. Thus, if the information system (IS) profession is to participate in this application of ICT, it will be important to muster the processes of rural community development in addition to being familiar with organisational behaviour, management and marketing. The social

difficulties that exist, even within relatively well-coordinated organisations, are even greater within less formally planned rural communities.

The power of the available ICT at the Telecentres is that it can offer unlimited opportunities to streamline local development and governance and also empower the rural and remote communities, in addition to providing access to ICT and ICT capacity building. As a result, the Telecentres are increasingly being seen as delivery channels for e-Governance and welfare services in several developing countries and their governments are taking a keen interest in them or public access centres. However, sustainability has been a major concern as a benefit to the community who are supposed to take advantage of these interventions.

There has been a concession in the studies concerning the barriers and components of the Telecentre sustainability. Matters related to sustainability have been examined in three categories – financial (or economic), political (or policy), organisation, social sustainability and operations, as highlighted in Figure 12 below (Bailey and Ngwenyama, 2010.

Over the last decade, the social viability of Telecentres has remained one of the key issues facing digital inclusion projects (Mayanja, 2006). According to Bailey and Ngwenyama, 2010, "Social sustainability is the capacity of Telecentres to recognise and address emerging needs of the communities". Recognising this, Harris and Rajora (2006) argued that the rural community receptive approach is key to the overall Telecentre sustainability.

Figure 3.6 outlines the most important pillars that will ensure the sustainability and long-term operations of the sustainable Telecentres.

Figure 3.6: Five Pillars of Sustainable Telecentres (Source: Harris et. al., 2003)

Dass and Bhattacherjee (2011) mentioned that obsolete infrastructure and digital illiteracy, amongst others, are the major challenges of the majority of the failed Telecentres. The financial investment of rolling out the ICT infrastructure in rural areas is very high. Poor infrastructure leads to the huge operational costs of Telecentres that affect their financial sustainability especially in the initial years of operation when the revenue earned lowers substantially (Dass and Bhattacherjee, 2011). Moreover, the poor literacy level creates issues of awareness. Lack of different advertisement methods to make the people aware of these government projects has also proven to be a huge problem.

Additionally, the rural population is unable to adapt to digital devices at the Telecentres. More often than not the services provided within the Telecentres did not address the needs of the local rural communities and thus they were unable to generate enough revenue. Lack of a robust monitoring and evaluation framework by the responsible agencies and the government has also attributed to the failures of the Telecentres. Strong monitoring and evaluation ensures the accountability of the various project stakeholders and also helps to make constant improvement through feedback (Dass and Bhattacherjee, 2011).

One other prohibitive factor for the uptake of the current Telecentres has been the cost of the last mile technology which has been adopted. The majority of the Telecentres use satellite for connectivity, and this has proven to be a very costly solution to provide sufficient bandwidth for an acceptable Internet speed. This prompted USAASA to go for a solution with basic minimal bandwidth connectivity and this resulted in most of the Telecentres having an unacceptable Internet speed. The lack of skilled centre managers is also a significant problem and technical maintenance of the centres got negatively affected in the process. Thus, staff training is very critical to make sure that services are available in the centres.

Another area in which governments fail to do projects like these successfully is when they do not have a clear way to manage change. Often, participants in the project do not have enough time to absorb the changes caused by the introduction of information and communication technology systems, which in turn affects motivation. Nor was there any attempt to control the change of power of state officials in kiosks. One way to ensure a smooth transition is ongoing training for all participating organisations (Dass and Bhattacherjee, 2011).

3.7.2 National Development Plan

The National Planning Commission (2012) stipulated that by 2030 rural South Africa will have more opportunities to participate fully in the economic development and social and political life of the communities. These opportunities will need to be supported by a high standard level of education, proper road infrastructure and other essential services. Successful rural development with employment creation and contribution to food security will all contribute to the wellbeing of the rural communities with an inclusive rural economy. One of the biggest gaps in the NDP is that ICT is not afforded the same platform compared to agriculture and education as one of the major economic drivers.

The National Planning Commission (2012) highlights the following for success:

- All-inclusive e-strategy;
- Cross-sectoral coordination of all the stakeholders;
- Flexible regulatory framework for effective market competition;
- Broadband access by 2020 for all the citizens of the country;
- 2030 roll-out of the full scope of e-government services; and
- Local loop unbundling and the allocation of the most needed spectrum with structural separation.

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The National Planning Commission (2012) stipulated that regardless of mobile phones flourishing , the growth in the country's market has not brought about cheap universal access to a number of ICT services. Interventions to address ICT gaps have, since 1994, included establishing Telecentres in rural areas, providing Internet kiosks at the Post Office centres, setting up cyber-laboratories at schools, and other related measures.

Some of the serious barriers to the effective diffusion of ICT have been noted, and they are:

- Policy bottlenecks which do not address the matter of rural connectivity adequately;
- Weakness in the clear mandate of the various state owned entities;
- Duplication in policies within the various departments;
- Regulatory limitations; and
- Lack of market competition.

The National Planning Commission (2012) has further highlighted that a coherent, integrated strategy is essential to ensure the dissemination of ICT in all sectors of society and the economy. Information and communication technology is like energy and transport as it can speed up delivery, support analysis, generate intelligence and create new ways to share, learn and interact

The national e-strategy cuts across many government ministries and ICT sectors. The objective is to create sectoral growth and innovation through the coordination of policies that promote public and private investment, such as the deployment of network infrastructure, particularly in the production of information and communication technology, the creation of applications, and the development of local content (National Planning Commission, 2012).

The National Planning Commission (2012) also stated that the strategy will include plans to develop the expertise focused on institutional capacity required for the policy responsiveness and efficient regulation of the ICT sector. This will focus on demand-driven innovation to facilitate serviceability (promoting electronic literacy, education and training, and examining ICT-related discounts and incentives, as well as the needs of key development sectors such as health and education). It will also focus on the supply of infrastructure and facilities, ensuring the quality of ICT.

Previous initiatives of universal access have not distinguished between the real access gap and differences in market power. Real access to homes or individuals can be achieved through permanent subsidies or any other support. The market efficiency gap has got to do with the difference between the

share of households reached an effective market and what is achieved under existing conditions (NDP, 2012).

However, Gillwald, Moyo and Stork (2012) mentioned that the NDP only classified ICT as part within the context of the economic infrastructure. The vision does not depict the ICT as having the cross-cutting nature of the economic development sectors including the rural development. There is little to suggest that ICT policy documents get priority treatment.

There is, thus, a critical need for the national ICT strategy to implement the objectives of the NDP, which clearly outlined a vision for the ICT sector as an important economic development sector within the rural communities. The NDP calls for the ICT strategy to improve the low levels of ICT roll-out and to ensure an acceptable speed for a longer term. The all-encompassing ICT strategy will need a repositioning of the ICT market to ensure market competition followed by coordination of the state resources and also earmarked universal service strategy to eradicate the gaps and the ICT market, but will also address the demand-side stimulation of the market (Gillwald et al., 2012).

3.7.3 South Africa Connect Policy

The much revised and long-awaited South Africa Connect, also known as the National Broadband Policy, Strategy, and Plan, have objectives to speed up the South Africa's ICT backbone and the last connectivity, especially within the rural and disadvantaged communities. This should meet the vision of the country to provide connectivity for all by 2020. The DoC (2013a) broadband plan outlines four complementary interventions, namely digital readiness, digital development, digital future and digital opportunity, with an additional focus on supply-side and demand-side interventions. These will close identified gaps between the current status of ICT and the vision of a "seamless information infrastructure".

The four South Africa Connect interventions are summarised below (DOC, 2013a):

- ***Digital Readiness:*** The establishment of environments for suitable regulatory and institutional arrangement to facilitate ICT roll-out whilst keeping in mind the broader rural community's interest; the formation and reconfiguration of relevant institutions and state-owned companies to derive a potential of ICT services; any regulatory obstacles constraining infrastructure roll-out and managing further builds to get rid of unnecessary duplication, more especially in civil works.

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- ***Digital Development:*** The aggregation of public sector demand and buying high-capacity and robust network capacity at cost-effective investments to redress the digital divide'; rejuvenating service providers network constructions by eliminating the common investment risk ánd ensuring demand.
- ***Digital Future:*** Create environments for facility sharing and collaboration on an open access wholesale network to leverage economies of scale with the reduction of possible risk and ensure guaranteed returns on investments.
- ***Digital Opportunity:*** Create an awareness which can sensitise people to realise the benefits of ICT and develop the skills and relevant content which will stimulate the demand and the uptake of the services. Develop support systems for R&D and the creation of higher levels of expertise, innovation and entrepreneurship.

In Figure 3.7 the four prongs of the strategy are mapped against the broadband value chain to illustrate how they impact on different aspects of this value chain.

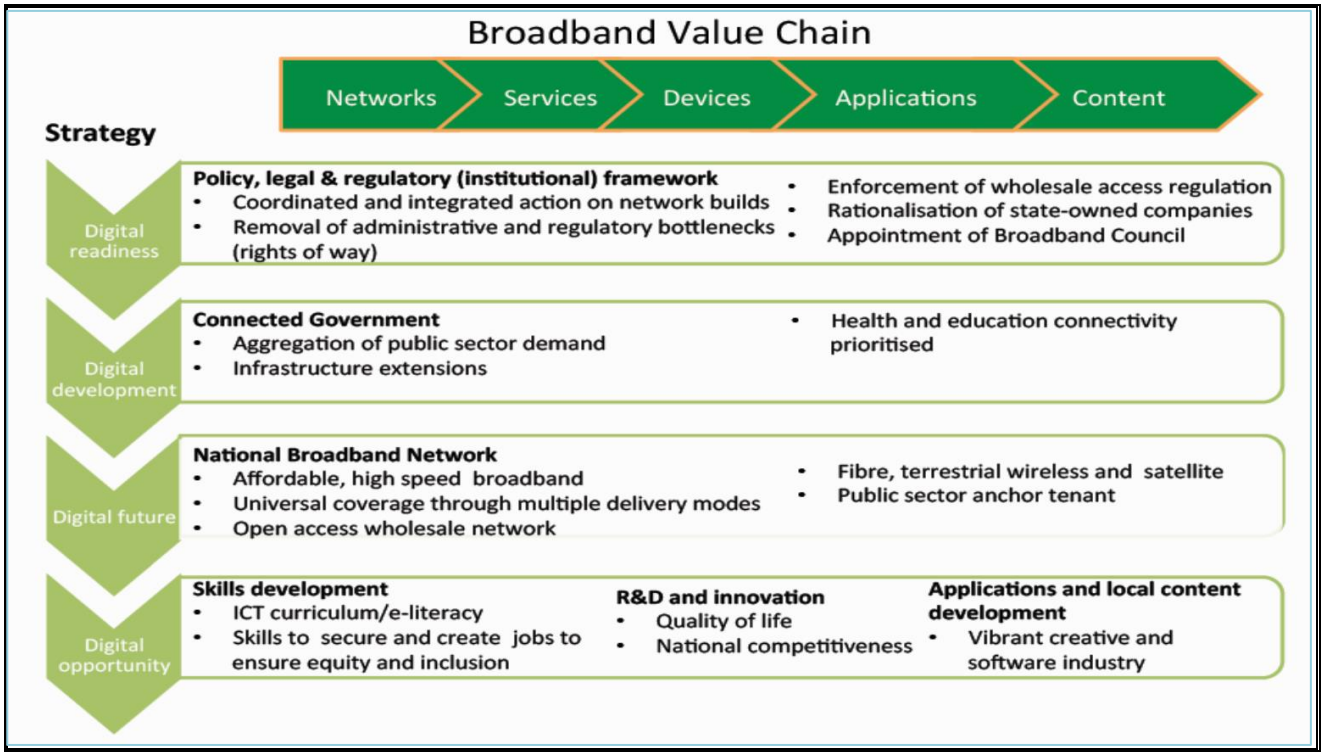

Figure 3.7: Four Pillars of the Broadband Strategy (Source: DoC (2013a)

The Policy stated that the creation of an enabling policy and regulatory environments is fundamental to the success of this national project. It further stated that there will have to be a flexible regulatory

framework to address the demand-side issues and, additionally, deal with the traditional supply-side issues such as interconnections, facilities sharing, scarce resource allocation of numbers and frequency spectrum, tariff regulation and quality regulation (DOC, 2013a).

The cost of building a national digital infrastructure is enormous and requires both public and private investments to accomplish the goal. Use of the public right-of-way is an important factor in accomplishing this aim. Eighty to ninety percent (80-90%) of the cost associated with the laying of infrastructure is in the excavation of the roadway. Streamlining this process can reduce the cost and increase the speed of ICT deployment while minimising stress on the pavement and traffic disruptions. National, provincial and local municipality funds are regularly used for road and public works improvements. Much of this activity disturbed and used the public rights of way, and allowed opportunities for installing conduit at the times public works projects are undertaken. One of the most active projects around Gauteng has been the *Rea Vaya* project where there have been many excavations and partial closing of major roads such as Katherine Street in the Sandton central business district. This is one flagship and big project, which can be used as a dig-once project where all the necessary infrastructures including the ICT passive infrastructure gets laid.

The **South Africa Connect** policy recognised the need to map current broadband deployments and coordinated deployment plans of operators, but it did not specify who should do this, how and by when. The emphasis has been to implement the infrastructure based more on the one-build approach, but the policy did not specifically mandate infrastructure sharing between utilities (e.g. roads, rails, power lines, pipelines) (DOC, 2013a).

The Broadband Policy also highlights that the high cost (up to 80%) in deploying new networks relates to civil works. The sharing of cost on the building of the infrastructure is encouraged to eliminate duplication and investment earmarked for areas considered uneconomical to invest. The policy, therefore, makes an undertaking that the Department of Telecommunications and Postal Services will work closely with other departments to ensure alignment of the strategies (DOC, 2013a). Thus, the cross-sectoral coordination is pivotal to the successful integration and implementation of the government's scarce resources, including the enhancement of state resources and capacity building to ensure competencies to optimise public service delivery. This remains one of the biggest challenges in ensuring that interdepartmental coordination is efficient and monitored.

One of the other most challenging aspects of policy implementation is ensuring its success and robustness. One aspect that will guarantee success is making sure that there is seamless adoption and uptake of ICT and this can be ensured if the demand-side is adequately addressed.

Adera, Waema, Mascarenhas and Diga (2014) have highlighted that the lack of a relationship between ICT services and the alleviation of poverty on demand, at a more microeconomic level, can lead to the creation of policies that are insufficient for the needs and interests of users of ICT, especially for the poor. According to Adera et al. (2014), policymakers are being persuaded to channel resources into the investments for the roll-out of the ICT infrastructure and there will have to be a clear indication of how those investments are going to benefit the rural poor. The demand-side must put more emphasis on the mobile applications and open data to encourage ease of adoption.

The DoC (2013a) said that the SA Connect policy mentions that one of the areas that will lay the foundations for the future success of ICT services are policies that are not restricted to the competitiveness of the market with ease of expansion of the ICT infrastructure. The policy framework did not show what these policies are and where there are bottlenecks.

Also, the DTPS (2012) indicated that it will issue a directive to the regulator to speed up the reallocation of the ICT lucrative spectrum. Moreover, the allocation of the frequency spectrum is not the major problem but who will benefit. The other issue is whether those who are due to benefit from the reallocated spectrum will be in business for profit or public interest. This is a digital dividend spectrum, which will go a long way in ensuring universal access to the most affected areas.

The lack of viability of the business model for the rural communities is the effective brake to the involvement of the relevant stakeholders on the roll-out of ICT infrastructure for rural communities. The decision for open access is of minimal benefit whenever an over-riding public interest element in the implementation and access to connectivity is needed (DoC, 2013a).

The policy is not aligned to the national economic development and growth plans. It differs from the national ICT policies of countries which are linked to their economic growth plans. The South African ICT policy did not put enough emphasis on the impact of ICT on the economic growth and not much linkage had been articulated around the economic recovery, stimulation and job creation within the rural poor communities. There is also not much emphasis on the demand stimulation policy whether through

the ownership of personal end user devices or computer literacy strategies with coordination across government in the sector.

3.7.4 Strategic Infrastructure Project 15 (SIP15)

SIP 15 in the Presidential Infrastructure Coordinate Commission (PICC) focused on increasing access to ICT. It made a promise to provide ICT services to all households by 2020 by rolling out Main Points of Presence (POPs) within the district local governments, extending new fibre networks across the provinces linking districts, implementing POPs and fibre connectivity at the local level, and making inroads into the deep rural communities. The government has made a commitment to co-invest in the township and rural communities as well the government institutions whilst the private sector will focus on the urban and corporate networks roll-out. The school roll-out focus is initially on the one hundred and twenty-five (125) Dinaledi (science and mathematics-focused) schools and one thousand five hundred and twenty-five (1525) district schools. Part of digital access to all South Africans includes TV migration nationally from analogue to digital broadcasting (PICC, 2012).

PICC (2012) highlighted that there is a critical need for a comprehensive policy review that has not been implemented in the ICT sector since 1995. For five years, South Africa needs to develop a more integrated electronic strategy that reflects a cross cutting nature of the ICT. This should combine political objectives with specific ICT strategies. It should include an action plan for the new spectrum bands which will be made available during the transition to the new digital broadcasting and should establish a plan for universal service with clear monitoring and evaluation objectives. In addition, measures should be taken to promote the dissemination of information and communication technologies, such as e-literacy programs to promote demand, the development of ICT capabilities and the creation of institutional capacity. Evidence has also shown that affordable access to ICT is most effectively achieved in controlled market competition, complemented by specific state monitoring mechanisms such as SIP 15.

For the strategic intents to work the following policy issues need to be adequately addressed:

- Fix the market structure and do away with the legal bottlenecks to facilitate full market competition;
- Devise a strategy for the local loop to improve quality and cost reduction with the line coverage expanded to meet the need for higher speed ICT services;

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- Make sure that the regulatory bodies have enough resources to promote market entry with the playing fields levelled;
- Frequency spectrum allocation will be followed by stringent universal service obligations to overcome the historical inequalities within the ICT sector. These obligations should never delay the competitive distribution of the resources;
- Make sure there is access to low-cost, high-speed international bandwidth with seamless access polices;
- Evaluate the state-owned companies and local government's performance in the ICT provision, make a decision on the future role and ensure the rationalisation of all the relevant state-owned companies;
- Investigate the market's ability to maintain infrastructure competition and whether there is a clear benefit that outweighs the problem of duplication of facilities in a resource-constraints rural environments;
- Identify a different approach to infrastructure competition via the structural separation of the backhaul networks from the services offered by Telkom to establish a common carrier which offers open access to service competitors. Equally, encourage the sharing of passive infrastructure for expensive trenching infrastructure by establishing a common rights of way for competing service providers to lay dedicated services;
- Consider and roll-out a licensing regime which promotes a service and technology neutral infrastructure that allows for flexible use of resources; and
- Make sure that the frequency spectrum is made available on a "use it or lose it" basis for the efficient use of and the reduction in cost to communicate and stimulate innovations.

These are the important considerations which will ensure the successful implementation of SIP 15. Otherwise, there will be no guaranteed success without these vital policy aspects sorted out.

3.8 Conclusion

There have been a number of important observations in the literature studies which will make sure that the rural strategy becomes sustainable:

- Involvement of the end users to influence the design of the system which will address the needs of the rural community;

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- Identification and use of cost-effective and robust technology suitable for the deep rural connectivity;
- Build cost-effective Internet outlets for the benefits of small businesses to operate the services with profit and expand the services for sustainability;
- Redesign the back-end processes and implement the changes that explore the benefits of the storage, processing and distribution powers of the latest ICT trends;
- Make sure that there are well designed change management processes for the seamless involvement of the end users within the rural communities;
- Build trust for transparency and efficiency to establish confidence among the rural community members on the operations of service delivery mechanisms;
- Collaboration with the private sector who will bring the knowledge and expertise, fast track the implementation, and grant better value propositions to minimise the burden on the state to serve the rural communities; and
- Earmark and prepare the project champion for the successful implementation with a smooth transition and ease of learning of the changed procedures.

The potential for using ICT in the eradication of poverty is to provide information and knowledge to rural communities and encourage local development service providers to strengthen the poor. The various benefits of information and connectivity can benefit the poor by improving the capacity of specialised local agencies. One example is Chile's electronic rural information system, which was linked to farmers' organisations, rural local governments, NGOs and local government extension agencies for information and communication technology services. According to estimates, the circulation of information on prices, markets, supplies, meteorological services, social services and credit limits is estimated at 40% less than traditional methods (Balit, 1998).

ICT is able to play a meaningful role in fighting rural poverty and enabling sustainable improvement by creating information rich communities and supporting the lives of the rural communities. The ICT has the potential of becoming an essential tool for economic development and social empowerment if the technology is appropriately rolled out.

The improvements in rural areas are part of an important agenda for the South African government. However, the application of information and communication technology in the rural development sectors is relatively slow. The main reasons for the slow uptake are poor ICT infrastructure in rural

areas, poor educational awareness on the use of ICT and the creation of applications using the local languages. Agriculture remains an important sector with more than 36% of the South African population living in rural areas and acquiring the means of subsistence for fresh produce and related income. There are a lot of problems in the sector to reduce the efficiency of production in the reduction of production resources. The growing demand for agricultural products, however, also offers producers the opportunity to maintain and improve their livelihoods. ICT plays an important role in solving these challenges and improving the livelihoods of rural communities. ICT offers an opportunity to introduce new activities, new services and applications in rural areas or to improve the existing services. This will help in decreasing the urbanisation trend where most of the rural citizens have been migrating to urban cities with a huge drive since 1995 and where the size of the urban population has increased from 54.5% in 1995 to 63.9% in 2016. This can be attributed to lack of developments and service improvements within the rural communities.

The Government also recently adopted the South Africa Connect broadband policy. The Policy states that the creation of an enabling policy and regulatory environments is fundamental to the success of this national project (DOC, 2013a). It further states that there will have to be a flexible regulatory framework which will need to address the demand-side issues and additionally deal with the traditional supply-side issues such as interconnections, facilities sharing, scarce resource allocation of numbers and frequency spectrum, tariff regulation and quality regulation.

One of the other initiatives which did not work is the Telecentre concept. Most researchers on this topic had identified certain parameters which contributed to the under-performance of the Telecentre projects. One of the challenges is poor infrastructure. The cost of setting up ICT infrastructure in rural areas is prohibitively high. Poor infrastructure led to an immense operational expense for Telecentres in the developing nations that influence the financial sustainability of such Telecentres, particularly in the initial years of operation when the income earned is generously lower. The services implemented in the Telecentres once in a while did not match the requirements of the people they were endeavouring to reach, and the Telecentres did not produce enough income. Moreover, poor literacy levels created issues of awareness. Lack of different advertisement methods to make the people aware of these government projects had also proven to be a huge problem. The absence of a robust monitoring and evaluation framework by the responsible agencies and the government had also attributed to the failures of the Telecentres. A solid checking and assessment guaranteed accountability with respect to the partners of a venture and furthermore helps in making steady change through criticism.

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However, there are some gaps in the NDP which might compromise the success of this policy document. There is little to suggest that ICT policy documents get priority treatment. A working ICT strategy will need the repositioning of the ICT market to ensure competition, coordination of state resources and ICT across the government departments. It will also need a universal service strategy to deal not only with the gaps in the ICT market but also to address the demand-side stimulation for the ICT services uptake.

These are a number of issues highlighted by the current strategies that need to be critically analysed and resolved:

- Deal with bottlenecks in infrastructure industry-imperfect competition;
- Review institutional arrangements – effectively regulated competitive markets;
- Review market structure – open access to regulated competitive services and prevent duplication of infrastructure investment/deployment;
- Manage incentives for investment in ICT network extension, spectrum management;
- Reduce ICT service prices ante wholesale regulation – peering and IP transit;
- Address issues of net neutrality/safeguard free and open Internet;
- Service neutral licensing; scrap excise duties and taxes for ICT;
- Secure environments of e-services, privacy, security and surveillance;
- Demand stimulation critical: affordability and e-skills;
- Open data, open government and stimulate localisation;
- Infrastructures sharing, open access and one builds policies to be strengthened and enforced; and
- Need for integrated development – informational development dependent on human development.

It is very clear from the literature study that there have been some initiatives to ensure the equitable access to sustainable ICT services, but none has been successful so far. This study will explore an effective strategy for sustainable ICT development in deep rural environments.

3.9 Summary

The National Planning Commission (2012) articulated that South Africa's rural communities should be afforded an opportunity to participate in the development of the economy and the political life of the country. The rural population should be afforded high-quality necessities which should be nourished

with increased skills and expertise. The rural strategy will, therefore, have to find an expression on infrastructural development such as ICT to help combat poverty and job creation in the rural environments.

Some strategies and policy failures were also discussed comprehensively in the study. The Integrated Rural development strategy is one of the strategies which do not explore ICT comprehensively as an enabler to rural upliftment. ICT ought not to be viewed exclusively as a method for understanding the complexities of rural livelihood plans better through enhanced information accumulation yet in addition, as a method for encouraging progressive differentiated ways in dealing with accomplishing rural development objectives. The strategy failed to recognise though that ICT cuts across all development and none can be achieved by excluding the use of ICT.

The **South Africa Connect** policy recognised the need to map current broadband deployments and coordinate the deployment plans of operators, but it did not specify who should do this, how and by when. The emphasis has been on the implementation of the infrastructure based more on the one-build approach, but the policy did not specifically mandate infrastructure sharing between utilities (e.g. roads, rails, power lines, pipelines). The policy is not aligned to the national economic strategies.

The Government adopted the NDP as the blueprint of service delivery policy called vision 2030. One of the biggest gaps in the NDP is that ICT is not afforded the same platform compared to agriculture and education as one of the major economic drivers. The NDP highlighted that in the next five years there is a need to create a more comprehensive and integrated e-strategy that reflects the cross-cutting characteristics of ICT. This should connect policy objectives to specific strategic intents. This will include plans to allocate a new frequency spectrum that will become available with the switchover to digital broadcasting, and will create a strategy for universal access together with clear targets and monitoring and evaluation indicators.

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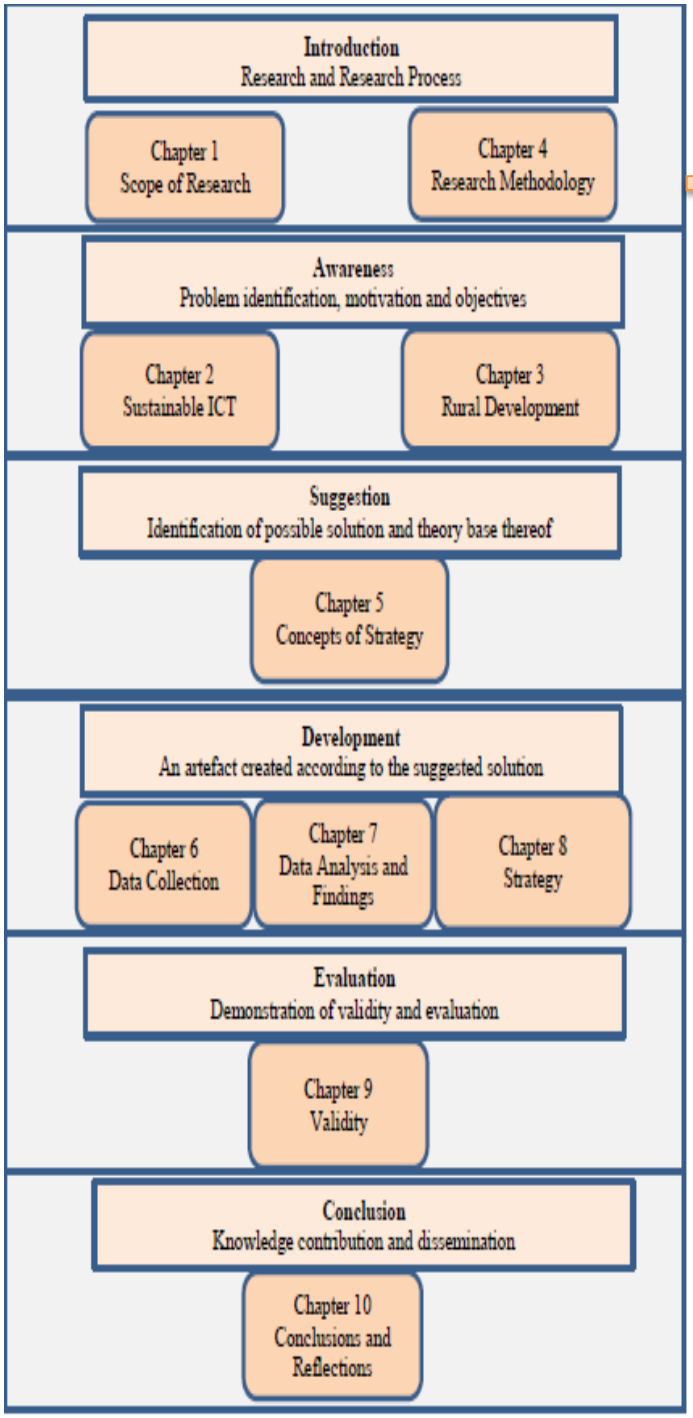
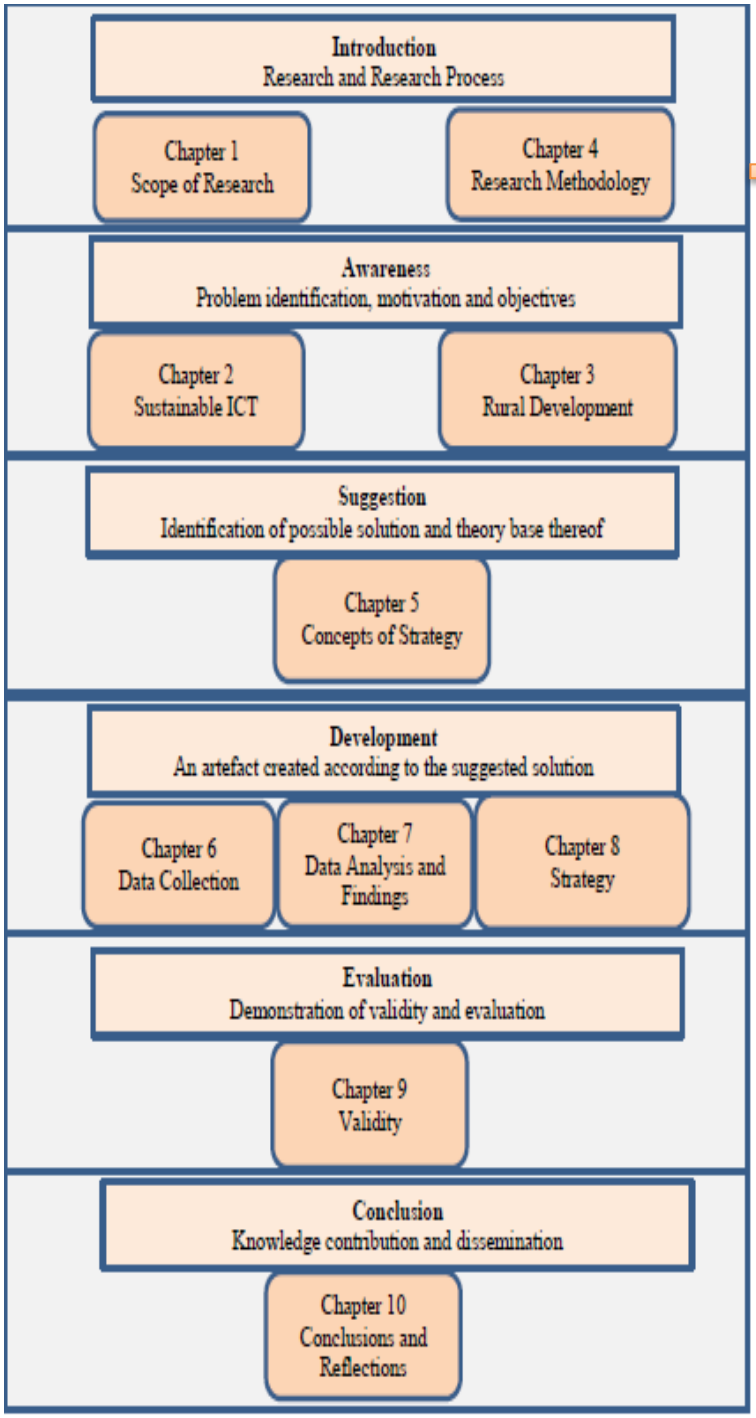
CHAPTER 4: RESEARCH METHODOLOGY





Chapter 4 Research Methodology

4.8 Data collection techniques
4.8.1 Interviews
4.8.2 Literature review
4.8.3 Expert validation
4.9 The analysis of methods of data collection
4.10 Data analysis triangulation
4.11 Research validation
4.12 Ethical consideration
4.13 Conclusion
4.14 Summary

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4.1 Introduction

The research methodology is defined as a way to resolve the research problem statement systematically. It can also be described as the science of studying how the research work is conducted scientifically. In the research methodology, there are a number of steps which are adopted to assist in the study of the research problem along with the logic behind them (Kothari, 2004). Williams (2007) also defines the format of research methodology as a coordinated set of guidelines to help in generating valid and reliable research outputs.

The definition makes a deduction that the research methodology is how a particular scholar took a specific research strategy or method rather than others. Closely related to the research methods is the philosophical stance of the researcher. Yin (2014) referred to research strategy as research design and defines it as:

> *"... A logical plan for getting from here to there, where here may be defined as the initial set of questions to be answered, and there is some set of conclusions about these questions."*

This chapter outlines the research approach, techniques, procedures and instruments used to carry out the research work. The overall methodology for this research is a case study. Case study methodology, as explained by Yin (2014), is used to build a single extensive case study, consisting of case study design, conducting the case and analysing its results. The data is predominantly qualitative in nature and the inductive method is used. The chapter highlights the way in which the research is planned, the methods used and the steps that are taken in conducting the data analysis. It mainly covers the research methodology.

The objective of this chapter is to design and motivate the research methodology followed. The introduction is presented in Section 4.1. Section 4.2 briefly summarises the research paradigm. Section 4.3 addresses various research strategies. Section 4.4 outlines the design science strategy overview. Section 4.5 describes design science strategy applied to this particular study. Section 4.6 deals with the research process. Section 4.7 outlines the various types of case studies. Section 4.8 outlines the data collection techniques. The analysis of methods of data collection is then discussed under Section 4.9. Section then deals with the data analysis triangulation. Then Section 4.11 presents the Research Validation. The Ethical Consideration is discussed under Section 4.12. Section 4.13 outlines the conclusion derived from the chapter. Finally, Section 4.14 covers the Summary of the entire chapter.

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4.2 Research paradigm and philosophical assumptions

The research in this discipline is based on a vast body of knowledge and the methods used are based on specific paradigms. The paradigms are defined as world views or assertions that guide researchers by defining the subject of research and the type of research questions, as well as the research process (Oates, Edwards and Wainwright, 2012).

The paradigm can also be defined as nothing less than a position which is taken on the information, another analytic stance that helps to systematically gather and position data in such a way that structure and processes are integrated (Jonker and Penink, 2010). It is a term that seeks to emphasise the common elements of vision that combine the work of group theorists in a way that can be considered to approach social theory within the same problem-solving. Jonker and Penink (2010) also showed that the paradigm can be considered as a set of key beliefs that refer to the final or first principles. It represents a world view that defines its possessor of the character of the world, its appropriate place and the potential relations between this world and its parts.

4.2.1 The Research Paradigms

The main paradigms that have been identified over the years that are used in research are defined in the literature as follows (Creswell and Plano Clark, 2011; Vaishnavi and Keuchler, 2013):

- *The Pragmatic paradigm:* has a mixed views approach, and is set on making things work practically. The focus in this one is on the consequences of the research, rather than on the methods. This paradigm uses mixed methods to obtain and analyse the data.
- *The Interpretive paradigm:* this infers that there are multiple realities that are founded on the subjective views of the respondents, and as such, they are shaped by one's social interactions. Interpretivism takes the world's views into account, and assumes that every person has an experience, belief, attitude and set of values that must be considered, when conducting research.
- *The Realist paradigm:* this is more relevant to the scientific research. It is positioned midway between positivism and Interpretivism which means that the researchers using this paradigm acknowledge that human factors can influence the behaviour of entities, and that these factors will then need to be exposed.
- *The Positivist paradigm:* this infers that there is a single reality and this is used mainly in quantitative approaches. This implies that only observable data is analysed with consideration

given to values or emotions. Scientific experiments and evaluation of hypotheses fit into this particular paradigm.

4.2.2 Philosophical assumption

According to Creswell and Plano Clark (2011) and Vaishnavi and Keuchler (2013), there are four philosophical assumptions that can influence how researchers conduct their research, namely:

- *Ontological assumptions* this refers to nature, or the understanding of reality;
- *Epistemological assumptions* this refers to the nature of the knowledge, or the ways of exploring knowledge;
- *Axiological assumptions* this refers to the role of values in the study, and these values will be ethics and aesthetics;
- *Methodological assumptions* this refers to the process of the research and comprises the general strategy or methods used to undertake the research project.

4.2.3 Research paradigm and philosophies assumptions applicable to this study

The ontological perspective of this thesis understands a reality in context, through an interpretation of dynamic population views as they are influenced by contexts in time. Ontological multiple realities in context, which are socially constructed and dynamic, exist according to the experiences of the person with access to the ICT services. This study will not use positivism; as there are no fixed realities that are precisely measurable. Design Science and Interpretivism offer multiple realities. They differ in that Interpretivism offers dynamic realities, whilst design science offers multiple static views of reality that are social-technology enabled.

The epistemological point of this research is subjective as it depends on the person who is giving the interviews and those using the technology. Methodologically, the data is collected and analysed qualitatively through in-context structured interviews. An artefact is built through reflection. From an axiological point of view, design-science research creates utility and understanding, while Interpretivism offers a contextual understanding. Table 4.1 summarises the paradigms and philosophical assumptions that are most suited to the field of Information Systems. Each element is considered and compared to the needs of this study.

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Table 4.1: Philosophical assumptions and Research paradigms (Source: Vaishnavi and Keuchler, 2013)

Basic belief	Positivism	Interpretivism:	Realism	Design
Ontology: The nature of reality	A single reality, knowable and probabilistic	Multiple, realities, socially constructed	Real existence	Multiple realities, contextually situated alternative world-states, Socio-technologically enabled
Epistemology: What constitutes acceptable knowledge	Objective, dispassionate and detached observer of truth	Subjective, i.e. values and knowledge emerges from the researcher	Knowledge can be acquired through scientific means	Knowing through making, construction within the context, iterative circumscription
Methodology: The process of research	Observation, quantitative and statistical	Participation, qualitative, hermeneutical and dialectical		Developmental, measure impacts of artefacts.
Axiology: The role of values in research	Truth, universal and beautiful and prediction	Understanding; situated and description	Hidden social facts influence behaviours	Control, creation, progress, understating

4.3 Research Strategies

Following a research strategy means that there is a plan-of-action in place that is followed to achieve a goal or answer the research questions (Saunders, Lewis, and Thornhill 2009, and Yin, 2014). The type of strategy to employ depends on the research questions asked, the extent of control that the researcher has over events, and the degree of focus on current as opposed to historical events (Yin, 2014). There are various strategies with which one can conduct social-science research. Case studies, focus groups, ethnography, action research, documents and artefacts (design science) are usually employed in qualitative studies that are more inclined towards the interpretivist approach (Saunders et al., 2009; Hevner and Chatterjee, 2010). According to Vaishnavi and Keuchler (2013) and Creswell and Plano Clark (2011), experiments, testing, modelling and simulation, as well as proving theorems are more qualitative and positivist.

Observations and surveys can be used in most types of research approaches (Creswell and Plano Clark, 2011). This study has employed design and creation, thus design science, to produce a strategy. This

research is multi-disciplinary in nature, and therefore it uses literature reviews, semi-structured interviews and generalisation to gain an understanding of the phenomenon in context.

The main objective of this research is to design an ICT strategy which incorporates design-science research (DSR), or creation and design, as DSR focuses on the production of artefacts. DSR is a problem-solving strategy aimed at building and evaluating artefacts to address real-life situations (Hevner and Chatterjee, 2010). The next section presents the design-science research as a strategy; and shows how it fits in with this study.

4.4 Design Science Strategy Overview

4.4.1 Design Science Leading Authors

Real world problems are usually addressed through innovative artefacts (Simon, 1996). Ellis and Levy (2010) developed a systematic way of identifying a research problem by following the problem-based research cycle. Once the problem has been identified, solutions are then explored and, if at all necessary, a framework is then designed to address the phenomena. The framework which has been developed is applied to the context and evaluated to verify applicability in a specific domain. Design Science Research is considered as one of the methodologies which can be applied for Information Systems (IS) particularly when addressing social problems (Vaishnavi and Keuchler, 2004). The DSR is also considered as an additional way of complementing the positivist and interpretivist philosophies for performing research in IS (Vaishnavi and Kruechler, 2013).

Design Science was chosen as the research paradigm for this research study. Design Science addresses research through the development and evaluation of innovative artefacts intended to meet an identified business need or to solve a relevant problem (Hevner et al., 2004). This research study aims to develop an artefact in the form of a strategy to address the relevant problem of sustainable ICT development in deep rural environments. Design Science is a suitable paradigm for the study.

Hevner et al. (2004) developed a design science approach, which consists of seven guidelines based on the fundamental principle that knowledge and understanding of design law and its solution are acquired through the construction and application of artefacts. Table 4.2 illustrates the way in which this research utilised the seven guidelines in the creation of the proposed artefact.

Table 4.2: Design Science Research Guidelines (Source: Authors Design)

Guideline	Description	Application in research study
Guideline 1: Design as artefacts	Design-science research must produce a viable artefact in the form of a construct, a model, a method, or an instantiation.	This research intends to create an innovative, purposeful artefact in the form of a strategy
Guideline 2: Problem Relevance	The objective of design-science research is to develop technology-based solutions to critical and relevant business problems.	The proposed artefact will address the relevant business problem of the lack of Strategy to guarantee sustainable ICT Interventions for Development in deep rural environments.
Guideline 3: Design Evaluation	The utility, quality, and efficacy of a design artefact must be rigorously demonstrated via well-executed assessment methods.	The validity, usability, and quality of the artefact will be determined by a South African expert on Strategy. The artefact will be complete and efficient when it satisfies its purpose, and the requirements of the original problem have been fulfilled.
Guideline 4: Research Contributions	Effective design-science research must provide clear and verifiable contributions in the areas of the design artefact, design foundations, and/or design methodologies.	The artefact will be innovative and will contribute to the existing body of knowledge by solving the relevant business problem in a unique and efficient way.
Guideline 5: Research Rigor	Design science research relies on the application of rigorous methods in both the construction and evaluation of the design artefact.	Appropriate rigorous methods will be followed to develop and evaluate the artefact. The artefact will have a formalised theoretical background.
Guideline 6: Design as a Search Process	The search for a powerful artefact requires utilising available means to reach desired ends while satisfying laws in the problem environment.	The design will utilise existing knowledge and knowledge gained through data collection to fulfill the requirements of the solution and meet the laws in the problem area to ensure effectiveness.
Guideline 7: Communication of Research	Design-science research must be presented effectively both to technology-oriented as well as management-oriented audiences.	The developed artefact will be communicated using publication (peer review) and validation (exclusive interview).

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4.4.2 Knowledge-building and the cognitive processes in design-science research

Knowledge is generated and accumulated through action, and then judging the impact of the action. This gives new insights and the action can be adjusted and repeated, until a satisfactory outcome is achieved. The cognitive processes that can be employed are abduction, deduction, induction, reflection and abstraction (Vaishnavi and Keuchler, 2013; Saunders, Lewis, and Thornhill, 2009).

- *Abduction* is the use of existing knowledge to suggest a solution to a problem. The existing knowledge may not be complete, but it yields enough information for an initial attempt at the solution.
- *Deduction* takes place when the researcher tests generalised ideas or theories, and then come up with a specific idea or theory that is an improvement on the original.
- *Induction* is the use of qualitative data to create a conceptual strategy through known premises.
- *Reflection* allows the researcher time to review, rethink and learn from the iterative processes in the progression of the research.
- *Abstraction* is the result of reflection. This means that reflecting on an artefact and its impact, leads to a conclusion that furthers the knowledge contribution in the study.

4.4.3 Design Science by Vaishnavi and Keuchler

Vaishnavi and Keuchler (2013) undertook further investigations into the DSR methodology. The DSR methodology relies heavily on the knowledge contribution aspect and this is clearly outlined in Figure 4.1. The fact that this knowledge contribution is the key focus in DSR is what makes it so different from the original model.

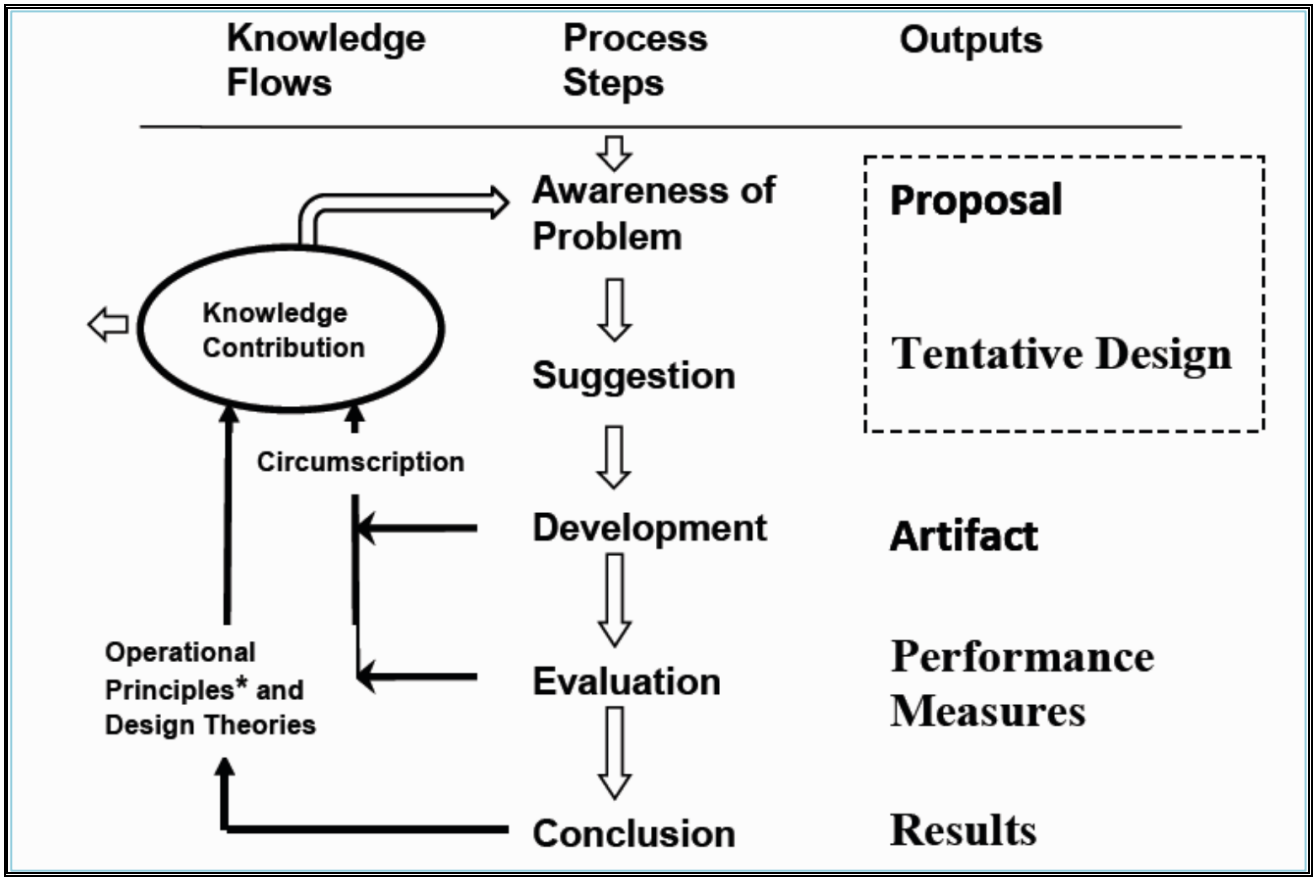

Figure 4.1: DSR (Source: Vaishnavi and Keuchler, 2013)

Vaishnavi and Keuchler (2013) outlined that the DSR methodology consists of five phases:

- *Awareness of a problem* can come from many sources, including new developments in industry, the emergence of a new field of study, or an observation of a situation in a specific area or community. This awareness leads to a formal or informal proposal for a new research effort.
- *Suggestion* follows awareness, for a tentative design must be made, based on the proposal of a possible solution to the problem. This tentative design phase is the creative phase of the research process, and it requires investing a considerable amount of effort in understanding the problem and the functionality of the output that will resolve the problem, or change the situation. It can even result in these findings leading to the halting or setting aside of further research on the idea.
- *Development* is where the design is realised, once the artefact is developed and implemented. This artefact can take on many forms, such as software development, or the development of an algorithm to construct a formal prototype. The novelty is in the design of the artefact and in its functionality.
- *Evaluation* uses criteria that have been explicitly laid out in the problem-awareness stage to hypothesise on the behaviour of the artefact and its impact on the environments in which it

functions. This evaluation leads to a further knowledge contribution that is used as an input in another round of suggestion, hence the circumscription. The next round of suggestions now starts with the new information and the limitations of the previous version of the artefact are noted. The next development cycle can then yield an improved artefact.

- *Conclusion* can refer to the end of the research or the end of this particular cycle, where the outputs are to be used for further investigation and projects in the future. In this phase, the behaviour of the artefacts is written up and the deviations due to the multiple cycles are noted. The knowledge gained through this process can be considered to be facts that have been learned and can be re-applied, or it can be behaviour that can be repeatedly invoked. The researcher must share the knowledge learnt and contribute to the knowledge base by writing up all the findings and sharing the research with other researchers in the field of study.

4.5 The Design Science Research Strategy applied to this study

The DSR methodology applied to this study is that of Vaishnavi and Keuchler (2013). The DSR methodology relies heavily on the knowledge contribution aspect. The fact that this knowledge contribution is the key focus in DSR is what makes it so different from the original model. This DSR methodology consists of five phases. The different stages are: Awareness of the problem, suggestion, development, evaluation and conclusion. As previously discussed, there is also rigour involved in the DSR methodology, which makes it necessary for some stages to be iterative to produce the desired output (Vaishnavi and Keuchler, 2013). The circumscriptions and the other details required are discussed in each phase, as deemed appropriate for this study.

This research follows the following five phases, as required in the DSR methodology:

- *Awareness of a problem* - In this phase, a wide literature study is conducted to establish the underlying reasons for the importance of the strategy for sustainable ICT and the study also looks into various interventions which have been undertaken but failed. The literature review looks at the various relevant government policies which have been formulated and their adequacy for a meaningful intervention for the sustainable ICT development in deep rural environments. It also looks at the elements of sustainable ICT and the various government ICT policies and seeks to establish the bottlenecks hindering the success of such policies. The output of the problem awareness stage is formulated as:

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There is a lack of strategy for Sustainable ICT Development in Deep Rural Environments

- *Suggestion* - Based on the literature study and the interviews held with the community members, the suggestion is to develop an artefact that can help achieve the goals of the proposal. The proposed solution is a strategy for sustainable ICT development in deep rural environments.
- *Development* - This requires using the knowledge from the literature study and the interviews conducted to create the strategy. A precise and detailed strategy is formulated and developed for sustainable ICT to develop the AmaJingqi rural communities.
- *Evaluation* - This phase is required to confirm the applicability of the new artefacts to its purpose. This study uses descriptive evaluation by applying validation through literature, as well as the feedback by experts on the subject matter.
- *Conclusion* - This is the final stage of this research, and the strategy is considered good enough to perform its function in the context for which it is created. The knowledge gained is written up as the output of this doctoral thesis, and it is to be shared in a journal article and a conference paper.

4.5.1 Chapter Mapping of this Study to DSR

The research process of this study is mapped as outlined in Figure 4.2, according to Vaishnavi and Kuechler's (2013) DSR:

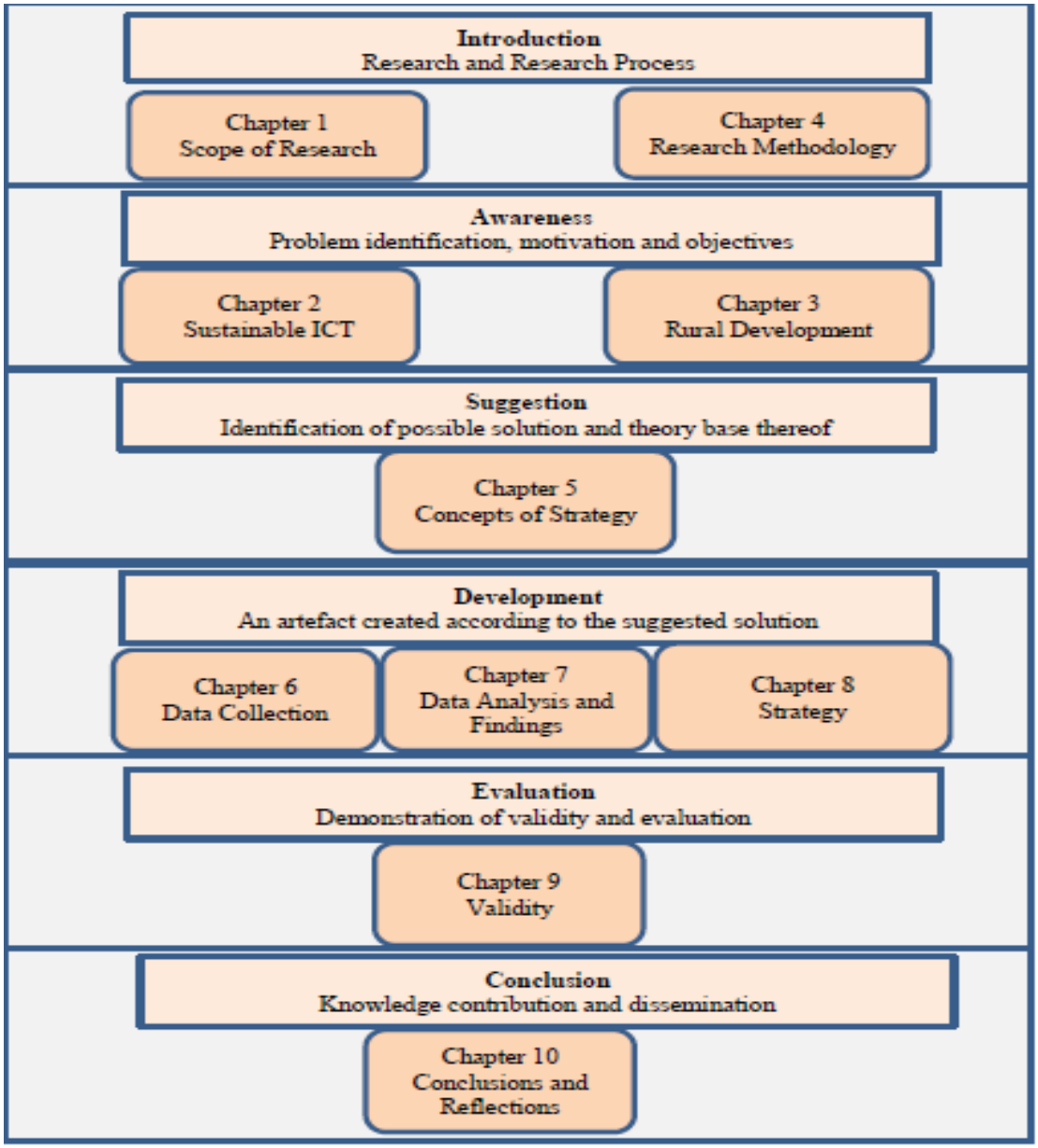

Figure 4.2: Mapping of chapters to DSR according to Vaishnavi and Keuchler (Source: Authors Design)

4.6 Research Processes

There is a need for a clear understanding of the research process which is needed for the study to be successful. The approach involves the use of a specific framework, including the identification of the research questions and determining the research strategy (Caster-Steel and Al-Hakim, 2009).

Caster-Steel and Al-Hakim (2009) also stated that the researcher will need to have a clear understanding of the philosophical assumptions of the complicated phenomenon which need to be studied as well as the method required to investigate it. The discipline mandates a clear understanding and ability to

articulate the research process through a thorough understanding, acknowledging, and defending the ontological, epistemological and methodological assumptions. It is this precise articulation which will infuse quality into the research process and interpret them in the context of the phenomenon under study.

One of the research processes which have flexibility, as per the suggestion of Saunders et al. (2009), is an onion model as outlined in Figure 4.3. This procedure "is composed of six layers: naming and identifying the research philosophy, research approaches, the strategy of conducting the research, the choice of the study, establishing time horizons, and finally methods used to collect data".

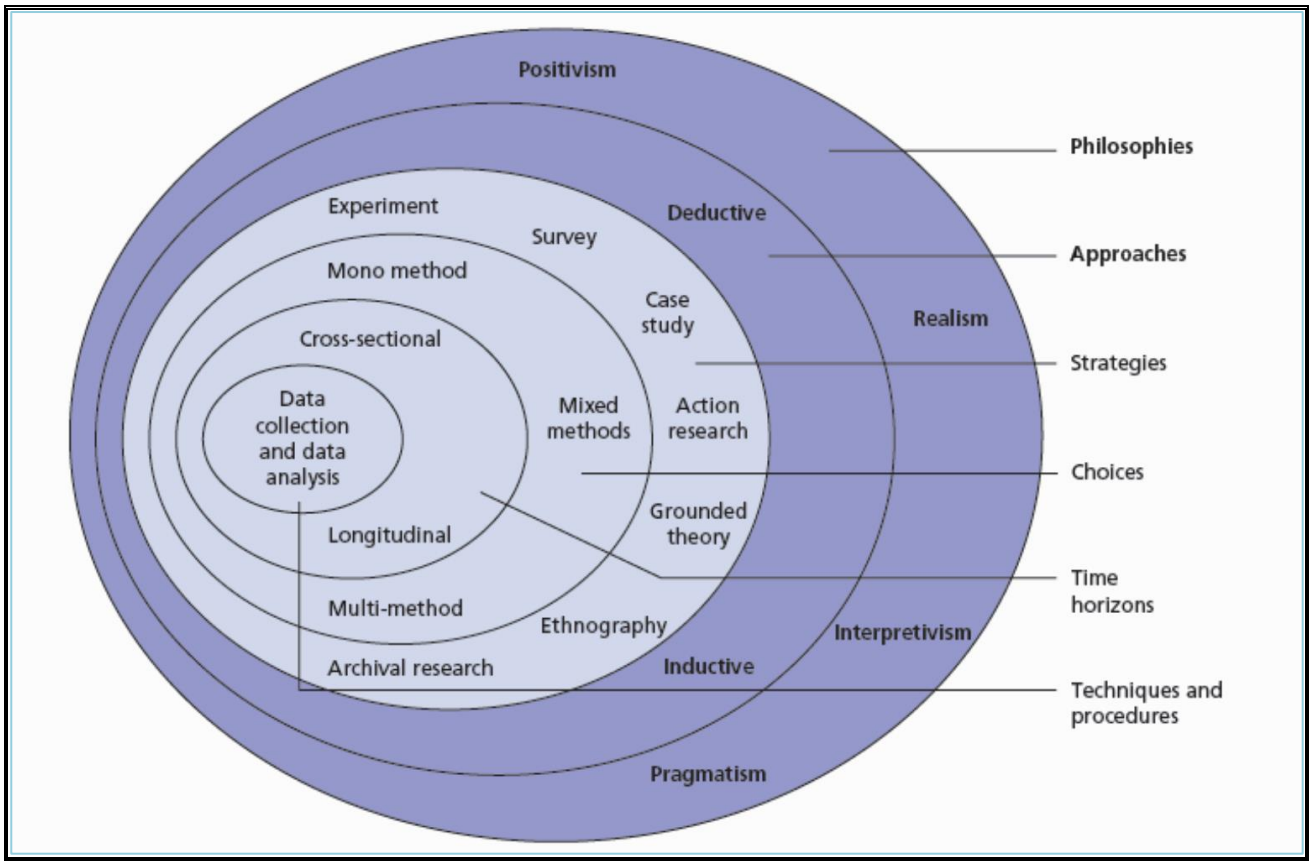

Figure 4.3: Research process indicated as a research onion (Source: Saunders, Lewis, and Thornhill, 2009)

4.6.1 Research Philosophy

The research philosophy is defined as how data should be gathered, collected and interpreted to describe and explain a particular phenomenon. There are two major research philosophies which have been identified in the western tradition of science and these are positivist and interpretivist.

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4.6.1.1 Positivism

Saunders et al. (2009) said that if your research is the philosophy of positivism, you are probably a scientist of philosophical sciences. It is advisable to work with the social reality to be identified and that the result of such investigation can be a generalisation based on the law that is the same as the physical and natural sciences. Positivism narrates that all knowledge can be represented in a statement of laws and facts that are positively collated by measurement (Caster-Steel and Al-Hakim, 2009).

However, positivism has tested criteria of validity, replicability, and rigour in the context of scientific research, and has developed models which have increased the understanding of the expansion and use of IS (Caster-Steel and Al-Hakim, 2009). The natural scientist is likely to reflect and adopt the philosophy of positivism as the ethos will prefer to work with noticeable social reality and that the end results of such research can be law-like generalisations similar to those produced by the physical and natural scientist (Saunders et al., 2009).

Another critical area of the positivist approach to research is that the research work is carried out, practically, in a value-free way. Initially, this is a practical approach, more so when one contrasts the position of the 'resources' researcher with the 'feelings' researcher in the earlier example. The difference is that the resource researcher will be perceived to be outside of the process of data collection given that there is a minimum chance of altering the substance of the data collected. The assumption is also that the resource researcher is independent of and is neither affected or affects the subject of the research (Saunders et al., 2009.

The positivist researcher will have the likelihood of using a highly structured process of facilitating the replication (Gill and Johnson 2010). Moreover, the emphasis will be on refined observations that can assist in statistical analysis. It is entirely possible to adopt some of the characters of positivism in any research, for instance, hypothesis testing, using data initially collected in detailed interviews (Saunders et al., 2009).

A positivistic philosophy is not favoured by this research, based on the fact that the objective of the research is to develop a strategy for sustainable ICT development in deep rural environments. The strategy formulation is not governed by scientific laws as it is a prerequisite for Positivism approach.

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4.6.1.2 Interpretivism

Interpretivism dictates that the researcher understands the role of the humans as social actors. This is dictated by the difference between conducting research among human beings rather than objects such as cars and tablets (Saunders et al., 2009).

Furthermore, Takhar (2003) indicated that interpretivists contend that it will be through the subjective interpretation of the intervention that reality is fully understood. The investigation of phenomena in normal environments is essential to the philosophy of Interpretivism, together with the recognition that scientists do not necessarily influence the phenomena studied. They admitted that there could be many things, but they claim that these interpretations are part of their scientific knowledge. Interpretivism has a tradition that is not less outstanding as positivism nor is it shorter (Takhar, 2003).

In interpretive Information System research, the validity of the case study approach becomes clear once it is realised that one seeks to understand the context of the IS and the process, over time, of mutual influence between the system and its context (Mahmood, 2006). To this end, the case study is not merely a technique or even a means of obtaining data for research purposes. The selection of the case study does not rest on how typical the case may be but depends on its explanatory power and this will be the approach of the interpretivist (Caster-Steel and Al-Hakim, 2009).

For an interpretivist, the generalisability is inapplicable; his focus is rather of other in the plausibility and the cogency of the logical reasoning used in describing the results of the cases, and in concluding them (Mahmood, 2006). Mahmood (2006) adopted the view that case studies provided a primary vehicle for research in the interpretive tradition.

Caster-Steel and Al-Hakim (2009) mentioned that, in contrast, the interpretivist perspective is based on the ontological assumption that reality and our knowledge are social constructs, incapable of being studied independently of the social actors who build and had a sense of the reality. Instead of looking for causal relationships, the attention will be to understand the actors' view of their social world.

An Interpretivism approach is found to be an excellent research philosophy for this study because it's ontological, epistemological and methodological assumptions are well in line with the characteristics of design science and the objectives of this study.

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4.6.2 Research Approaches

The research project will include the utilisation of theoretical work. That theory is stated unequivocally in the outline of the research, despite the fact that it will generally be expressed in the introduction of the discoveries and conclusions. The degree to which an individual is precise about the research at its start brings up a critical issue concerning the plan of the research project. This is whether the research should utilise a deductive approach in which the individual builds up a hypothesis and speculation (or theories) and outlines the research work to test the theory, or the inductive approach, in which data are gathered and a hypothesis built up from the data analysis. Seeing that it is helpful to connect the research approaches to deal with the diverse research rationalities, findings owe more to positivism than induction, in spite of the fact that it is trusted that such naming is conceivably deceptive and of no genuine common sense esteem (Saunders et al., 2009).

4.6.2.1 Inductive Reasoning

The inductive or deductive reasoning or both can be used in a content analysis (Straus, 1987). However, Berg (2007) explained that the inductive approach starts with the researchers dwelling deeply in the documents to identify the dimensions or topics that appears meaningful to the generators of each message.

Whether the individual knows it by this name or not, the person has reasoned thousands of times inductively in their lifetime. Inductive reasoning is reasoning that goes from specific to general – that is, the person takes specific bits of information and draws a general conclusion from it. Another way to view inductive reasoning is to say that most social science research is mainly inductive. This is because academic researchers gather a bunch of data and attempt to draw more general conclusions from them (Lapakko, 2009).

The precise purpose of reading literature will depend on the approach the person intends to use in the research. The inductive approach is when the person is planning to explore the data and to develop theories from them that will subsequently relate to the literature (Saunders et al., 2009). The objectives of this research, as well as the subjective nature of the study, justified the appropriateness of inductive logic for this study.

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4.6.2.2 Deductive Reasoning

In a deductive approach, researchers use some category related scheme suggested by a theoretical perspective, and the documents provide ways for evaluating the hypothesis. "In many cases, the relationship between a theoretical point of view and a certain message involves inductive and deductive approaches. However, to present the perceptions of others (producers of messages) with more franchise, greater reliance on induction is necessary. Nevertheless, as will be shown, induction should not be undertaken to the exclusion of deduction (Berg, 2007).

Deductive reasoning is essentially the opposite of inductive reasoning. It goes from general to specific.

Again, it all begins with a general idea. Then that generalisation can be applied to a variety of specific cats, including but not limited to Max. For whatever reason, logic courses seem to be obsessed with deductive reasoning and a fair share of such courses involve a close examination of deduction (Lapakko, 2009).

When the person begins the research project using a deductive approach, the individual will seek to use the current theory to model the approach that the person adopts for the qualitative research process and the areas of data analysis. Deductive reasoning is not an appropriate method for our study because it is not appropriate for our approach to the case study.

4.6.3 Research Strategy

Each research strategy can be utilised for exploratory, descriptive and explanatory research (Yin 2014. Some of these have a place with the deductive approach, others with the inductive approach. Be that as it may, frequently dispensing strategies to one approach or the other is unduly oversimplified. Additionally, there is a need to underline that no research strategy is characteristically better or second-rate than the other. Subsequently, what is imperative will not be the name that is appended to a specific strategy, but whether it will empower the individual to answer the specific research question and meet the intended objective. The decision about a research strategy will be guided by the research question and objectives, the degree of existing information, the measure of time and different assets the individual had accessible, as well as their own philosophical underpinnings. In the end, it must be recollected that these techniques ought not to be thought of as being fundamentally unrelated (Saunders et al., 2009).

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Table 4.3: Different Research Strategies (Source: Authors Design)

Research Strategy	Brief Description
Survey Research	A research tool which is composed of at least one question that is either open-ended or close-ended and employs an oral or written method for asking these questions. The goal of the survey is to gain correct information about either a specific group or a representative sample of a certain group (Jonker and Pennink, 2010).
Action Research	"In action research, the researcher works in close collaboration with a panel of people to improve a situation in a particular setting. The researcher does not 'do' research 'on' people, but instead works with them, acting as a facilitator" (Dawson, 2002.
Argumentation	Argumentation is the process of advancing, examining, and responding to claims, primarily through the use of reasoned discourse (Lapakko, 2009)
Grounded Theory	A grounded theory strategy is, according to Goulding (2002), "especially useful for research to predict and explain behaviour, the emphasis being upon developing and building theory".
Ethnography	The ethnography method is a description of people or cultures. It has its origins as part of the studies approach in the development of the early social anthropologists, whose intention is to offer a detailed and consistent account of the cultures and lives of small, isolated tribes. (Denscombe, 2007)
Case Study	The case study technique works well when the researcher wants to look into a problem extensively and offer proof which can deal with the complexity and subtlety of real existing conditions.

So, how does a person make a decision about the perfect methodology for the research? Perhaps the simplest approach is to make a decision first as to whether the individual will consider qualitative or quantitative research. The research strategies introduced in Table 4.3 are discussed next.

4.6.3.1 Survey Research

The methodology of the survey generally relates to the deductive approach. It is a common and shared methodology in business and management research, and most of the time it is used to answer who, what, where, and how many questions. In this way, it tends to be used for exploratory and descriptive research. Surveys are common because they gather a large amount of data from a large population in an exceptionally reasonable way (Saunders et al., 2009).

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4.6.3.2 Action Research

Action research promotes a situation where the researcher will have to work in close collaboration with some people to improve a situation in a particular setup. The approach is more about the researcher working with people while acting as a facilitator, and not doing research on people. This will then require the researcher to have group management skills to be able to control the group's dynamics. This type of a research is popular in areas such as organisational management, community development, agriculture and education. The action is mainly centred on the communication and agreement amongst people who are determined to change something (Dawson, 2009).

Action Research emphasises the importance of working with people to correct a situation and does not research people. Our research study concentrated on the behaviour of people and hence action research is not suitable for our study.

4.6.3.3 Argumentation

Argumentation is a verbal and social activity of reasoning aimed at increasing (or decreasing) the acceptability of a controversial standpoint for the audience, by forwarding a constellation of propositions meant to justify (or refute) the perspective before a rational judge (Van Eemeren et al., 1996). Argumentation is also an oral activity which is most often in an ordinary language. In argumentation people utilise words and writings to present or negate an argument. Non-verbal communication is followed by verbal communication in argumentation and plays a prominent role. Furthermore, argumentation is a social occurrence, which in principle is meant for another set of people. Argumentation is also an occurrence of reason where people present their arguments and put their considerations in the realm of reason. Argumentation is always related to positioning. An opinion by itself is never enough; arguments are necessary when people have different points of view. Finally, the objective of argumentation is to substantiate one's standpoint or to refute someone else's.

4.6.3.4 Grounded Theory

According to Goulding (2002), the Grounded theory strategy is particularly useful for research to anticipate and explain behaviour, while the focus is on developing and constructing the theory.

The grounded theory is a more prominent form of inquiry in the areas of education and health research. The emphasis in this theory emerged from the data and is more on the generation of theory which meant that it had emerged from the data. This is different from other types of research which seeks to test the

hypothesis which has been generated by the researcher. In the grounded theory, the preferred data collection methods are focus groups and interviews together with the literature review, which happens throughout the data collection process. The literature review is used to explain the emerging results during the process (Dawson, 2009).

4.6.3.5 Ethnography

The term "ethnography" refers to the description of people or cultures. It is based on a research strategy for the first social anthropologists, whose objective is to provide a detailed and permanent report on the cultures and life of the small and isolated tribes (Denscombe, 2007).

The concept of ethnography is established in the inductive approach and the two can complement each other. Ethnography has taken its characteristics from the field of anthropology. The research subject sometimes inhibits the way the social world gets explained and it is through the use of ethnography that it gets to be explained. This is one of the research strategies which is time-consuming and will require an extended period for it to be completed as researchers get to immerse themselves in the social world being researched as much as possible (Saunders et al., 2009).

Ethnography deals mainly with the cultural aspect of the people involved in the study. The study concentrates primarily on the strategy for sustainable ICT of which culture is only an insignificant part. The research will therefore not use ethnography.

4.6.3.6 Case Study

Case studies endeavour to describe relationships which exist in real life and which are quite often in a single organisation. Case studies can also be interpretivist or positivist, and this depends to a large extent on the methodology used by the researcher, the data collected and the analytical approach used. The researcher can describe reality more accurately by analysing multiple variables, as is practically possible in a research study. Case studies are limited to one organisation and are considered weak and it is difficult to generalise the results, since it is difficult to find similar cases with the same data that can be analysed statistically. In addition, different researchers may have different interpretations of the same data and, therefore, raise the biases in the study.

The Case Study research method works very well with inductive reasoning and is, thus, a suitable method for our research study. The case study research method is also selected as it is better suited for

the in-depth investigation of the problematic area within the selected communities and provides an explanation to cope with the complexities.

4.7 Types of Case Studies

This section discusses the specific types of case studies, namely; explanatory, descriptive and exploratory.

4.7.1 Explanatory

The explanatory type of case study aims to provide comprehensive explanations for the occurrences of a social phenomenon. The description of what is taking place is followed by attempts to explain the concepts within the account; accordingly the explanatory type goes further than mere narrative or description. In this type of case study, it is of paramount importance to be accurate in matters of detail to provide adequate evidence. This type of case study is suitable for seeking to explain the underlying links between real-life phenomena that are too intricate for the survey or experimental strategies (Yin, 2014). It also explores those situations where the phenomenon being investigated has no clear or single set of outcomes (Yin, 2014). Explanatory research must answer 'who', 'what', 'when' and 'where' questions (Mills, Durepos, and Wiebe, 2010). Explanatory cases are purposefully designed, using inductive methods to create a theory by means of hypothesis testing.

The problem addressed in this research is apparent the lack of strategy for sustainable ICT development in deep rural environments. The research sought to understand the reason on the failure of the previous studies and a proposal for a new strategy. An explanatory case study may therefore be used to explain and shed more light on these questions. Since this is an inductive research design, selection of the cases was based on empirical considerations (Mills et al., 2010). It was hoped that an explanatory case study would help in understanding the current environments prevailing in the ICT sector, as well as helping to come up with appropriate building blocks for the overall strategy.

4.7.2 Descriptive

The descriptive case study type is used to comprehensively portray a phenomenon and the real-life context in which it occurs (Yin, 2014). A descriptive case study attempts to provide an intricate description of a phenomenon within its natural context. The case is expected to produce new insights into, and an in-depth and detailed understanding of, the phenomenon under examination (Hill, 2012). A descriptive case study describes the characteristics, mechanisms, qualities or features prior to

examining the situation. In order to get a detailed and an elaborate account of the key phenomena, the carefully chosen cases should provide comprehensive information about the detailed features and characteristics of a specific social phenomenon (Mills et al., 2010). Descriptive case study may result in a multiple case study design, where a variety of cases with similar characteristics are examined. The examination then focuses on describing the cases individually rather than merely observing (Yin, 2014). Descriptive case studies provide rich insights about a particular case and they look at revelatory cases, exemplary cases and even common patterns and explanations (Mills et al., 2010). Descriptive cases are theory driven (Klenke, 2008). As this research sought to develop the strategy for sustainable ICT, it required more than simply a description of the factors that influence the use of ICT in the sector. This type of case study was therefore not deemed appropriate for this research. The appropriate solution was a method that looks at many cases and then observes common patterns before coming up with explanations of the factors that help to come up with building blocks of a strategy.

4.7.3 Exploratory

Exploratory case studies seek to understand a phenomenon as it happens and to draw some lessons (Olivier, 2009). Exploratory case studies generally take the form of field-work and data collection precedes research questions or precise methodology. Such research can take an intuitive path as no structured methodology is required (Olivier, 2009; Yin, 2014). This approach is suitable where there is little or no previous research on the phenomenon under examination (Klenke, 2008) because it offers prospects for understanding key concepts, asking further pertinent questions and better understanding the phenomenon under investigation (Hill, 2012). It is often used as a pilot study to preclude a larger study of the phenomenon later.

Exploratory case studies help to refine the research questions to be used in a later study or to assess the feasibility of research techniques (Hartley, 2004). Exploratory case study designs can also establish how events occur by examining their cause and effect relationships. An exploratory research design was carefully considered and then deemed the most appropriate approach because the use of ICT in the tourism sector in Zimbabwe is underrepresented in the literature with little having been published about the situation. Furthermore, the phenomenon of interest, the use of ICT, is very dynamic and is changing rapidly. There has been limited research dedicated to this area (Maswera, Dawson, and Edwards, 2005, 2006, 2008; Maswera, Edwards, and Dawson, 2009). Maswera, Dawson and Edward‘s research

conducted in southern and eastern Africa looked at four countries, namely; South Africa, Kenya, Uganda and Zimbabwe.

Since it was clear that there has been limited research in this area, a pilot study was necessary. The interview questionnaire should pre-tested manually aimed at carefully selected respondents such as the chieftaincy who are influential in the area. This has to be done to establish the strengths and weaknesses of the interview questions and the questionnaires regarding question format, wording and order. The respondents should be informed about the pre-test and asked to answer the survey questions and make comments on the question format, wording, ambiguity and order. After the pre-test, feedback from the answers and recommendations from the respondents, some questions can be reformulated, adjusted, reordered, and incorporated into the final interview questions and questionnaire. This is based on the recommendations of Mills et al. (2010) who argue that exploratory cases can help to refine the research questions of the later research or to assess the feasibility of research techniques.

4.8 Data Collection Techniques

4.8.1 Interviews

There are two types of data sources which are the primary and secondary data. Secondary data is the one that will be reanalysed after having already been collected and analysed. Primary data is the new data that has been collected and analysed for the first time. Secondary data incorporate both raw and distributed summaries. Most associations gather and store an assortment of data to help their operations, for instance, payroll operations, copies of letters, minutes of gatherings and records of merchandise sales or services.

Primary data can also be collected using semi-structured, in-depth and group interviews. An interview is an intense discussion between two or more people. One of the most important aspects is the collection of reliable data and the interview is one of the methods which can assist the researcher to gather valid data which is relevant to the research questions and objectives. The nature of the interview will have to be relevant and consistent with the research question and strategy which has been adopted (Saunders et al., 2009).

Saunders et al., (2009) state that one typology that is used is related to the level of formality and structure, whereby interviews may be categorised as a:

- Structured interview;
- Semi-structured interview; or
- Unstructured or in-depth interview.

Saunders et. al., (2009) mention that, structured interviews use questionnaires based on a predetermined and 'standardised' or identical set of questions, and are referred to as interviewer-administered questionnaires. Questionnaires, therefore, tend to be used for descriptive or explanatory research.

In semi-structured interviews, the researcher will have a rundown of subjects and questions to be covered despite the fact that these may fluctuate from interview to interview. This implies the researcher may exclude a few questions in specific interviews in a particular organisational context that is experienced about a research topic. Unstructured interviews are informal. The researcher will use these to explore a general area in which the researcher is interested in-depth. Figure 4.4 outlines different types of interviews. Our research followed the standardised format of the interview with the interviewer-administered questionnaires.

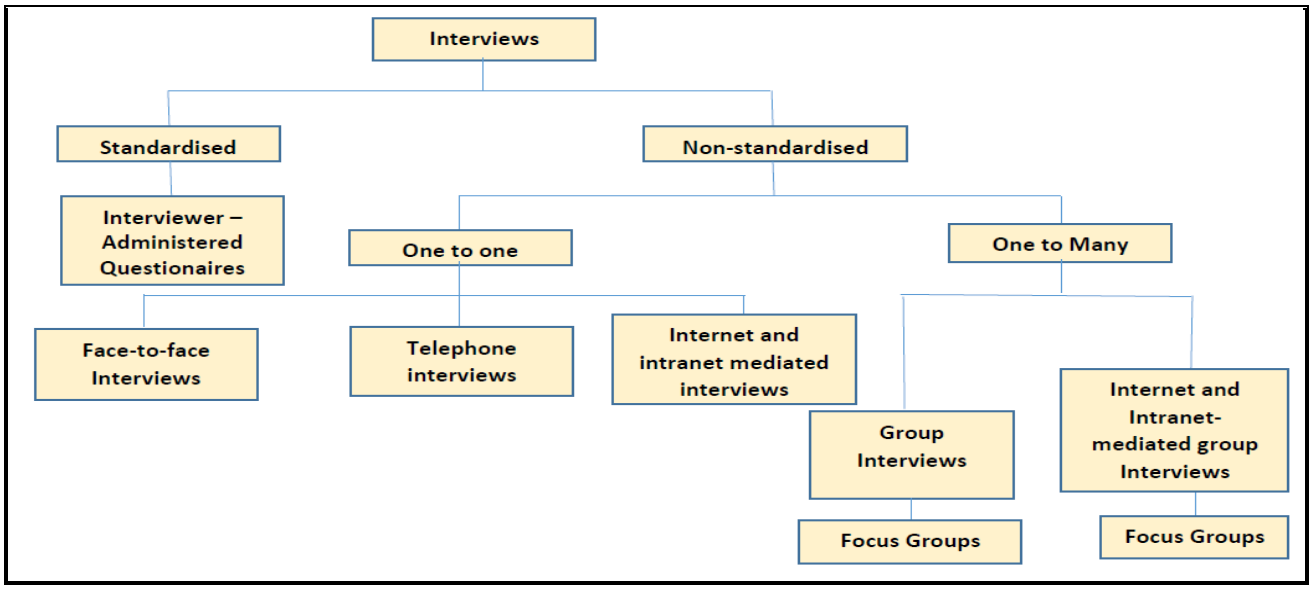

Figure 4.4: Forms of Interviews (Source: Saunders et al. 2009)

There are various types of questionnaires which can be used to collect research data as highlighted in Figure 4.5. According to Saunders et al., (2009), the approach formulation and compilation of the questionnaires differ depending on how they are administered and the amount of contact the researcher

has with the respondents. There are self-administered questionnaires where the respondents will complete the questionnaires themselves.

These questionnaires are sent electronically through the Internet (questionnaires sent over the Internet) or through the intranet (questionnaires sent through the intranet) to respondents who return them by mail, or delivered to each respondent manually and collected later (forms delivery and collection). The interviewee answers the interviewer's questions based on the responses of the respondents. Telephone conversations are called telephone interviews. The final class, structured interviews (sometimes called "interview schedule"), refers to consultations in which the interviewees physically confront the respondents and ask questions personally. These are different from semi-structured and structured interviews (in-depth), as there is a definite schedule of questions from which interviews should not deviate.

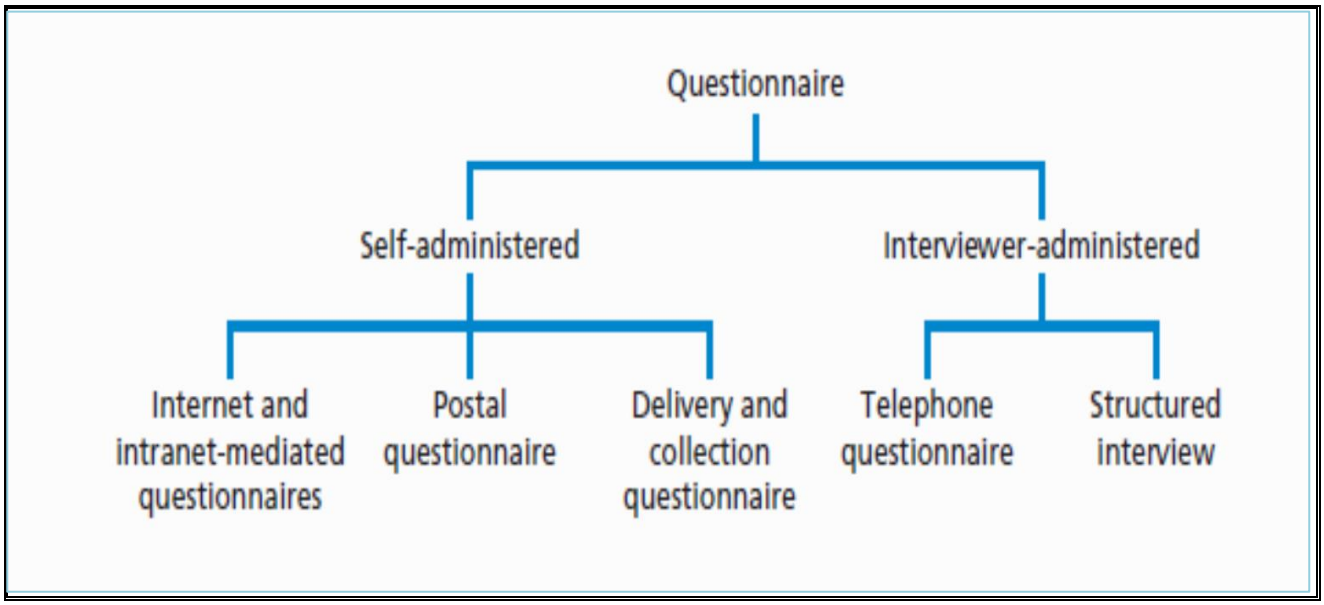

Figure 4.5: Types of Questionnaires (Source: Saunders et al. 2009)

The Interview-administered questionnaires have some challenges which need to be noted. According to Hoffstee (2006), questionnaires have the disadvantage of not allowing the researcher to interact, or often even to observe, respondents. They are also limited to the depth to which the researcher can probe any particular respondent and do not allow for any digression from the set format. However, Hoffstee (2006) highlighted that, depending on the situation, questionnaires have several advantages over oral interviews. They can offer confidentiality to respondents, and are easier to analyse and turn into quantitative results. They also allow for more volume to raise confidence levels in a sample. The more structured a questionnaire, the more easily results can be compared later.

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4.8.2 Literature Review

The purpose of the literature review is to give an overview of what has gone before. This is the work which provides the reader with a theory base, a survey of published works that pertains to the investigation, and an analysis of that work. The literature is expected to be a factual, critical overview of the research which has previously been conducted in the area of interest. This is the place where secondary resources are used.

4.8.3 Expert Validation

Interviews with experts is a manner of collecting data directly from the person who has been identified as having the required knowledge or information for the study to be conducted successfully, but also credibly (Hofstee, 2006). Expert reviews in the form of an evaluation tool with subject domain experts were conducted to evaluate the usefulness and applicability of the proposed strategy.

The evaluation tool was developed and is shown in Appendix B. This tool was designed for the experts to validate the proposed strategy for sustainable ICT for the development of deep rural environments. The main purpose of this evaluation tool was to assess the proposed strategic framework. Additionally, it aimed to gather factors that might influence the successful strategy for the rural community in the deep rural Eastern Cape.

4.9 The Analysis of Methods of Data Collection

To answer the research questions, it was necessary to use various instruments to gather the data required to build the researcher's knowledge and to allow for an appropriate and educated answer to be reached. These instruments are dependent on the type of knowledge the researcher requires to answer the question, and they can be qualitative or quantitative. Quantitative data are normally measurable and are expressed in numbers; whilst qualitative data are descriptive and expressed in everyday language (Yin, 2014. This section looks at the appropriate instruments for use in this study, and it motivates their appropriateness. One of the tools used is a questionnaire and this has been highlighted in Appendix A. Table 4.4 presents the various methods of data capturing.

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Table 4.4: Methods of data capturing (Source: Adapted from Yin, 2014)

Interviews		
Advantages	**Disadvantages**	**Applicability to this study**
• There is direct feedback from the respondent • Probes provide an opportunity for more information and therefore usually yield richest data, details, new insights • Allow the interviewer to clarify questions • Can use observation as another evaluation method • Allow the interviewer to be flexible in administering the interview to particular individuals or circumstances	• Expensive and time consuming • Interviewers must have good communication skills • The interviewee may distort information to please the interviewer • Probing for more information may lead to inconsistencies among the interviews • There is a chance of an interviewer error or bias • Lots of information may be difficult to analyse.	• A possible tool • The advantages outweigh disadvantages as this tool will allow for direct access to highly knowledgeable participants who can assist with solving the issues faced in the real world
Literature Review		
Advantages	**Disadvantages**	**Applicability to this study**
• It saves time since secondary data can readily be available online • Provide a context for the research • Justify the research • Ensure the research hasn't been done before • Show where the research fits into the existing body of knowledge • Enable the researcher to learn from previous theory on the subject • Illustrate how the subject has been studied previously • Highlight flaws in previous research • Outline gaps in previous research • Show that the work is adding to the understanding and knowledge of the field	• Data that is collected for a different purpose may be inappropriate and irrelevant during the current study • Lack of control over data quality (Saunders et al., 2009) Government and other official institutions are often given a guarantee of quality data, but it is not always the case.	• This is a very appropriate tool as data can be gathered with ease from sources around the world. • This will build the knowledge of the researcher to make sure that a thorough understanding of the field is obtained • This will make sure that a solution elsewhere does not exist and that this study is bringing new knowledge to the field

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• Help refine, refocus or even change the topic		
Expert Validation		
Advantages	**Disadvantages**	**Applicability to this study**
• They may provide new ideas and insights • They may increase the credibility of research findings and process • The use of expert reviews may allow the researcher to pursue strategies and approaches that make inherent sense of the context • Experts may make it possible for the researcher to formally or informally benchmark against other, similar systems and/or contexts.	• It is a challenge to identify reliable criteria for selecting experts to involve in the expert review process. • An expert may be working in a different environment hence diminishing the expert's observations and recommendations • Experts' subjectivity and prior experience may affect the outcome of the expert review process • Soliciting insight from experts is can be expensive	• This allows for experts in the field to give input as well as evaluate the findings and make suggestions as to where the strategy can be improved throughout the design

Various methods of data collection are used in this study. The argumentative nature of this study leads to an inductive approach to research, and as such, it requires the collection of qualitative data.

4.10Data Analysis Triangulation

Data analysis incorporates the categorisation of things into their respective parts. It particularly includes the research of complex matters to identify the core elements. It places the demand on the researcher to identify the major components underlying a certain phenomenon so that these can be used to provide a clearer understanding (Denscombe, 2007).

Denscombe (2007) further stated that various research approaches are not to be seen as being mutually exclusive. On the off-chance that no technique is inherently superior to others, and if strategies are to be fairly picked, then this is the point that opens up the likelihood of consolidating strategies and

utilising a blended strategy approach. More than one strategy can be used for the research with the unmistakable goal that shortcomings in a single technique can be adjusted for by qualities in another method. Denscombe (2007) further asserted that utilisation of more than one strategy enables the researcher to utilise triangulation. The blend of various techniques can be used by the researcher at the exploration point to take a gander at an assortment of viewpoints, as a method for correlation and complexity, with every strategy moving toward the theme from an alternate edge.

Triangulation includes the act of reviewing things from more than one point of view. This can mean the utilisation of various strategies, different wellsprings of information or even different researchers in the study. The standard behind this is that the researcher can show signs of improving comprehension of the thing that is being explored if seen from various positions (Denscombe, 2007).

According to Denscombe (2007), researchers have applied the principle of triangulation in a variety of ways. The possibilities include:

- ***Methodological triangulation:*** This type of triangulation utilises approaches that are particularly extraordinary and which enable the researcher to see things from as many alternate points of view as will be prudent.
- ***Data triangulation:*** The legitimacy of discoveries can be checked by utilising different wellsprings of data. This can mean looking at information from different sources (informant triangulation) or utilising information gathered at various circumstances (time triangulation).
- ***Investigator triangulation:*** As a check against inclination emerging from the impact of a particular researcher, the discoveries from different investigators can be analysed for consistency. A quantitative researcher will need to refine the coding calendar or lead additional training with the information gatherers. Qualitative researchers will be interested about the personality of the researcher and how this might have affected the researcher's elucidation of the circumstance or the procedure of information gathering itself (e.g. interaction with members).
- ***Theory triangulation:*** This includes the utilisation of more than one hypothetical position about the information. Diverse speculations can shape the sort of information that is gathered and the way the information is deciphered.

Data triangulation is used in our research study to combine the findings gathered through the literature study, review of academic publications and expert review interviews.

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4.11 Research Validation

To make sure that the artefact, the strategy, is both useful to practitioners and contributing to the body of knowledge (rigorous), it must undergo a strict evaluation and justification. The research validation process aims to establish the relevance and rigour of the identified content, to assess how well they satisfy the needs of the target audience and solve the identified problem.

The purpose of the evaluation stage is to demonstrate the applicability of the developed strategy to the problem domain. The utility, quality and efficacy of the strategy is rigorously established by using well implemented evaluation methods (Hevner, et al., 2004. The strategy is evaluated against the criteria established in the awareness phase. The evaluation is discussed in Chapter 9. One of the research validation methods was a presentation of the paper to one of the conferences and the paper is attached in Appendix C.

4.12 Ethical Considerations

Ethics is best described as the set of values or principles that the investigator maintains during the investigation. Ethical considerations include the confidentiality of the client/investigator, including those who have given their consent to only record the interviews when allowed.

Similarly, to make sure that ethical considerations are respected, the researcher plays a key role in the interpretivist inquiry. The researcher, therefore, can never assume an attitude of neutral value in the relationship between theory and practice and is always associated with the underlying phenomenon (Orlikowski and Baroudi, 1991). It is, therefore, critical that investigators acknowledge their role in an interpretivist inquiry, and try to control individual bias.

The articulated ethical values are present throughout the research process, thus adding to the rigour of the research process. These qualities incorporate, for instance, reasonable and legitimate dealings with research members and partners. The participants voluntarily consented to participate in the research. They were informed of their rights to privacy, and of the fact that their data will be presented anonymously. The Memorandum of Understanding was signed by the Council of Traditional Leaders of the AmaJingqi to allow the research to use their community as a case study. Finally, the interpretivist is fully involved during the research process to make sure that the collection of data is smooth and manipulated and interpreted accordingly.

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The research ensures that the confidentiality of the participants is guaranteed, and personal information is not shared without consent. The participants are assured that their personal information will only be used for research purposes and that the researcher alone will have access to the information. Personal information was kept in the password protected storage device to prevent access to the information by unauthorised persons.

4.13 Conclusion

Interviews with experts is a manner of collecting data directly from the person who has been identified as having the required knowledge or information for the study to be conducted successfully, but also credibly (Hofstee, 2006). The experts had to provide input into the current state-of-affairs in the country about the various interventions which have been undertaken and the various implementation challenges.

The literature review and a survey of work done in the same field were used to provide a theoretical basis for the researcher. An analysis of that work, showing any gaps, weaknesses and potential new research areas, could then be done based on the knowledge the researcher had built up through the literature reviews (Hofstee, 2006). In design science, the literature review reveals, almost simultaneously, an understanding of the phenomenon as well as an initial design of the artefact (Vaishnavi and Keuchler, 2013). The literature readings were found in newspaper articles, conference papers, journals, books and website.

4.14 Summary

In this chapter, the Design Science research methodology is discussed and the reasons for using this methodology are motivated. The Design Science suited our research study as our research paradigm was a key characteristic in resolving a significant, previously unsolved problem for a class of businesses or environments, while also making a contribution to the knowledge-base.

The research study uses the qualitative research method together with a bit of qualitative and inductive reasoning. The study also adopts interprevitism as a research philosophy. Interpretivism advocates that it is fundamental for the researcher to comprehend the contrasts between people as social actors. This accentuates the distinction between leading research among individuals instead of items, for example, trucks and PCs.

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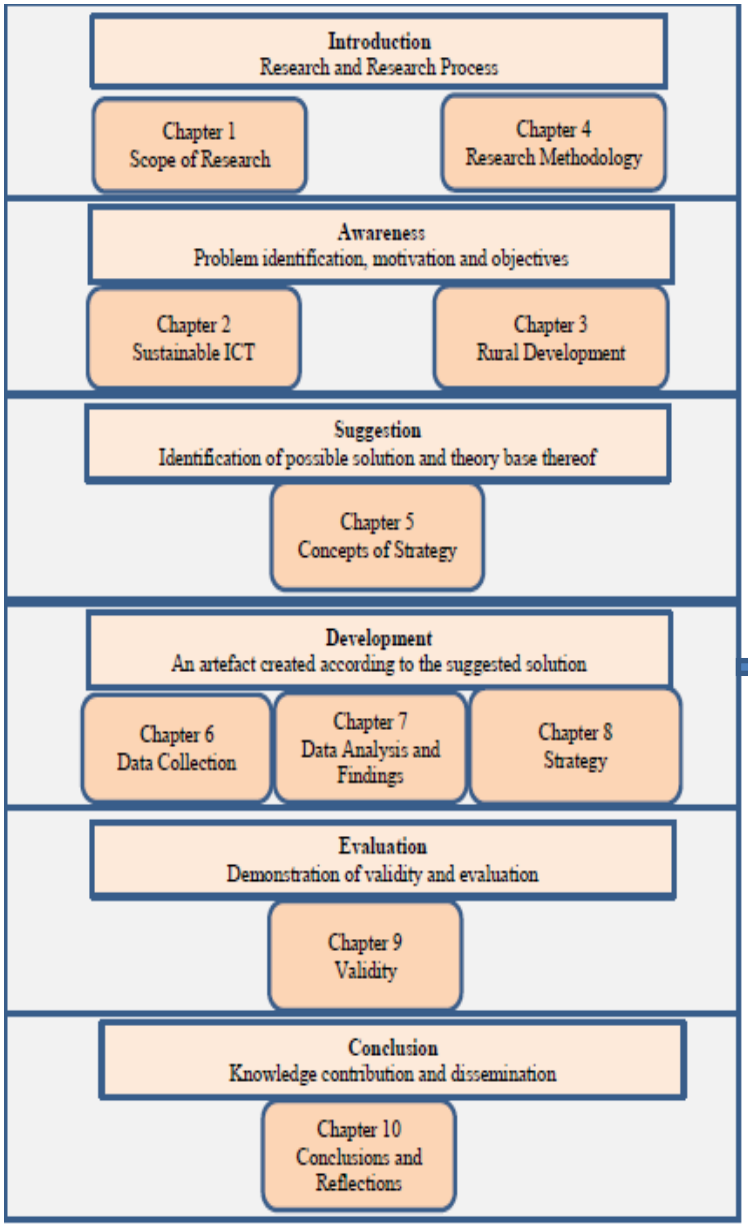
The discussions make it clear that the DSR methodology has been widely accepted for use in information systems research. It has been refined through the years, providing guidelines and steps to be followed by the researcher to make sure that the study is done scientifically and yields credible results.

The methodology followed raised awareness of the various areas that need to be investigated to achieve the final strategy. These areas include studying the various government current ICT policies and the intervention which have been previously implemented. Each one of these “awareness areas” has been discussed in the previous chapters. The first is the sustainable ICT, which is discussed in Chapter 2, followed by the exploration of the various strategies around rural development in Chapter 3.

CHAPTER 5: CONCEPTS FOR STRATEGY FRAMEWORK DESIGN



Chapter 5 Concepts for Strategy Framework Design

5.1 Introduction
5.2 The concept of a strategy
5.3 Theoretical foundation for the strategy formulation model
5.3.1 Strategy formulation approach
5.3.1.1 Objectives
5.3.1.2 Environmental scanning
5.3.1.3 Strategy formulation
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5.3.1.5 Monitor, evaluate and control
5.4 Devising a strategy formulation model
5.4.1 Objectives
5.4.2 Environmental assessment
5.4.3 Strategy formulation
5.4.3.1 The kernel of the strategy
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5.4.5 Strategy control
5.5 Conclusion
5.6 Summary

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5.1 Introduction

This chapter seeks to fulfil the core objective of this research, which is to devise an ICT strategy for the sustainable ICT development in the deep rural environments. It focuses on the design of the ICT strategy for the development of the AmaJingqi traditional community in the rural Eastern Cape Province. Section 5.1 introduces the chapter. Section 5.2 describes the concept of strategy, while Section 5.3 provides the theoretical foundation for the strategic formulation approach. Section 5.4 discusses how the strategy is devised. The chapter concludes with Section 5.5.

5.2 The Concept of a Strategy

A strategy is defined as a complete and integrated unified plan linking the strategic benefits of the company or enterprise to the challenges of the environments. It is designed to make sure that the basic strategic objectives are achieved (Rudani, 2013). Strategy is not a destination but a road map for success (de Ruijter, 2016). It determines how an organisation is positioned in a particular market for competition. A well-formulated strategy is indispensable to the sustainability and growth of any organisation (Karami, 2012). It can also be seen as an inclusive and broad plan that is focused on taking advantage of an organisation‘s internal strengths and opportunities. A strategy responds to challenges and competitors in the organisation‘s environments. It incorporates a specific plan prepared to respond effectively to the organisation’s extended environments. It involves a conscious, active, and rational program to define objectives and determine response to the environments (Rudani, 2013). Hence, a strategy, in the author’s view, is a purposefully designed plan. This is further concretised by Rumelt (2011) who defined a strategy as a coherent set of analyses, concepts, policies, arguments and actions to meet a significant challenge. The specific issue in this definition is that a strategy is based on actions that flow from policies that, in turn, most likely stem from an analysis to solve problems and to meet objectives.

A strategy can also refer to the long-term policy measures taken by a competent authority in charge of economic affairs in tackling major industry problems with an aim for the sustained development of the local and state-level industry as a whole (Zhu, 2013). From this definition, it is clear that a strategy is a long-term plan that is crafted to solve a particular problem in a sustainable way. A strategy can apply to an industry, a sector or an organisation. A typical organisation can be seen as a miniature industry or sector. The factors that affect an industry also affect the organisation and vice versa.

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In all of these definitions, four issues are common:

- A coherent broad plan that combines both internal and external factors;
- Related to the challenges of the environments;
- Combined actions; and
- Sustainability as it has a future orientation.

From these critical issues, it can be seen that a strategy is an integral part of an organisation‘s continued existence. The operational activities of two organisations might be similar, but strategy is what makes the difference between them. All organisations must consistently improve operational efficiency in their assigned but sustainable performance which rests on having a distinctive strategic position (Porter, 2000). Sustainability in this research is regarded as the achievement of long-term survival, growth and success. For the purpose of this research, strategy is defined as a coherent, broad, all-inclusive plan that is purposefully designed to make sure that internal strength are used in a sustainable manner to respond to the challenges of the environments and attain set objectives.

Triantis (2016) observed that the word strategy is commonly paired with some variant of the word plan, as in the process of strategic planning or the resulting strategic plan. It involves the process of supporting future value creation by identifying, defining, assessing and applying goals and resources in the marketplace (Achtenhagen, Melin and Naldi, 2013Consequently, the whole aim of strategic planning is to achieve success and survival by directing resources to achieve organisational goals.

Kachru (2009) maintained that effective strategic planning links long-term goals to the actions and resources to achieve those goals. It, therefore, sets the organisation‘s strategic goal, integrates business systems, coordinate actions, and thereby improves organisational performance (Fadol, Barhem, Elbanna, Adcroft and Bruce, 2015).

Daft and Samson (2014) supported the above view by positing that strategic planning is an instrument to achieve the long-term strategic goals of an organisation. It defines where the organisation is going, how the organisation will achieve its plan and conversely, shows the organisation where it has not

achieved its objectives (Chege, Wachira and Mwenda, 2015). Khan and Khalique (2014) added that strategic planning bridges the gap between where the organisation is and where it wants to go.

5.3 Theoretical Foundation for the Strategy Formulation Model

This section deals with the theoretical foundation of a strategy formulation process. First, the literature outlines and defines the number of approaches to the strategy formulation. Secondly, the components identified from a variety of strategic management processes specifically for the strategic planning process in this research were consolidated. Thirdly, the proposed strategy formulation approach applied in this research is explained. The existing strategy formulations that are utilised are from Tsokota (2017). The motivation for opting for these strategies is their proximity and alignment with this research. On the basis of this, four existing strategy formulating approaches are discussed in the rest of this section.

5.3.1 Strategy Formulation Approach

The strategic formulation approach is depicted in Figure 5.1.

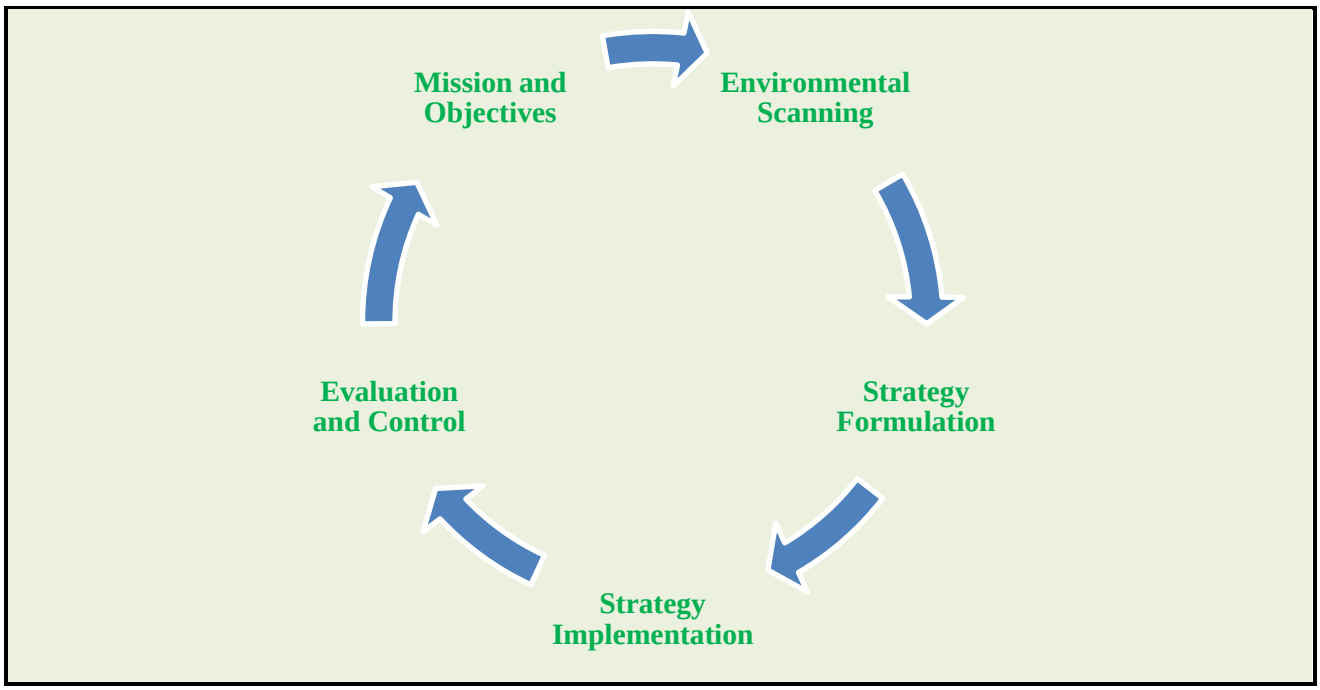

Figure 5.1: Strategic formulation approach (Source: Researcher's adapted design)

Figure 5.1 presents the strategic formulation approach which outlines the various stages that need to be undertaken for the crafting and formulation of strategy. The various steps to be undertaken are: 1)

mission and objectives, 2) environmental scanning, 3) strategy formulation, 4) strategy implementation, and 5) evaluation and control.

5.3.1.1 Objectives

The Mission is about the reason for the existence of the organisation and the objectives that concisely express a sense of what it wants to attain in the future. This is also referred to as a strategic intent which broadly follows a chronological structure consisting of three elements: broad vision definition, the translation of a vision into a mission, and specifying goals and operationalising strategic objectives**.**

5.3.1.2 Environmental Scanning

In environmental scanning, organisations observe their environments to detect opportunities and threats affecting their business when taking strategic decisions. There are many methods that are used to carry out environmental scanning, which include a Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis and a Political, Economic, Social, Technological, Environmental and Legal (PESTEL) analysis. In the environmental scanning process, all possible risks and opportunities are assessed. Both the internal and external factors in the environments that might positively or negatively affect the organisation are analysed.

5.3.1.3 Strategy Formulation

After reviewing information obtained from the SWOT analysis, an organisation‘s mission is converted into challenging problems, targets, actions and processes to achieve its goals. The goals of an organisation are crafted, measured and used as yardsticks in all the key areas. What emerges from the goals should be comprehensive plans that show the desired outcomes as well as how the organisation will achieve them. Therefore, strategy formulation does not deal only with the crafting of actions, but also creating an overall strategy which can be used to pursue the actions.

5.3.1.4 Strategy Implementation

The agreed-upon actions and processes are converted into action steps to achieve strategic goals and objectives. This involves channelling resources, creating required structures, and defining processes and action plans to be followed in attaining the set objectives. It is important to note that strategy formulation and implementation are closely linked but fundamentally different. This is because strategy

formulation takes place before any action to solve a problem, while implementation takes place during problem-solving, and requires meticulous coordination.

5.3.1.5 Monitor, Evaluate and Control

This aspect refers to the processes which lead to necessary changes in the strategic intentions. All strategies and mission statements can be modified because of the constantly changing environments. Strategy evaluation and control determine whether the selected strategy is attaining the organisation's objectives. The original strategy evaluation and control framework includes reviewing the internal and external parameters which are in the current strategies, evaluating performance and implementing corrective actions.

5.4 Devising a Strategy Formulation Model

In Section 5.3.1 various approaches to strategy formulation are presented. These will be employed to provide the base for crafting an appropriate strategy formulation framework for this particular research. The proposed strategic formulation model borrows relevant concepts from the models that are presented. It is tailor-made to suit the situation at hand as presented earlier in this research.

5.4.1 Objectives

Section 5.3.1 outlines why is there a need for objectives to be defined and how is this is going to assist the formulation of the most effective strategy. The formulated strategy addresses the gap and lack of access to viable ICT infrastructure within the rural community of the AmaJingqi Traditional Council. The major objective of the strategy is sustainable ICT development in deep rural environments through the implementation of accessible ICT services. The strategy will provide guidance on the objectives which will need to be achieved for it to be effective. There are a number of major objectives which will need to be addressed by the sustainable ICT strategy:

- Provisioning cost-effective and ubiquitous ICT infrastructure access
- Providing a platform of inclusivity for the community, and supporting the democratic inclusion
- Promoting a digital access and information society inclusive of the rural poor of the AmaJingqi Traditional Council
- Promoting sustainable development
- Digitalising the economy through the use of ICT

These objectives will be able to drive the community towards what is needed to accomplish an effective strategy for sustainable ICT development in deep rural environments.

5.4.2 Environmental Assessment

The environmental assessment involved analysing both the internal and external environments to understand the factors that affected the strategy for sustainable ICT for development in a deep rural environments. It required the engagement and the inclusion of all stakeholders. There are many tactics that can be utilised to carry out an environmental assessment (Tsokota, 2017). These included a SWOT and PESTEL analysis, and Porter‘s (2000) competitive force model, a resource view model, and value chain analysis. Although the SWOT analysis is commonly used for environmental assessment, its major weakness is that it is very subjective (Bazin, Cassard, Caudron, Prognon and Harvard 2015; Fertel, Bahn, Vaillancourt and Waaub, 2013) and lacks objective stakeholder engagement (Navickas and Malakauskaite, 2015), which is an objective way of evaluating the environments.

For the purposes of this study, a baseline assessment was used to conduct the environmental assessment. It used a formulation of questionnaires to collect data, which was analysed and interpreted and the strategy evolved from the outcome. Section 4.7 describes various data collection methods with the structured interview as the favoured model to collect the data.

The environmental assessment is discussed in Chapter 7. The findings of the environmental assessment must be validated, and this is done through triangulation of the findings from the literature reviews and the interviews. This cross-referencing is discussed in detail in Chapter 8, and the results will yield the details required to formulate the strategy for sustainable ICT.

5.4.3 Strategy Formulation

Rumelt (2011) called the strategy formulation the “kernel” of the strategy approach. He stated that there are three elements to take into account to ensure the quality of the strategy, namely, diagnosis, the guiding policy and a set of coherent actions.

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5.4.3.1 The Kernel of the Strategy

The kernel of a strategy provides the structural approach which serves as a guide for excellent strategy development. It is made up of three distinct but related parameters, namely: diagnosis, guiding policy and a set of coherent actions. These elements and their roles are discussed in detail below.

a) Diagnosis

Diagnosis is a major element of a strategy. It defines the type of challenge, highlights the important aspects of the situation, and the hindrances that have to be overcome, directly from the situational assessment. In the diagnosis, there is an attempt to identify the cause of the problem and put it into the correct perspective by clearly understanding the situation. Initially, the diagnosis compares situations, linking the facts to patterns, and recommends issues which need to be granted more attention. The diagnosis helps to simplify an overly complicated and ambiguous situation so as to make sense of the environments.

b) Guiding Policy

The guiding policies are the policies that will organise the various actions to be taken in a focused and co-ordinated effort. They also assist in showing and arranging the interactions of the different practical action that takes place, thus helping to concentrate and coordinate efforts. In the absence of a guiding policy, efforts and resources may be less consistent, less coherent and even antagonistic to each other. Adoption of a guiding policy helps to collaborate, coordinate and disseminate the information and knowledge among the stakeholders, so as to ensure a successful strategy for sustainable ICT.

c) Set of Coherent Action

A sustainable strategy has a coherence, coordinated activities, policies and resources. A set of coherent activities are steps, policies, resource commitments and actions created to reignite the guiding policy. An effective strategy will transform focused goals into a coherent set of implementable objectives. The three parameters discussed in the kernel of the strategy, are core to the final strategy.

5.4.4 Strategy Implementation

Strategy implementation implies the implementation of a set of coherent actions. It follows the guiding policy and executes the set of coherent actions highlighted in the strategy formulation process. The implementation process is holistic and involved different role-players and the deployment of the devised

strategy in the rural area. The implementation gives guidance about the order in which the actions are to be implemented, including the role of various stakeholders. It involved the re-alignment and redesign of how ICT services will be offered in the deep rural areas.

The strategy implementation is discussed in Chapter 8, where a scenario is used to identify the stakeholders and their roles, as well as the action plan that they need to perform.

5.4.5 Strategy Control

Strategic control links components of the strategy formulation procedure together and assists in assessing their effectiveness, ensuring continuity on the revision of the strategy. The control process continuously assesses the relevance, progress and report back in the guiding policy and a set of coherent actions. It also makes deductions about how well the set of coherent actions fulfils the devised strategy and make it possible for remedial actions to address the gaps in the needs of all the various stakeholders. The seriousness of the gaps in the various stakeholders' requirements should be judiciously documented for future evaluations.

5.5 Conclusion

The main purpose of this chapter was to gain insight into the strategy formulation process and strategy design for sustainable ICT development in deep rural environments. Various definitions of the strategy concept and its formulation processes have been looked at. Consequently, a definition and a strategy formulation process have been developed for this research. The subsequent strategy formulation is then applied, resulting in the development of a strategy for sustainable ICT.

5.6 Summary

In this chapter, the various theoretical models for devising a strategic-formulation approach were discussed. This theoretical background allowed the researcher to devise a strategy-formulation approach that is suited to this study. The motivation behind the suggested strategy approach is discussed, in addition to a broad overview of what it will address at each stage.

The study of the various theoretical models of the strategy-formulation process in Section 5.3, indicate that:

i. All strategy processes follow the same steps, albeit some are more detailed than others are, or they may differ in sequence.

ii. All strategies must indicate
   a. Where the project currently stands
   b. Where the project wants to be
   c. How to get there, and
   d. How to evaluate its success.

iii. A strategy process suitable for this study is developed, allowing for an iterative approach to objective setting and environmental assessment.

iv. The strategy must address how sustainable ICT can be implemented.

v. This strategy is driven by the overarching vision and mission of the government of South Africa to provide affordable ICT services.

The proposed model is outlined below in Figure 5.2.

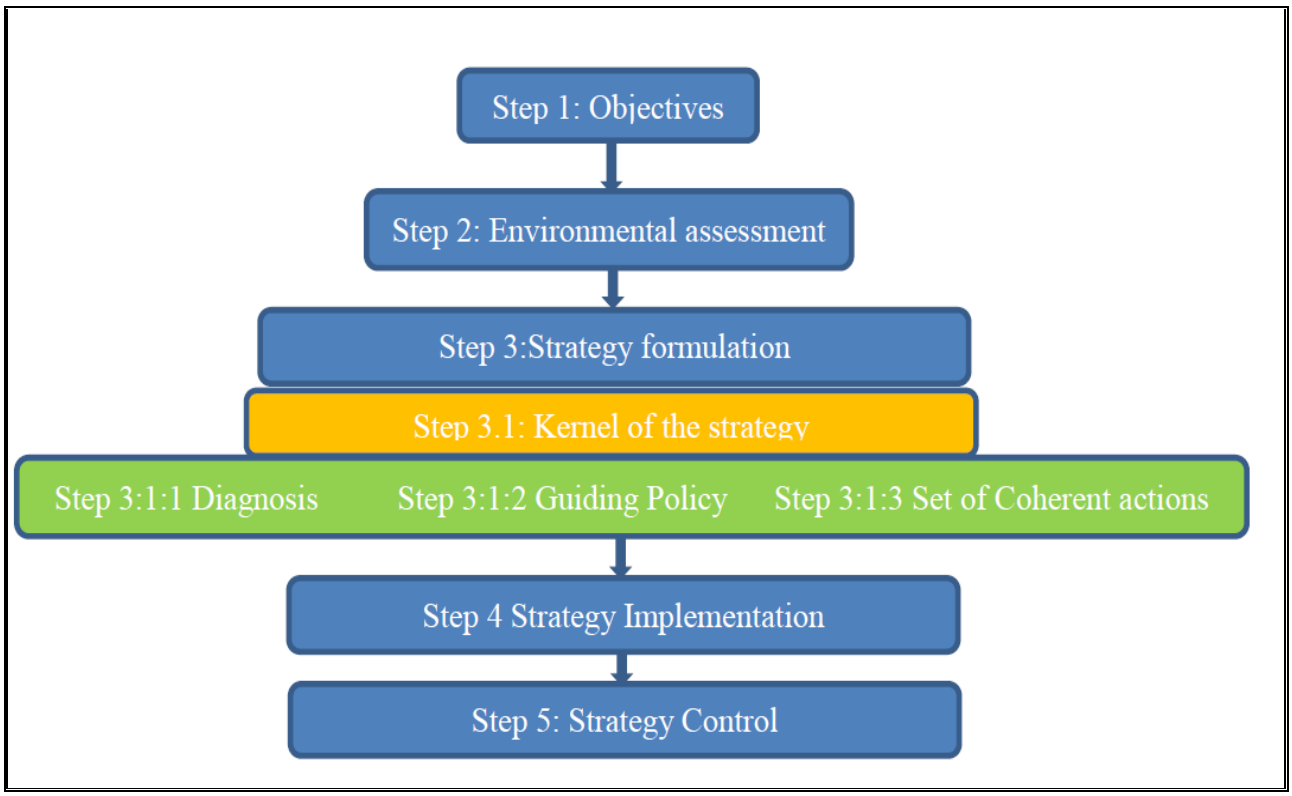

Figure 5.2: Proposed strategic formulation model (Researcher's adapted design)

The strategy process shows that there are four phases involved in this study. The first phase consists of two steps, namely, setting initial objectives, and then performing an environmental assessment that will help identify further sub-objectives needed to satisfy the main objective. Phase 2 is the formulation

phase which requires an exact diagnosis of the problem, as well as high-level guiding policies on how to solve the problem. The guiding policies must point to exact and detailed action plans that must be implemented. Phase 3 is the implementation of the strategy, as formulated in phase 2, and requires stakeholders and role-players of each action plan to be identified and notified of the role they have to play in the strategy implementation. The final phase is the evaluation phase, and it requires some measurement of the performance to be done through feedback and monitoring of the process.

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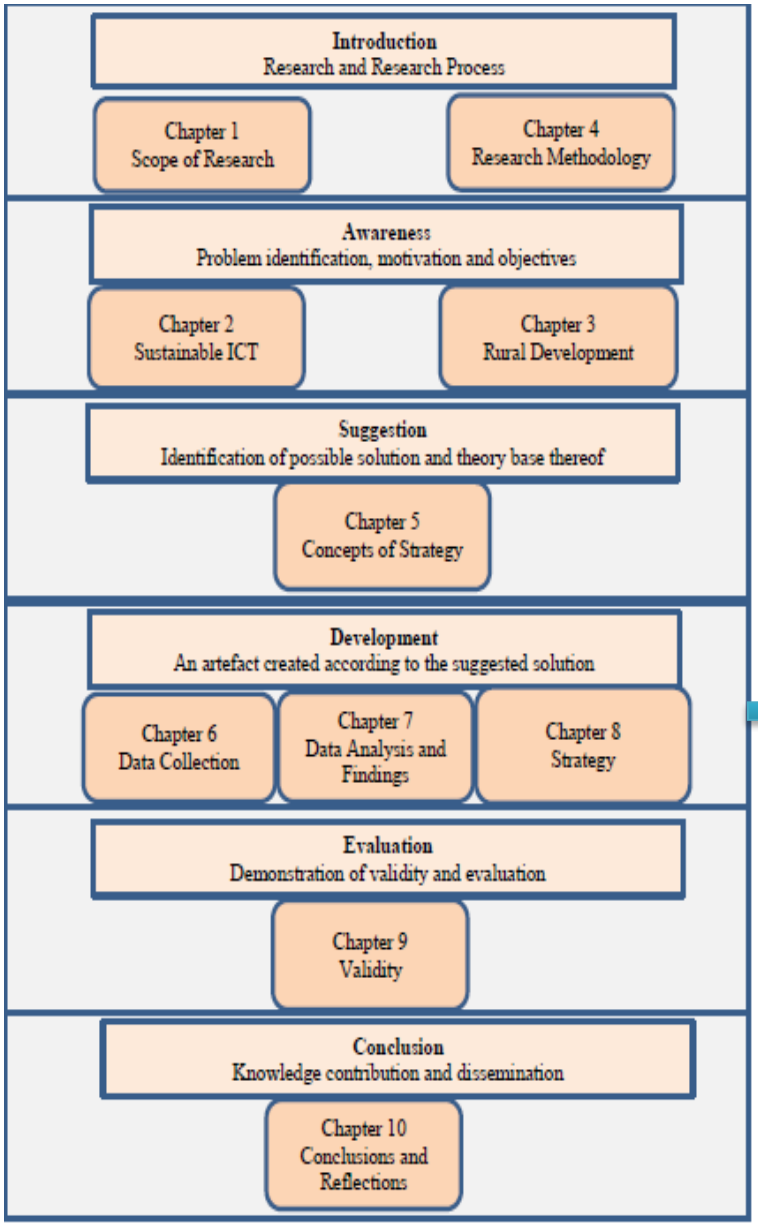
CHAPTER 6: DATA COLLECTION PLANNING



Chapter 6 Data Collection Planning

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6.1 Introduction

This chapter outlines the data collection and the analysis process with a brief explanation on how the data are gathered. Section 6.1 introduces the chapter and outlines the purpose of data collection. Section 6.2 deals with the theoretical framework which addresses the theoretical base for guiding data collection. Section 6.3 deals with setting the objectives and outlines what needs to be achieved. Section 6.4 outlines what needs to be covered under the environmental assessment of the study. Section 6.5, discusses the data collection plan, case study overview, and the sampling. Subsection 6.6 describes the design of the instruments and explains the various interview forms used. The preparation for data collection and how this is done is presented in Section 6.6. Finally, Section 6.8 presents the summary and conclusion of the chapter.

6.2 Theoretical Framework

Meyer (2001) quoting Hartley (1994), emphasises the need for a theoretical framework to ensure a solid theoretical base for guiding data collection and avoiding the collection of data that is without meaning. The following two major theories were used to establish factors that could influence the use of ICT in the general economy; these factors were also assumed to inherently affect technology adoption in all the other sectors of the economy including the rural communities. The two theories used were, firstly, the factor category of e-commerce adoption decision and the key areas of bench-making ICT theory. Therefore the two theories complemented each other to build more dimensions, as they emphasise different aspects that affect ICT adoption in the rural communities. The theories will now be briefly discussed.

Communities that want to effectively participate in the information society, to become e-communities with a full benefit to the ICT services need to address each of these steps of infrastructure, skills and use to fully realize the benefits of ICT. The ITU (2011) and the E-Index provide some examples of how to determine progress towards effective engagement in the information society with the ITU focusing on country measurements while the E-Index concentrates at a community level. ITU describes the combination of ICT skills and ICT access which enables the use of ICT and the Internet. In turn, it is using technology that results in communities taking full advantage of the information society. Another ICT assessment is built on this model. The understanding of the components of the functional strategy for sustainable ICT was very critical in gathering the useful data. The matrix is indicated in figure 6.1.

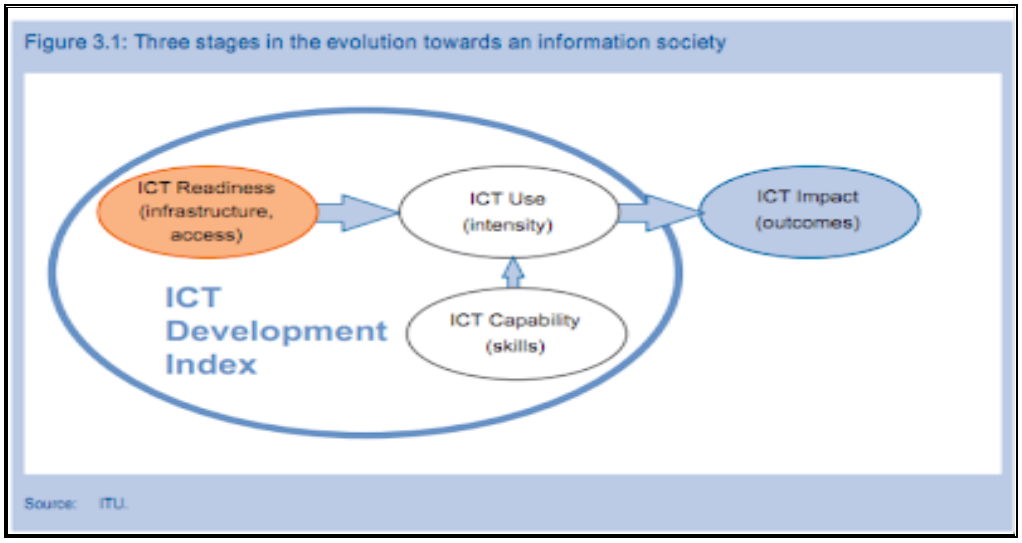

Figure 6.1Components of the functional ICT Strategy

It is equally important to mention that the general rule is that the application of ICTs to development should always begin with a development strategy. From that, an information plan for implementing the development strategy can be derived and only out of that should come a technology plan. While strategic thinking can be informed by an appreciation of the capabilities of ICTs, it is essential to have clear development targets that are specific to the context before the form of use of the ICTs is defined. Additionally, in considering the development strategy, bottom-up, demand-driven development objectives are usually preferable to top-down, supply-driven objectives, so that goals begin with an appreciation of the needs of development recipients as they would themselves express them. The successful collection of data will was underpinned by a clear understanding of the relationship between rural development and the use of information and ICT as depicted in figure 6.2.

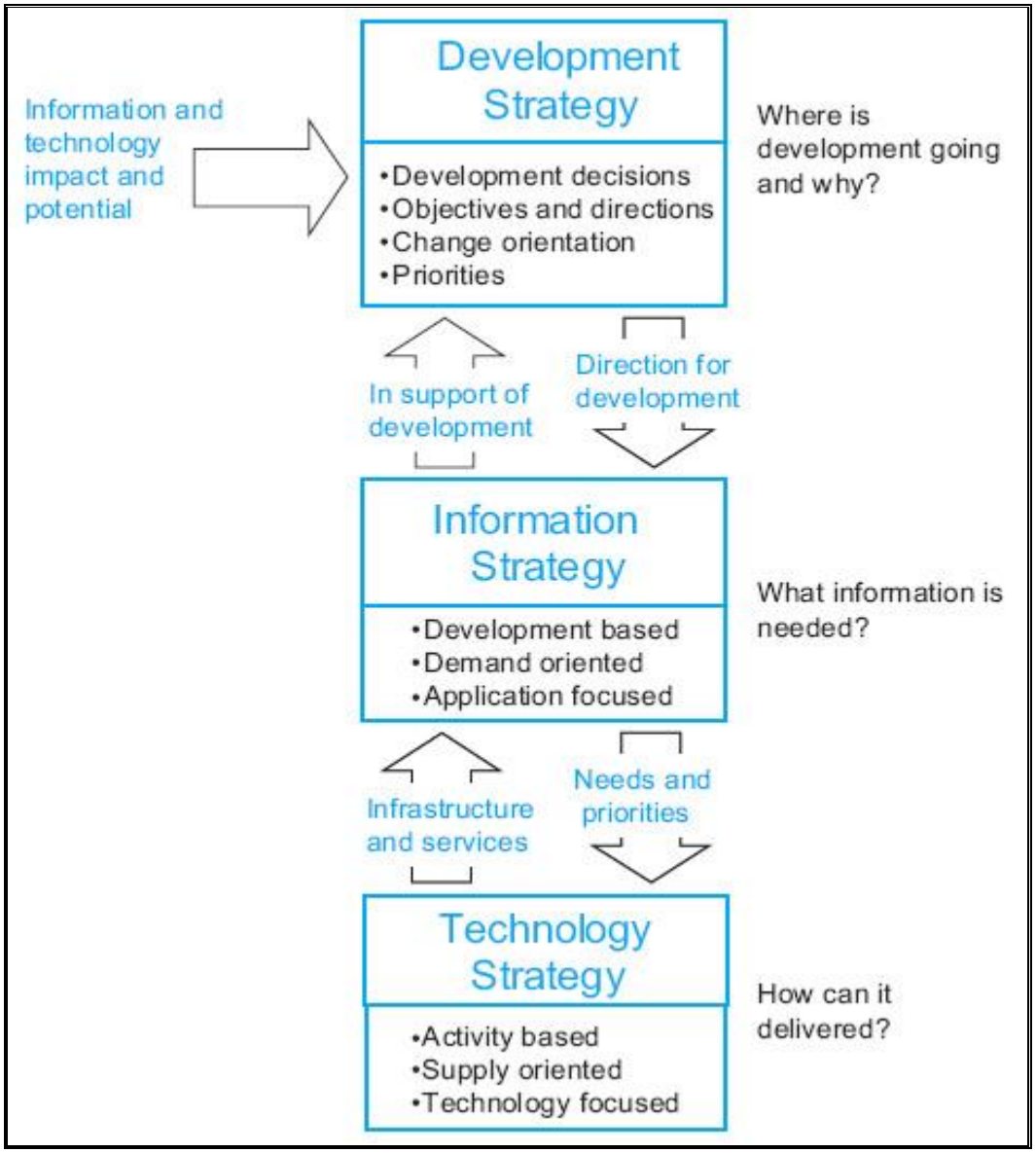

Figure 6.2 Relationship between development, information and ICTs

6.3 Objectives Setting

The objectives of the study were discussed in Chapter 1. This section serves to examine the objectives of the strategy in line with the strategic process, to make sure that these are in line with the objectives of the study. Section 3.6 of the literature study highlighted some of the areas that need to be considered for a successful sustainable ICT strategy:

- Scrutinise the current policies and verify which of those support the provision of ICT infrastructure in the rural communities with concrete, monitored objectives which can be utilised to develop a unique strategy to achieve the agreed developmental agenda;

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- Ascertain that the developed plans address the requirements for promoting the supply of the ICT infrastructure buildout as well as for increasing the demand for ICT services;
- Create environments to allow ample opportunity for stakeholders to provide input in establishing the strategy;
- Set achievable objectives with recognition and taking into account that the implementation of the strategy will take time;
- Focus on successes with longevity by developing sustained focused efforts for the future;
- Adopt a "one shot" solution which can be achieved in a short space of time. If minimal resources might not produce the best solution, this approach should be discouraged; and
- Ensure the appointment of a coordinating agency responsible for the implementation of the strategy.

6.4 Environmental Assessment

Phase 1 of the strategy process requires an environmental analysis to be performed, to understand the environments in which the study lies better. In this section, the internal and external environmental factors that play a role in sustainable ICT for the development of the rural communities are explored.

Some strategies and policy failures are explored and diagnosed comprehensively in the study to ascertain the degree of their effectiveness, their lack or inadequacy. The Integrated Rural Development strategy is one of the strategies that was explored and which failed to recognise that ICT cuts across all development and that nothing can be achieved without using ICT.

Some gaps in the NDP, which might compromise the success of this policy document, were also examined. There is little to suggest that ICT policy documents get priority treatment. A working ICT strategy will need to reposition the ICT landscape. This will ensure a competitive market, coordination of much-needed resources, ICT across the government departments, and a universal access strategy to address not on both the gaps in the ICT market and also the demand-side stimulation of the market.

The study also conducts full data collection from the affected community. This data is both qualitative and quantitative and is analysed to deduce the adequacy of the existing infrastructure and investigate the ICT needs of the community. The full data collection and analysis are discussed in Chapter 7.

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6.5 Data Collection Planning

The literature on strategy for sustainable ICT is presented in Chapter 2. Based on the literature review, a theoretical framework was developed and used to direct the study. To understand the components of the strategy in detail, it is imperative to conduct a case study of the phenomena. The purpose of the case study is to evaluate the impact of various ICT interventions and formulate a strategy for sustainable ICT development in deep rural environments.

To understand the components of the strategy in details, it becomes imperative to conduct a case study of the phenomena. The purpose of the case study is to evaluate the impact and formulate strategy for sustainable ICT development in deep rural environments. A single case study is conducted in a rural environments where the community members of the area are identified as the end users and therefore termed participants.

Based on the observations of the researcher, the formal data collection process is informed. The empirical study is conducted in a typical ICT-enabled environments. This chapter presents the case study of environments which uses ICT development in deep rural environments. The case study addresses Research Question 1 and the objective is formulating a sustainable ICT strategy.

The question addressed by the study is:

What is the Strategy that will guarantee Sustainable ICT Development in Deep Rural Environments?

6.5.1 Overview of the Case Study

The research area is within the ICT space and focuses on a strategy to guarantee sustainable ICT development in deep rural environments. Part of the research entails data collection within the community. This includes a baseline data analysis to identify the needs of the community and to assess how the earmarked interventions can address their critical needs as far as ICT requirements are concerned. The Kulo-Jingqi is an amalgamation of 22 villages in the southern part of Willowvale within the rural municipal area of Mbashe in the Eastern Cape. The community has a total population of about 11 000 with an unemployment rate of 87% and a 100% primary source of income coming from government social grants. Some of the challenges faced by the community are lack of resources and responsiveness from the local and provincial government to ensure upliftment and improvement in the lives of the community. One of the most outstanding interventions and the legacy left by the late

President Mandela is the building and donation of the High School in collaboration with Shell South Africa. The school is named after the local Chief Dumalisile.

The Chief mentioned that he would like the opportunity to improve the quality of their school curriculum, as this could have a lasting effect on the learners' **readiness** to improve the ICT skills pool. If the intervention is immediate, this could take another 20 years to get corrected. There is a greater need for a computer literacy intervention for the teachers. The community needs to be trained and assisted in taking ownership of and guiding what has been provided for their upliftment and benefit. There is also a need for access to information that will help the community and school children to improve the level of education within the community. There is about 87% unemployment and there have numerous studies that indicate that ICT can play a major role in job creation and enabling people to have access to job opportunities.

6.5.2 Sampling

In an interpretivist paradigm, qualitative researchers recognise that some potential respondents are in a better position to provide greater insight and understandings than others (Abrams, 2010). Therefore the use of arbitrary sampling research techniques is neither necessary nor preferable (Klenke, 2008). The selection of cases must be done in a way that maximises what can be learnt (Tellis, 1997). Therefore, the community selected for the case study must be purposefully chosen to provide a proper representative sample of the community and the purpose of the research. Using purposeful sampling, a sample is selected with a pre-defined purpose to answer specific research questions that have been identified (Abrams, 2010; Castillo et al., 2014). The logic, strength and power of purposeful sampling lies in selecting information-rich cases which produce deep insights and in-depth understanding instead of empirical generalisations (Patton, 2002).

The research methodology used to gather information regarding strategy for sustainable ICT development in deep rural environments is presented in Chapter 4. This chapter summarised the results of the questionnaires and interviews conducted during the study. Two hundred questionnaires were distributed across four rural communities within the AmaJingqi traditional councils. Two hundred questionnaires were returned, and 100 and 20 questionnaires were selected for analysis. The reason for the discarding of the other 80 questionnaires was due to the discrepancy on the responses provided. The results revealed that most respondents are positively inclined towards the ICT services and expected to see their livelihood improved with the appropriate ICT infrastructures. The respondents highlighted their frustration with the lack of dependable and affordable ICT services in the area. There is also a

huge level of unemployment, and the standard of living is very high, and basic ICT services are beyond their reach.

The total population sampling is an approach where whole populations which fall under the researcher's criteria are encompassed in the research being conducted. Total population sampling is more prevalently used where the number of phenomena being researched is relatively small. The total population sampling is employed in the study.

6.6 Designing the Data Collection

This section presents the process followed in designing the data collection.

6.6.1 Designing of the Research Instruments

One of the instruments outlined in Section 4.8 is data gathering by means of structured interviews. These types of interviews use questionnaires based on a predefined and 'standardised' set of questions, and are referred to as the interviewer-administered questionnaire process. Questionnaires, therefore, tend to be used for descriptive or explanatory research. There are 75 sets of questions which have been compiled to guide the research. The questions are formulated to gain a richer understanding of phenomena to be studied and to ascertain if there is indeed a problem. The target participants are ordinary members of the rural community.

There are also one-on-one information gathering sessions with Chief Dumalisile of the AmaJingqi Traditional council and these used the semi-structured interviews. In semi-structured interviews, the researcher will have a rundown of subjects and questions to be covered despite the fact that these may fluctuate from interview to interview. This implies the researcher may exclude a few questions in specific interviews, given a particular organisational context that is experienced about a research topic.

The unstructured interviews are characterised by an informal approach. Researchers use these as a general approach to examine, in-depth, a topic in which they have an interest. Researchers use these as a general approach to examine, in-depth, a topic in which they have an interest.

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6.6.2 Structured and Unstructured Interviews

Structured interviews use questionnaires based on a predetermined and ‘standardised’ or identical set of questions, and are referred to as interviewer-administered questionnaires. Questionnaires, therefore, tend to be used for descriptive or explanatory research

In semi-structured interviews, the researcher will have a rundown of subjects and questions to be covered despite the fact that these may fluctuate from interview to interview. This implies the researcher may exclude a few questions in specific interviews, given a particular organisational context that is experienced about a research topic. Unstructured interviews are informal. The researcher will use these to explore, in-depth, a general area in which the researcher is interested. The Figure 4.4 in the previous chapter outlines different types of interviews. Our research followed the standardised format of the interview with an interviewer-administered questionnaires.

6.7 Preparations for Data Collections

In the discussion with the Chief Sibongile Dumalisile of the AmaJingqi Traditional Council as part of the baseline study, he highlighted the plight and lack of ICT services and the negative impact it has amongst his community. The Chief highlighted that there is a greater need for intervention on computer literacy for the teachers. The community needs to be trained and assisted in taking ownership and guiding what has been provided for their upliftment and benefit. The Kulo-Jingqi is an amalgamation of 22 villages in the southern part of Willowvale within the rural municipal area of Mbashe in the Eastern Cape. The community has a total population of about 11 000 with an unemployment rate of 87% and a 100% primary source of income being the government social grants.

The research identifies four major areas within the community to conduct the survey. Each area was allocated about 50 questionnaires with a total of 200 questionnaires for the entire study. This survey is to collect data for the baseline study on the formulation of a strategy for sustainable ICT development in deep rural environments. This research aims to develop a strategy that will ensure deployment of sustainable ICT development in deep rural environments. The brief outline of the data collection plan can be summarised as outlined in the figure 6.3:

Figure 6.3: The framework of the data collection (Source: Researcher Design)

The case study questionnaire is designed to collect data based on the findings of the baseline study which was conducted though the one-on-one interview with the Chief Dumalisile. The main objectives of the questionnaire are mainly the following:

- To understand the ease of access to ICT services and which type of services the community is able to reach;
- To assess the income profile and affordability of different households;
- To assess the level of ICT skills and computer literacy among the various communities;
- To assess the readiness of the various users to adopt new technologies;
- To understand the buying patterns of local businesses and their access to online banking;
- To assess the level of understanding of the community of the benefit of ICT;
- To assess the level of sustainability of any ICT initiatives within the communities; and
- To assess the ability to innovate and the culture of creative thinking.

Data was collected about the ICT services accessibility and affordability within the rural community. The raw data is confidential and is used to ascertain and assist in the formulation of a strategy for sustainable ICT for development in the rural community.

All the questionnaires have the same type of questions as this is an interview-administered survey. The questions are close-ended as specific answers to assess the environments are sought from the respondents.

The closed questions allow for the other responses capture the essence of the response and provide more clarity where necessary. To improve the responses, a rated, ranked (e.g. Likert scale) matrix and multiple selection questions was also used.

The information was gathered to give a holistic picture of the issues impacting on access and the affordability of the ICT services in the rural environments.

6.8 Conclusion

The objectives of the study on its intention and what it seeks to achieve were briefly outlined and discussed. This was primarily to make sure that the end results of the data collection are able to address the gaps which have been identified and which prompted this particular undertaking.

The environmental analysis was identified as an important element to ascertain the current state and to formulate the appropriate strategy for sustainable ICT which will address the identified gaps. Various policies were looked into and their effectiveness was explored to identify the weaknesses that needed to be addressed in the formulated strategy.

The data collection formed a very important part of the study and there was a need to make sure that a data plan was formulated on how credible data was going to be collected to adequately address the research question and objectives. This prompted an appropriate sampling to adequately address a representation of the population under the case study. The research instruments formed an important part of the data collection and the chapter briefly outlined the instruments which were used and how they were designed. The questionnaires were the instruments used and followed the structured interview format for data collection.

6.9 Summary

The chapter outlines the data collection plan which seeks to outline how the research data has been collected. The objective of the research work is briefly outlined and appropriately linked to the study. The environmental assessment is conducted through the use of data collection and the analysis of the literature review. The case study has been adopted as adopted as the method used to collect data by use

of questionnaires. The overview of the case study is undertaken and accepted that the sample collected is good enough to provide credible data to assist present a picture of the rural community.

The research instruments used are explained and considered to be appropriate for the purposes of the study. One of the data collection methods used is both the structured and unstructured interviews and this involves the domain experts.

The chapter has highlighted a diverse and dynamic nature of the community where data are due to be collected and few challenges experienced by the community are also outlined.

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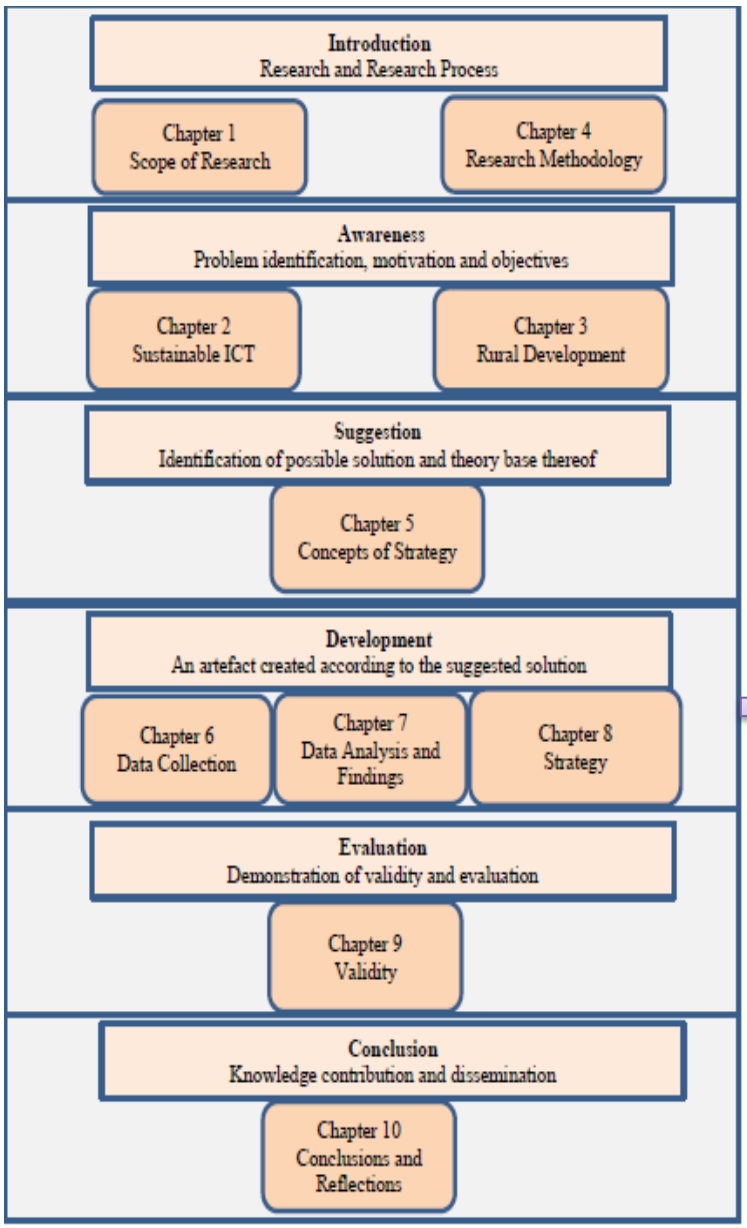
CHAPTER 7: PRESENTATION ON FINDINGS



Chapter 7 Presentation on Findings

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7.1 Introduction

This chapter analyses the findings of the data collected. The findings include the information that was gleaned during the environmental scanning and during the assessment of the infrastructure and the level of affordability in the rural communities. They assist with the establishment of the strategy for sustainable ICT, establish whether the existing infrastructure is able to serve the community, and test to see if there is sustainability. This chapter presents the research findings and looks at the data collection, analysis and literature review. Section 7.2 deals with the research findings from the collected data. Section 7.3 outlines the discussions of the research findings and the literature review. The chapter then concludes with Sections 7.4 and 7.5 which discuss the conclusion and the summary respectively.

7.2 Research Findings

7.2.1 Demographics

Table 7.1: Gender distribution

N=120		
Gender	**Male**	**Female**
	47%	53%

The respondents, according to Table 7.1, constituted mainly females. More women (53%) responded than men (47%). One of the main reasons for this could be that the tradition in the rural areas still dictates that women are expected to stay at home and look after the children while men go to the cities to find employment to take care of their families. It has to be pointed out that this trend has marginalised the women when it comes to exposure to ICT due to the lack of environments which will expose them to the use and understanding of ICT technologies. Section 2.3.7 has dealt extensively with the gender digital divide and highlighted the importance of empowering women who more often than not remain in the rural communities while the males go to urban cities for employment purposes.

Table 7.2 Age distributions

N=120					
Age	**16-21**	**22-30**	**31-40**	**41-50**	**50+**
	20%	38%	28%	8%	8%

The responses constituted mainly young people between the age of 22 and 30 years. As illustrated in Table 7.2, the majority of the participants (38%) are in the young adult 22 – 30 age range, with the least

number (8%) in the older adult 41-50 year and older 50+ year categories. The majority of the participants in the 16-21 age range were the school going youth. This is an indication that the majority of the participants are in the economically active age groups. This is a clear sign that the most affected group fell within a category that is supposed to be actively involved in the improvement of the country's economy. This calls for policies that will ensure all-inclusive ICT provisioning as outlined in the NDP Section 3.7.2 of the literature review.

Table 7.3 Categories of participants

N=120				
Category of participants	**Youth**	**Employed**	**Self-employed**	**Unemployed**
	10%	37%	8%	46%

Table 7.3 highlights that the highest number of participants (46%) is unemployed, and the lowest number of participants (8%) is self-employed. It is also important to note that the youth constituted 10% of the participants and the majority of those are high school pupils. The current South African unemployment figure is 25%, and it is important to note that the youth constituted about 46.9% of the total unemployed individuals according to the 2011 Census. Thus, 46% of the unemployed respondents is mainly constituted by youth, and this must raise some serious concern for a developing country such as South Africa. It is important to make an assertion that the impact of ICT is expected to be even more robust once the penetration reaches the critical mass of unemployed youth. The effective policies for supply and demand are crucial for penetration of the ICT services as outlined in Section 2.3.5.

Table 7.4 Home Language

N=120									
Home Language	**Xhosa**	**Zulu**	**Tswana**	**S. Sotho**	**N. Sotho**	**Venda**	**English**	**Afrikaans**	**Other**
	100%	0%	0%	0%	0%	0%	0%	0%	0%

Table 7.4 illustrates that all the participants are Xhosa speaking, and this is due to the fact that the survey was undertaken in one of the biggest rural environments in the Eastern Cape which is Xhosa dominated. This is a clear indication that the content providers will not have difficulty in generating content in the indigenous Xhosa language. The demand-side advocates for relevant content, which in this case should be Xhosa, for ease of adoption as outlined in Section 2.3, which covers elements of sustainable ICT.

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Table 7.5: Level of literacy

N=120		
Level of literacy	**Yes**	**No**
	97.50%	2.5%

Table 7.5 indicates the highest level of literacy for the participants at 97.50%. This is an indication that most of the community members can read and write, and this will, therefore, assist with the seamless ICT development for the members of this community. One of the major concerns raised by the literature studies is that the ICT lack of computer literacy will be disadvantaged by a lack of access to a fast growing space of job opportunities. It, however, suffices to note that it will be quite easy to introduce digital literacy among the community members for the ease of uptake and adoption. Section 2.3.6 of the literature review has highlighted that digital illiteracy has proven to be one of the challenges that inhibit the ease of ICT adoption in deep rural environments.

Table 7.6 Highest qualifications

N=120				
Highest Qualification	**Grade 7 or less**	**Grade 8 or more**	**Diploma/Certificate**	**Degree/Postgraduate**
	13%	58%	18%	11%

Table 7.6 illustrates that that majority (58%) of the participants has grade eight (8) and more as their highest qualification with the second group (18%) having achieved a diploma or certificate. The trend indicates that the majority of the people are yet to see the door of institutions of higher learning. However, there is a strong indication that most of the respondents can read and write. In ICT, the ability to be able to consider and use the latest technology trends within the current socioeconomic area of the livelihoods of the possible end users will need added resources and new expertise. Thus, literacy capabilities matter in determining ICT access. Section 2.3.5 has placed an emphasis on the need for the absorption capacity for the end users and this requires the users have an educational level which will enable them to absorb the new information.

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7.2.2 Employment

Table 7.7 Employment rate

N=120				
Who do you work for?	**Self-employed**	**Family**	**Private/Public sector**	**Unemployed**
	8%	0%	37%	56%

Table 7.7 illustrates a high level of unemployment (56%) amongst the respondents. It is important to note that the affected age group is within the supposedly economically active individuals. There is a clear indication that the level of unemployment is high within this community. Table 7.7 also illustrates that there is a small number of respondents (8%) who are self-employed, and this is an indication that there are not many entrepreneurial activities within the communities. Studies show that there is a direct link between the roll-out of ICT infrastructure to the small businesses and job creation. Section 3.2 indicated that one of the solutions which can be explored for rural ICT is Internet access through the Internet portals hosted on a delivery web server. This will provide seamless Internet access to the citizens through affordable Internet connectivity. The strategy will have to explore possibilities of job creation using ICT.

Table 7.8 Type of employment

N=120				
Do you work full-time or part-time	**Full-time**	**Part-time**	**Fixed-term contract**	**Piece-work**
	75%	4%	21%	0%

The majority of the employed respondents (75%) as shown in Table 7.8 are employed full-time and the rest are on fixed-term contracts (21%) with a few on part-time (4%) employment. One of the most important aspects of sustainable ICT is the element of affordability. The application of information communication which is meant to increase job opportunities for the rural poor and provide them with learning will require strategic intent. There will have to be substantial experimentation which will include grassroots participation for scaling up and sustainability. The literature review in Section 3.7.2 highlighted that rural development with employment creation will contribute to food security and the well-being of the rural communities with an inclusive rural economy. Rolling out cost-effective network infrastructure is key and the spectrum allocation and technology-neutral network are some of the key components to provide affordable services as outlined in section 2.3.1 and 2.3.2 respectively.

Table 7.9 Working Experience

N=120				
Working Experience	**Less than one year**	**1-5 years**	**5-10 years**	**10+ Years**
	6%	66%	19%	9%

Table 7.9 illustrates that the majority of the respondents (66%) who are employed have 1-5 years of working experience. This is followed by the respondents (19%) with 5-10 years of working experience. This is a clear indication that the majority of the interviewees who are working have very minimal work experience, and this will most likely require them to be developed further to make sure that they have enough capacity to explore the full benefits offered by sustainable ICT. One of the biggest problems highlighted during the unstructured interviews is that 87% of the community is receiving grants, and affordability is a major problem. Stable job creation is necessary and this can only be achieved by sound investment which will be guided by a sound business model as outlined in Section 2.3.9.

7.2.3 Communication and Information

Table 7.10 Access to fixed-line

N=120				
Do you have access to a fixed-line phone?	**Yes**		**No**	
	18%		82%	
Where is your nearest access point?	**An office computer**	**Home Computer**	**Internet café**	**Cellphone**
	64%	5%	27%	5%
How far do you have to travel	**<5km**	**5-10km**	**10-20km**	**>20km**
	27%	41%	14%	18%

Table 7.10 shows that the majority of the respondents (82%) don't have access to fixed-line telephone services. This trend is primarily due to the terrain which is very complex in the rural areas and as a result makes it very expensive to roll-out fixed-line infrastructures in such areas. The rest of the respondents have access to a fixed-line telephone at their workplaces (64%) and the closest Internet café (27%). It is also important to note that most of the respondents have to travel more than 5km to reach the nearest fixed-line telephone network. The literature review noted that the cost of services and the infrastructure remains a significant hindrance to the increased use of the mobile devices and the

fixed-lines. Limited network competition further escalates the cost and this is clearly articulated in Section 2.3.3.

Table 7.11: Frequency to fixed-line access

N=120				
How long does it take you to reach a fixed-line?	**<1hr**	**1-2hrs**	**2-3hrs**	**>3hrs**
	41%	32%	23%	5%
How often do you need to make the trip?	**Daily**	**Once a week**	**Twice a week**	
	59%	32%	9%	
To whom do you make most fixed-line calls	**Business calls**	**Relative**	**Friends**	**Other**
	55%	18%	0%	27%

The Table 7.11 illustrates the frequency of how often the respondents had to make a trip to a fixed-line telephone. The majority of the participants (59%) have to undertake daily trips to make fixed-line calls as illustrated in the table above while the rest do so once and twice a week. It took most of the participants (41%) less than an hour to reach the fixed-line telephone line, and the rest of the participants took between an hour and three hours to arrive at a fixed-line. Most participants (55%) made business calls and the rest call families (18%) and other people (27%). There is a clear indication that the fixed-lines are still very much relevant. However, this is likely to pose a problem though due to the exorbitant cost of rolling out fixed-line services in the sparsely populated rural community. Section 2.3.8 of the literature review recommends the use of Television White Space technologies as one of the cost-effective approach of rolling out wireless technologies in the rural areas.

Table 7.12 Access to fax

N=120				
Do you have access to a fax?	**Yes**		**No**	
	31%		69%	
Where is the nearest access point?	**Office**	**Home**	**Internet cafe**	**Cellphone**
	47%	0%	53%	0%
How far do you have to travel	**<5km**	**5-10km**	**10-20km**	**>20km**
	22%	25%	14%	39%

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Table 7.12 illustrates that most of the respondents (69%) do not have access to fax services. Those who have access (31%) are using the Internet Café or using the fax at their place of work. The majority of the respondents (53%) have access to fax at the Internet café. The rest of the Respondents have access to fax at their place of work. It is important to note that the majority of the Respondents (39%) have to travel about 20km to reach fax services. There is also a general decline in the use of the traditional fax services. The technology has evolved, and most people can now scan documents into emails. There is, however, a trend where most of the rural community members do not have access to email, and this makes it tough for them to use the scan services, hence, they still rely on the use of faxes. One of the other restrictions to use fax to email is probably a lack of adequate infrastructure for rural connectivity as alluded to in Section 3.4. The reason is that acquiring rural consumers is financially unattractive for the network providers due to the low purchasing power and sparse population density, long leads to limited returns on investment on the infrastructure network providers.

Table 7.13 Distance to fax

N=120				
How long does it take you to travel to the nearest fax?	**<1hr**	**1-2hrs**	**2-3hrs**	**>3hrs**
	33%	31%	14%	22%
How often do you need to make the trip to the fax?	**Daily**	**Once a Week**		**Twice a Week**
	34%	58%		8%
To whom so you send/receive fax	**Business**	**Relative**	**Friends**	**Other**
	50%	11%	6%	33%

Table 7.13 illustrates that the majority of the respondents (34%) have to travel more than an hour to reach the nearest fax. The respondents also indicated that they fax at least once a week (58%), and most of the faxes are business related. There is a clear indication that the exchange of faxes is mainly for businesses with about (50%) respondents indicating that they either receive or send faxes for business purposes.

Table 7.14: Cellphone ownership

N=120						
Do you own a Cellphone?	**Yes**			**No**		
	96%			4%		
What make of a Cellphone	**Samsung**	**IPhone**	**Nokia**	**Blackberry**	**Huawei**	**Other**
	19%	10%	46%	10%	7%	9%
Type of Contract	**Prepaid**			**Postpaid**		
	94%			6%		

Table 7.14 illustrates excellent cell phone penetration. 96% of the respondents owned cell phones and only 4% were without cell phones. The majority of cell phones were from Nokia, and this is a reflection of what make and model of cell phones the respondents are able to afford. The only downfall is that most of the interviewees (96%) have prepaid contracts, and this comes with a limitation to access ICT services any time they want to. It is important to note that the majority of the respondents did not necessarily own smartphones which offer many other benefits besides making calls and texting. According to Section 3.4, it is a fact that smartphones are not within the affordability reach of most of the rural poor. In the literature review, there was an assertion that the low ICT penetration is attributable to the cost of the end user devices and the prevailing low digital literacy. By implementing the policies to guide the intitatives to reduce the cost of the end user devices.

Table 7.15: Access to cellphone

N=120					
Do you have an alternative access to a cellphone.	**Yes**			**No**	
	86%			14%	
What is the alternative means of access to cellphone	**Business**	**Family**	**Friends**	**Other**	
	0%	67%	33%	0%	
Which Cell Phone Service Provider do you use?	**MTN**	**Vodacom**	**Cell C**	**Virgin Mobile**	**Telkom Mobile**
	69%	24%	7%	0%	0%

There is an unyielding indication of alternative access to a cell phone for some of the respondents. This is illustrated in Table 7.15 where 86% of the interviewees have 67% access to the mobile phones of

family members. A good number of those interviewed (33%) have access to the mobile phones of friends. Table 7.15 illustrates that most of the interviewees (69%) are MTN subscribers with only (24%) using the Vodacom network. The rest of the respondents are with the Cell C networks. There is an unyielding indication that Telkom Mobile is yet to make some serious inroads into this particular rural community. The trend indicates that MTN is the only dominant operator in the area, and the rest are yet to make sure that there is cell phone coverage. This is not good for competition as the community members are forced to take a subscription with only one service provider and Section 2.3.3 outlines the reason why there is a need for competition. One of the policies which will ensure competition is enforced is the open-access policy. Open-access is mainly encouraged to make sure that the market is fully accessible by small operators and this will then promote full market competition. This will ensure a full variety of physical network topologies with applications to interact seamlessly in open network architecture. Open-access will enforce the use of the networks of other operators and this will make sure that small players have access to affordable local services and that the end users can choose their service provider.

Table 7.16 Use of the Cellphone

N=120								
What do you use your cellphone for	**Making Calls**				**Receiving Calls**			
	Always	**Sometimes**	**Not at all**	**Don't know**	**Always**	**Sometimes**	**Not at all**	**Don't know**
	58%	42%	0%	0%	59%	41%	0%	0%
	Sending SMS				**Receiving SMS**			
	Always	**Sometimes**	**Not at all**	**Don't know**	**Always**	**Sometimes**	**Not at all**	**Don't know**
	14%	77%	9%	0%	12%	84%	4%	0%
	Internet Browsing				**Internet Banking**			
	Always	**Sometimes**	**Not at all**	**Don't know**	**Always**	**Sometimes**	**Not at all**	**Don't Know**
	40%	25%	35%	53%	14%	32%	53%	2%

According to Table 7.16, there are a huge number of respondents (56%) who always uses their cell phones to make calls and the rest sometimes make calls. Similarly, there is a similar trend of those surveyed (59%) always receiving calls compared to (41%) who seldom receives calls. The other

interesting trend is that (77%) of respondents sometimes receives SMSs as compared to (12%) who always send SMSs and the rest of the respondents (9%) seldom send SMSs. Table 7.16 also indicates that the majority of the interviewees (84%) receive SMSs very rarely, and only (12%) receive SMSs regularly. It has to be noted though that the majority (40%) of the respondents browse the Internet on their cell phones. However, (35%) of the respondents do not use their mobile phones to browse the Internet. It is equally important to note that the majority of the cell phone owners (53%) do not use their cell phones for Internet banking. Only (32%) have indicated that they occasionally do Internet banking using their mobile phones. There is a clear indication that there is a greater need to make sure that the community is an e-literate. Individuals need to have the capabilities to utilise ICT platforms to execute tasks, resolve problems, communicate, manage information, ensure collaboration, develop and share contents to build knowledge in critical areas of their daily livelihoods. One of the other challenging aspects of the effective use of the cellular devices is the lack of relevant local content as alluded to in Section 3.4 of the literature studies.

Table 7.17: The cost of airtime

N=120					
How much do you spend on airtime a month?	**0-R50**	**R50-R100**	**R100-R200**	**R200-R400**	**>R400**
	27%	43%	19%	7%	3%
Do you buy SMS bundles	**Yes**			**No**	
	32%			68%	
Who writes the SMSes?	**Yourself**			**Somebody else**	
	97%			3%	

According to Table 7.17, the majority of the respondents (43%) spent between R50 and R100 to buy airtime every month. Only a mere (3%) can afford to spend more than R400 on airtime every month. Only (32%) buy an SMS bundle every month and the rest do not buy any SMS bundle. Most of the respondents (98%) can write their SMSs. It looks like airtime affordability is also one of the huge inhibitors of fully exploiting the benefits of ICT. Even though the country's cost to communicate has been reduced via the Mobile Termination Rate framework, the decline in the use of voice services and the increase in the use of data have a significant impact on the growth of the mobile market. Section 2.3.3 highlighted that the competition within the ICT market can no longer be understood within the context of only voice and data segment. The voice and data services require to be understood within the context of the changing nature of business and the impacts on consumer welfare.

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Table 7.18 Cell Phone reception

N=120				
Is the cellphone reception adequate in your area?	**Yes**	**No**	**Intermittent**	**Don't know**
	41%	27%	23%	9%

It is interesting to note that (41%) of the respondents are convinced that there is an adequate cell phone reception as outlined in Table 7.18 above. It is equally important to note that a combination of the interviewees (50%) believes that the mobile phone reception is not adequate, and the current coverage is not always available and is intermittent. There is also a significant number of the respondents (9%) who did not have an idea of what constitutes adequate network reception. One of the reasons might be that they have only been exposed to better network quality. The respondents indicated that MTN, Cell C, and Telkom Mobile had serious network coverage in the area, and the likelihood is that the majority of the interviewees might be the subscribers of the same networks. One of the suggested solutions is to recommend roaming across the networks. Some of the reasons where the availability of the sites is limited might be due to certain imposed restrictions, or the business model might not be sustainable for some of the operators. Thus, the quality of mobile services is affected. To deal with this situation, a practical solution will identify such areas and call them critical infrastructure sites (CIS) and ensure sharing. Section 3.4 of the literature study has also highlighted that the lack of the spectrum frequency limits the growth and adequate network coverage for cellular networks.

Table 7.19: Do you own a television set?

N=120					
Do you own a television set?	**Yes**			**No**	
	86%			14%	
Which are your favourite TV programmes?	**News**	**Sports**	**Documentary**	**Movies**	**Debates**
	50%	18%	6%	20%	6%

Table 7.19 illustrates that (86%) of the respondents own a television set. There is a strong indication that the majority of the interviewees (50%) preferred to watch the news on their television sets. Some of the respondents (20%) watch movies and then sports. TV is considered a key economic sector, an important source of public value and a service that should be universally accessible. The impact of ICT, the information and communications technologies, particularly radio and television, would be a major

contribution to rural development although the capabilities are yet to be fully exploited. Section 2.3.8 outlined the digital television migration which will improve the quality of television and afford the viewers improved programming with a better picture quality. This new technology will ensure an improved television user experience.

Table7.20: Do you own a radio?

N=120							
Do you listen to a radio	**Yes**				**No**		
	90%				10%		
What is your favorite radio station?	**Umhlobo Wenene**	**Lesedi FM**	**Motsweding FM**	**Metro FM**	**R2000**	**SAFM**	**RSG**
	81%	0%	0%	10%	8%	0%	0%

Table 7.20 indicates that 90% of the respondents owns a radio, and the majority (81%) prefers to listen to Umhlobo Wenene. This is a radio station broadcasting local knowledge and will be key in preserving the indigenous knowledge of the locals as outlined in Section 2.3. The rest of the respondents listen to Metro FM and Radio2000. This indicates that most of the interviewees prefer to listen to the radio in their native language. While radio is normally explained as ancient media, it nevertheless remains important for providing information to rural communities in both developed and developing countries. Access to this primitive information dissemination platform is still important in the information society as it is able to improve the attainment of developmental programs such as education, safeguarding local indigenous knowledge and the encouragement of cultural diversity. In developed nations, radio broadcasting is exploring the latest technologies such as the digital radio to develop a better listenership experience. For the rural communities who lack ICT expertise, radio can serve as a main source of news and knowledge sharing. It is for the this reason that tracking access to all radio and television services remains a critical task, more so in the rural communities.

Table 7.21: Do you read newspapers?

N=120					
Do you read the newspapers?	**Yes**			**No**	
	71%			29%	
What are your fields of interest in the newspaper?	**News**	**Sport**	**Finance Column**	**Entertainment**	**Others**
	49%	25%	11%	12%	4%

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It is interesting to note in Table 7.21 that (71%) of the respondents had access to newspapers of which (49%) prefer to read the news column. It is also critical to note that the second highest number of respondents (25%) reads the sports column and the rest read the entertainment and finance columns. It has to be noted that ICT had transcended and ensured that the newspaper is accessible through the Internet. The e-paper is the electronic format of the old traditional newspapers. There are countless benefits of having access to the newspaper in the new format. This is an opportunity to encourage online news coverage since a large number of respondents read the news in the newspaper. This will call for further improvement on the supply-side for ease of access to the online news material, as outlined in Section 2.3.4.

Table 7.22: Do you have a postal address?

N=120					
Do you have a postal address	**Yes**			**No**	
	59%			41%	
If yes, where do you collect your post from?	**Local Supermarket**	**Post Office**	**PostNet**	**Delivered at home**	**Other**
	41%	45%	0%	14%	0%

Table 7.22 indicates that the majority of the respondents (59%) have access to a mailing address and (45%) indicated that they collect their post from the local post office. The rest collect their mail parcel from the local supermarkets. There is a small number who get their mail delivered at home. It is important to note that the Postal Services Act called for the regulator to license and monitor the SAPO on the attainment of acceptable customer service standards and the implementation of the universal service obligations. This will have to include the roll-out and implementation of street addresses and the delivery of retail postal services in the rural communities. Thus, the government has a duty to make sure that every household has address allocation. The indication is that the postal services are working relatively well and that there is a reasonable footprint of post offices. These are some of the infrastructure which could be used to set digital hubs, as outlined Section 3.7.1.

Table 7.23 Access to Internet?

N=120				
Do you have an access to the Internet	**Yes**		**No**	
	63%		37%	
If yes, what means of access do you use	**Community Centre**	**Cellphone**	**ADSL**	**Other**
	1%	92%	4%	3%

The majority of the respondents (63%), as shown in Table 7.23, indicate that they have access to the Internet. However, it has to be pointed out that most of the Internet access being referred to is social media. It is important to remember that web access is mainly through the respondents (92%) cell phones. There is a very small amount of access to the Internet through the ADSL (4%) and Community Centres (1%). This is a very clear indication that there is a huge lack of affordable ICT infrastructure within this community. ICT is equally dependent on the demand-side stumbling blocks such as the accessibility and the cost-effective ICT services as well as awareness of its benefits. Section 3.4 of the literature study has highlighted the importance of the stimulation of the demand-side and suggests that the government will have to sort out the challenges linked to the delivery of government services. The industry will also have to stimulate interest in the adoption services in the new markets with suitable new revenue models.

7.2.4 Computer Literacy

Table 7.24 Do you have an email?

N=120		
Do you have an email address	**Yes**	**No**
	46%	54%

The Table 7.24 illustrates that (46%) of the respondents have access to email. One of the reasons why the majority of the interviewees are without email addresses is likely due to the lack of access to reliable Internet and a stable network. Stable and reliable Internet is critical to make sure that people develop an interest in using the services over the web. The main benefit of ICT adoption is a two-way dialogue through email, social media and instant messaging or video chatting. The rural communities will discover that ICT is relevant when the users are more concerned about online services, exchange of information and development of the content. When online, the rural poor will remain online if they continue to discover information and ICT services which are important and relevant to their well-being and when the people who are close them do the same things. Thus, people owning email addresses will

ensure easier adoption and use of ICT services. Digital literacy is very important for the seamless use of the services as alluded to in Section 3.7.2 which outlines the objectives of the NDP.

Table 7.25 Use of Computer

N=120						
Have you ever used a computer?	**YES**			**NO**		
	51%			49%		
If yes, where do you get access to a computer	**Internet cafe**	**Home**	**School**	**Work**	**Library**	**Any other place**
	21%	8%	48%	20%	2%	2%

According to Table 7.25, there is only a mere (51%) of the respondents who have used a computer, and almost half of the interviewees have never used a computer. This is very concerning as this is a clear indication that a huge number of respondents are still not computer literate. There will, therefore, be a need for ICT education to make sure that the uptake and usage of the ICT services is encouraged. The majority of the respondents with access to computers are still at school, and most of their computer experience is from school. It must be indicated that some respondents (21%) have had access to a computer through the Internet café. There have also been some respondents (20%) who have access to computers at their workplace. One aspect that a successful strategy will have to deal with is the awareness of the importance of ICT and the ability to utilise ICT as the important first step in building the demand for ICT services. Section 3.7.3 of the literature review indicated that the South African Connect broadband policy emphasises the need for the stimulation of the demand-side by making end user devices such as personal computers affordable.

Table 7.26 Purpose of a Computer

N=120					
Purpose of Computer use	**Internet**	**Typing and printing**	**Pictures and presentations**		**Calculations**
	13%	74%	8%		5%
How many years of computer experience	<1yr	1-2yrs	3-5yrs	6+yrs	None
	16%	34%	41%	8%	0%

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The majority of the respondents (74%) have indicated that they mainly used the computer for typing and printing as outlined in Table 7.26. A small number of those interviewed (13%) use the computer for Internet purposes. One of the attributing factors as to why such a small number uses the computers for the web might be the lack of or unstable access to reliable Internet services. The biggest number of respondents (41%) has between 3-5 years of computer experience with a sizable number having 1-2 years of computer experience. Digital literacy remains one of the biggest obstacles to the uptake and adoption of ICT services as outlined in Section 2.3.6 where Kwaku Kyem (2010) mentioned that the delay of benefits from ICT usage was partly because societies had not had a long exposure to technology in general. This is a fact which also indicates the need to develop behaviours that are in line with the sustained adoption of technology before users can derive the full benefits of ICT deployment.

Table 7.27 which applications do you use your computer for?

N=120						
If you have computer experience, which applications do you use?	**MS Word**	**MS Excel**	**MS PowerPoint**	**Internet Explorer**	**MS Paint**	**Calculator**
	62%	8%	5%	21%	2%	2%

Table 7.27 indicates that the majority of the respondents (62%) are very familiar with the MS Word, followed by Internet explorer (21%) and this is followed by MS Excel (8%). There will be a need for policies that will make sure that there is e-readiness to make sure that the ICT infrastructures rolled out are sustainable and able to benefit the affected majority. This will address the common problem of the uptake of the ICT services as outlined in Section 2.3.

7.2.5 Economic outlook

Table 7.28 Monthly spend on food

N=120							
On average how much do you spend on food monthly?	**Less than R500**	**R1000-R3000**		**R4000-R6000**		**R6000+**	
	35%	63%		3%		0%	
On average, how often do you buy food?	**Every day**	**Once a Week**	**Twice a Week**	**Thrice a Week**	**Once a Month**	**Twice a Month**	**As in when needed**
	0%	0%	1%	0%	60%	26%	13%

Table 7.28 illustrates that most of the respondents (63%) spend between R1000-R3000 on groceries. This is followed by (35%) of the respondents who spend less than R500 on groceries. The majority of the interviewees (60%) buy their grocery items once a month, and there are about (26%) who buy groceries twice a month. The rest purchase groceries as and when needed. This is illustrated in Table 7.28. There is a clear indication that a bigger portion of the income spent goes to food. This, therefore, leaves a small amount for complementary services such the Internet and telephone costs. The regulatory environments must, as a matter of importance, address the affordability challenges for both supply and demand. Section 2.3.8 of the literature review highlighted that universal access mainly means the availability of critical services at affordable costs to the rural communities. These communities might be deprived of these services due to them being in isolated areas or in economically unviable communities.

7.2.6 Strategy for sustainable ICT

Table 7.29 Strategy for Sustainable ICT

N=120			
Is there any strategy for sustainable ICT development in deep rural environments?	**Yes**	**No**	**Not Sure**
	29%	34%	37%
If the answer is yes, what impact has the strategy had on deep rural developments?	**High Impact**	**Moderate Impact**	**Less Impact**
	17%	37%	46%

According to Table 7.29, most of the respondents (37%) were not sure if there is a strategy for sustainable ICT. This can be attributed in large part to a lack of access to information which is due to the lack of reliable access to ICT services. There are also a number of respondents (34%) who did not believe a strategy for sustainable ICT existed. The majority of the interviewees (46%) who believed that there is a strategy for sustainable ICT did not believe that the strategy had any impact on the improvement of lives amongst rural communities. Table 7.29 also indicated that (37%) of the respondents believed that there is a moderate impact. Only (17%) of the interviewees believe that the existing strategy had high impact. The literature study highlighted that some of the initiatives had failed due to lack of awareness and this is attributed to poor levels of literacy as attributed in Section 3.7.1.

7.2.7 Technical Support

Table 7.30 Fault logging

N=120				
Do you know who to contact whenever you have ICT related problems?	**Yes**		**No**	
	80%		20%	
What are the typical problems that you experience with your ICT networks?	**Device**	**Network Coverage**	**Connection Problem**	**Others**
	9%	71%	17%	3%

One of the major aspects of sustainable ICT is the development of the operations procedure for the acceptable uptime of the network. Table 7.30 indicates that the majority of the respondents know whom to contact to log network faults with various service providers. About (20%) of the respondents, however, state that they do not know whom to contact when there are network faults. The majority of the interviewees highlight that the network coverage is the biggest problem. 71% of the respondents indicated that they have difficulties with the network coverage. This is followed by 17% who state that they experience many connection problems. The rest complains about problems with the end user devices. The quality of service based on the availability of the network is quite key and this affects the measure of uptake and usage of ICT. The poor deployment of ICT infrastructure has resulted in a poor quality of service for the rural communities. The implementation of a reliable backhaul network for the ICT networks will mitigate the concern and ensure ease of adoption of ICT services. Section 2.3.4 of the literature review highlighted the importance of affordable backbone networks which will contribute to effective strategy of sustainable ICT.

Table 7.31 Fault reporting

N=120					
What are the means of communication to report an ICT related problem?	**Fixed Telephone**	**Cell phone**	**Fax**	**Walk-in-Centre**	**Email**
	5%	84%	1%	10%	0%
What are the challenges encountered when reporting ICT related problems?	**Lack of access to communication**	**Holding for an Operator**		**Lack of knowledge who to contact**	**Limited technical knowledge**
	4%	84%		11%	15

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Table 7.31 shows a high penetration of cell phones as the majority of the respondents (81%) indicated that they have used their cell phones to report network problems. There are about 10% of walk-ins, and the rest use the fixed-line to report network problems. One of the biggest challenges faced when reporting a network problem is the holding of calls while reporting a fault. An overwhelming 84% of respondents indicated that they hold for a long before their queries get attended to and solved, and this is a very costly exercise. 11% of the respondents indicated that they did not know whom to contact to report network faults. Section 3.7.1 of the literature highlighted that one of the reasons for the previous failures of the ICT initiatives was lack of support and maintenance. This will be a very important element of the strategy to be successful.

7.2.8 Accounts Payment

Table 7.32 Banking accounts

N=120		
Do you have a personal account?	**Yes**	**No**
	81%	19%
If yes, do you have access and use online banking?	**Yes**	**No**
	77%	23%

According to Table 7.32, 81% of respondents have personal banking accounts and about 77% of those have indicated they have access to online banking. The financial institutions are the core and essential components within the ICT ecosystem. There will be a need for the financial sector to be involved at various levels to enhance the chances of South Africa and particularly the rural areas to move toward an information-based economy. The national strategy will explore the challenges encountered by the financial services organisations as well as businesses and consumers on increasing the use of the ICT. The literature review highlights the fact that the National Planning Commission (2012) articulated that South Africa's rural communities should be afforded an opportunity to participate in the development of the economy and the political life of the country as alluded to in Section 3.7.2.

Table 7.33 how do you pay for your accounts?

N=120					
How do you pay for your personal accounts?	**Cash**	**Check**	**Credit Card**	**Debit Card**	**EFT**
	80%	0%	4%	11%	6%

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According to Table 7.33, the majority of the respondents (80%) use cash to pay for accounts. There is a clear indication that most of the interviewees do not use electronic banking. This can be attributed to the fact that there is poor network coverage, and a lack of Internet accessibility is a major contributor. There is a small number of respondents (11%) who use debit cards to pay for their accounts. Less than 5% of the respondents indicated that they used the electronic funds transfer (EFT) payment method and the rest use a credit card. One of the government's initiatives will be to build capacity that will assist the local businesses have access to ICT and run their businesses more efficiently. The community will need to be encouraged to use the online services more and this will require an implementation of change management as alluded to in Section 2.3.6. Change management will be critical to make sure that the adoption of the new technology introduced into the rural community is seamless. The study emphasises that the delay of benefits from ICT usage is partly because communities do not have extended exposure to ICT in general, a fact which also underlies the need to develop the habits that are in line with the sustained adoption of technology before the consumers can experience the full benefits of ICT deployment.

Table 7.34 how do you buy your supplies?

N=120			
How do you buy supplies?	**Physically go buy and collect**	**Order and collect**	**Order and have it delivered**
	97%	3%	0%

Table 7.34 presents a clear indication that a lack of access to technological means is still a serious drawback to the rural communities. The majority of the respondents (97%) are still using the conventional methods of acquiring supplies and, in the process, much time gets wasted. Only a very small number of respondents (3%) used the available technological means to order supplies. There is clearly a huge gap regarding the transition from the old to the new way of doing things using the available technology. It has to be noted that this question is mainly directed at smaller businesses operating in the area. There is a clear lack of ICT infrastructure to enable the small businesses and the community members to order goods online. The lack of use of the online services is attributable to a number of factors such as the lack of reliable infrastructure, digital literacy and proper change management. This is due to a lack of affordable ICT services and infrastructure sharing is one of the options which could be considered to reduce the cost of offering services as outlined in Section 2.3.

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7.2.9 Mode of Transport

Table 7.35 what is the mode of transport?

N=120				
What kind of transport do you use to go buy supplies?	**Own vehicle**	**Hire vehicle**	**Taxi/Bus**	**Other**
	21%	1%	78%	1%

The majority of the respondents (78%) indicated that they use a taxi or bus to get their supplies. This is illustrated in Table 7.35 with only (21%) stating that they used their transport to get supplies. The major concern of most of the respondents is that the public transport is not safe as most of the vehicles are not roadworthy, and they are therefore not safe. The absence of proper quality rural road infrastructure means poor connectivity and higher costs for the rural communities to seek lucrative markets. The number of districts which have poor connectivity and quality are some of the regions with the highest level of poverty within the rural communities. Countrywide, the primary reasons for the absence of public transport utilisation is the cost and being proximate. The strategy for an integrated rural development plan is supposed to address the supporting infrastructure for ease of access to the rural households as outlined in Section 3.3.

Table 7.36 how much does transport cost?

N=120				
On average, how much does transport cost?	**<R500**	**R500 – R1000**	**> R1000**	**Other**
	90%	10%	0	0

Table 7.36 highlighted that the majority of the respondents (90%) spend less than R500 for transport to purchase their supplies. This is mainly because the majority used public transport which is not as costly as using their private cars. There is a clear indication that the majority of the respondents depend entirely on the public mode of transport. There have been some major complaints that the transport system is not reliable and not safe at all. A reliable transport system is also an enabler to make sure that the ICT infrastructure becomes sustainable. The lack of appropriate passive infrastructure has proven to be a major problem and this was seen in Section 3.4 of the literature study.

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7.2.10 Supporting infrastructure

Table 7.37 Eskom Power Grid

N=120		
Is there an Eskom power grid?	**Yes**	**No**
	100%	0%
What is the stability of the Eskom power grid?	**Stable**	**Unstable**
	58%	42%

In Table 7.37, all the respondents (100%) indicated that there is the Eskom power grid. There is, however (42%) of the respondents who states that the power grid is very unstable The reason for the large number of respondents indicating that the electricity grid is not reliable might be due to the recent power outages experienced due to the Eskom power grid. An overwhelming majority of the respondents (58%) are happy with the reliability of the power grid. One of the continual challenges to guarantee sustainable ICT is reliable power to run the infrastructure. As a result, there is a need to develop solar energy units connected to batteries to power the infrastructures not attached to the national electricity grid. Section 2.3 highlighted that the government should be able to bring down capital investment by focusing on underserved regions and assisting with the roll-out of supporting passive infrastructure such as roads, electricity and fibre ducts.

Table 7.38 Eskom accounts payment

N=120		
Eskom accounts payment	**Prepaid System**	**Monthly Account**
	84%	16%

Table 7.38 illustrates that the majority of the respondents use prepaid electricity meters. Only 16%, a small number use post-paid meters. The downside with the prepaid system is the administrative and monitoring part where the users are always expected to monitor the system to make sure that there are always sufficient units to make sure that power failure is minimised. Thus, there is some indication that the power supply is not reliable, and there is, therefore, a need to ensure a reliable source of energy for sustainable ICT. Electricity plays an important role in the socioeconomic and ICT development of the rural communities. A reliable source of energy is the hallmark of a developed economy. It is widely accepted that there is a strong correlation between the accessibility to reliable sources of energy and socioeconomic development. The reliable energy source is very important to the lifespan of the

equipment as the constant dropping of power contributes to the unnecessary failure rate of the equipment.

Table 7.39 Access to Internet

N=120			
Do you have Internet access?	**Yes**		**No**
	73%		27%
If yes, what is the means of access?	**Cell phone or Data Connection**	**Community or Telecentre**	**Other**
	98%	2%	0%

According to Table 7.39, the majority of the respondents (73%) indicated that they have access to the Internet. The likelihood is that the respondents are referring to social media access. The respondents (98%) mainly use their cell phone to access the Internet. The government has advocated universal access in their broadband policy. It is, therefore, the responsibility of the government to promote the widespread availability and accessibility of quality ICT through the operationalisation of the Universal Service Fund, the identification of universal access programs for implementation and fostering of diverse and cost-effective funding mechanisms. This will be through design and implementation of universal service initiatives, ensuring the availability of diverse, affordable, quality and secure ICT services throughout the country to all persons. The availability of the affordable infrastructure is very important and the cost-effective roll-out of the networks will be achieved through various means, including the availability of the lucrative spectrum as alluded to in Section 2.3.1.

7.2.11 ICT Skills development

Table 7.40 Rating of skills

N=120								
Rating of Skills	**Cellphone**				**PC**			
	Never used	Still learning	Skilled	Expert	Never used	Still learning	Skilled	Expert
	3%	12%	83%	3%	58%	17%	25%	0%
N=120								
Rating of Skills	**Smart Phone**				**Tablet**			
	Never used	Still learning	Skilled	Expert	Never used	Still learning	Skilled	Expert
	23%	26%	51%	1%	43%	21%	36%	1%

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The majority of the respondents indicated the various levels of expertise and skills as expressed in Table 7.40. It is important to note that the majority of the interviewees (83%) are well skilled and conversant with the use of cell phones. A small number of those interviewed (12%) are still learning how to use cell phones. The interesting trend is that the majority of the interviewees (58%) had never used a personal computer and this will have an impact on sustainable ICT. Only 25% of the respondents are skilled in using a computer and 17% have never used a computer. Table 7.37 also indicates that the majority of the respondents (51%) stated that they are well conversant with the use of smart cell phones. 26% of the respondents indicate that they are still learning how to use the smartphones and a reasonable number of those interviewed (23%) have never used a smartphone. It is important to note that most of the participants (43%) did not know how to use a Tablet. Equally, there was an overwhelming response from the respondents (36%) who are skilled in operating a Tablet. 21% of the respondents indicated that they are still learning how to operate a Tablet. One of the possible causes of why there is a low skill level on the use of PCs and Tablets is the low penetration of these particular devices. It is quite apparent that the cost of the ICT infrastructure remains a major deterrent to ICT availability and uptake, especially among the rural communities and other less affluent communities. However, there are a number of choices available but the affordability of the devices is still beyond the reach of a large proportion of the rural population who might otherwise be interested in learning and utilising ICT-based services. This will ensure the encouragement and the promotion of small businesses to be involved in the manufacturing sector. Section 3.7.1 of the literature review highlighted that one of the reasons for the failed Telecentre model was the lack of uptake because of the challenges on the digital literacy of the users.

Table 7.41 Any ICT Qualifications

N=120		
Do you have any qualifications?	**Yes**	**No**
	28%	72%
Are you interested in obtaining an ICT qualification?	**Yes**	**No**
	81%	19%

Table 7.41 indicates that a whopping 72% of the respondents have indicated that they do not have any ICT qualifications. This is a major concern, and the adoption and use of ICT will be greatly limited by the lack of appropriate computer skills. However, the majority of the respondents (81%) have indicated that they would be interested in improving their ICT skills. It is important to note that there are a number

of ICT skills and expertise that increase in complexity as users gain more understanding of the ecosystem. Thus, competency in ICT skills and expertise can be part of basic ICT literacy, which can enable users to access valuable information using the ICT services for deeper technical knowledge. This will allow them to create and disseminate the community information including new applications and services. The development of ICT skills and expertise is very important for the strategy to be sustainable as indicated in Section 3.7.3.

Table 7.42 ICT career choice

N=120			
If interested in obtaining ICT qualifications, what career choice will you follow thereafter?	**Full time employment**	**Own a business within the community**	**Not Sure**
	30%	47%	23%

There is a strong position of the respondents (47%) on opening up their businesses after obtaining training on ICT competencies. This is followed by those who would like to use their ICT skills for full-time employment and all this is highlighted in Table 7.42 above. It has to be noted that there is some serious inhibitor though on the utilisation and uptake of ICT as a tool to optimise the operations of small businesses. Thus, it will be critical that the framework for the SMME's use of ICT to enhance the operations of the business and ensure efficiency will have to be addressed using the appropriate policies. Job creation is one of the primary roles of the working strategy for sustainable ICT and this is emphasised in Section 3.3.

Table 7.43 Training affordability

N=120		
Can you afford to attend basic ICT training?	**Yes**	**No**
	68%	32%
Do you have access to Online Training?	**Yes**	**No**
	39%	61%

Most of the respondents (68%) indicated their willingness to attend ICT training with the rest indicating that they are not prepared to go training and this is highlighted in Table 7.43. The respondents (61%) also indicated a lack of access to online training, and this can be attributed in large part to the lack of reliable ICT infrastructure. It has to be noted that training will help improve the adoption and uptake of

the ICT services. Technical development that might be needed on 'how' to utilise ICT is, however, evolving with conventional learning through the local organisations, for example, schools and community radio stations. This will empower local communities to set up 'what' to utilise them for and produce their demand. The lack of online government services also remains a major concern and the provisioning of relevant content will contribute to an effective strategy as highlighted in Section 3.4.

7.3 Discussions

7.3.1 Findings from Literature Review

7.3.1.1 Digital Inclusion

The literature review has identified that strategy for sustainable ICT for deep rural development will be achieved by reducing the gender digital divide within rural communities. In Section 2.3.7 of the literature review, Joseph (2012) stated that the increase in the capabilities of the rural women relied on the opportunities provided by the ICT services to alter their living conditions. ICT is a tool that empowers rural women with information and skills for political awareness, economic and social participation, sustainable food security, and a better life. It provides access to development and market intelligence for women entrepreneurs and a quick means of collecting valuable material for women's organisations.

It has also been noted that there is a notion which asserts that women are sidelined from technological evolution through two related issues. Firstly, the heavily male-dominated market structure of the ICT industry has been promoted to suggest that technology is likely to be designed from a male perspective and does not take into consideration women's familiarity with that particular technology. Secondly, the designation of women's work has been traditionally classified as unskilled which means that women have been located in occupations which do not require the use of technology, or that technology is not introduced into the workplaces where women dominate. The policy that promotes and enforces the narrowing of the gender digital divide has to be promulgated and implemented.

Rural women's development is a challenging exercise which needs commitment in the developmental activities that shaped their lives. The main reason was that women are the keepers of agricultural and health-related knowledge. Their traditional role was mainly reproduction and production which was agriculture related. ICT can enforce the participation of rural women in the development projects to alleviate poverty, and provide them with training as well as other informal employment opportunities.

In the South African context, access to ICT services and better education, the crucial elements that form the building blocks of empowerment, have liberated women from the crippling and discriminating agenda of Bantu education. Empowering women through the use of ICT ensured that the most needed skills and expertise remained within rural communities as women were expected to remain at home and bring up the children and thus the chances of migrating to urban areas to seek employment were very slim. It also has to be noted that the rural women are in the majority when it comes to the demographics of the rural population, as discovered during the data collection.

Thus, women's role in ICT will be primarily enforced by effective political interventions with improved living conditions and socioeconomic environments in rural areas. Cultural freedom, political freedom and social and economic freedom depend on the factors that propel the use of ICT by rural women. Factors such as effective infrastructure, low-cost ICT services, and reliable infrastructure can also influence the use of ICT by Women.

It is equally important to note that when youth is given access to 21st century skills such as critical thinking, collaboration, and decision-making as part of a strong educational foundation, they are then empowered and enabled. They then become key participants in solving a range of challenges faced by the country, continent and indeed the world. Thus, multifaceted stakeholder involvement, which includes both the policymakers and the private sector must make sure that affordable ICT is achieved and translated into the transformation of the less privileged, particularly the youth in the rural areas which are adversely affected by the lack of adequate ICT Infrastructures. The National Policies must prioritise and emphasise the importance of ICT youth development for effective development of local communities through innovation and entrepreneurship.

7.3.1.2 Rural Development

The agenda for rural development was followed in the past by a number of projects such as the Telecentres. The literature study puts an emphasis on the use of the Telecentre as one of the models for rural development as outlined in Section 3.7.1 in Chapter 3. This is one of the initiatives which have not worked in South Africa. Most researchers on this topic have identified a number of parameters which contributed to the poor performance of Telecentre projects. One of those parameters was poor infrastructure planning. Another major challenge was the cost of setting up the required infrastructure in rural areas which is prohibitively high. Poorly maintained infrastructure has also led to huge

Telecentres operational costs that affect their financial sustainability, especially in the initial years of operation when the revenue earned was substantially lower.

Moreover, the services rolled out in the Telecentres sometimes did not match the needs of the people being served and, thus, they did not raise enough revenue to ensure sustainability. Moreover, poor literacy levels also created challenges of awareness. The lack of different advertising methods to make people aware of government projects has also proven to be a huge problem. Equally lacking, was the absence of a robust monitoring and evaluation framework by the responsible agencies and the government, which has also contributed to the failures of the Telecentres. Solid monitoring and evaluation can ensure accountability on the part of the stakeholders of a project and also help in making constant improvements.

7.3.1.3 Government Leadership

One of the responsibilities of the Government is to promulgate policies which will assist to achieve the developmental goals and one of those blueprints was the NDP, which is outlined in Section 3.7.2 of Chapter 3 in the literature review. The state adopted the NDP as the blueprint of the service delivery policy vision for 2030. One of the biggest gaps in the NDP is that ICT is not afforded the same platform as one of the major economic drivers compared to agriculture and education. The National Planning Commission (2012) highlights the fact that in the next five years there is a need to develop an integrated e-strategy that characterises the cross-cutting nature of ICT. The strategy must include a process to allocate a new frequency spectrum that will become available after the digital migration, and will set out a universal access strategy to set targets for monitoring and evaluating indicators (NDP, 2010).

However, there are some gaps in the National Planning Commission (2012) that can compromise the success of this policy document. The NDP provides some guidelines for the development of the sector, but ICT is only considered within the context of the economic infrastructure. The policy fails to apply ICT throughout the document in recognition of it cross-cutting nature. There is little to suggest that the ICT policy framework gets priority treatment. An effective ICT strategy will require a repositioning of the ICT market to ensure competition, coordination of state resources and ICT across government. It requires a targeted universal service and access strategy to deal not only with the gaps in the ICT market but also to address the demand- and supply-side stimulation of the market.

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There are a number of issues highlighted by the current strategies which need to be critically analysed and resolved (NDP, 2010):

- Deal with bottlenecks in infrastructure industry-imperfect competition;
- Review institutional arrangements – effectively regulated competitive markets;
- Review market structure – open access to regulated competitive services and prevent duplication of infrastructure investment/deployment;
- Manage incentives for investment in ICT network extension and spectrum management;
- Reduce ICT service prices ante wholesale regulation – peering and IP transit;
- Address issues of net neutrality; safeguard free and open Internet;
- Service neutral licensing: scrap excise duties and taxes for ICT;
- Secure environments of e-services, privacy, security and surveillance;
- Demand stimulation critical: affordability and e-skills;
- Open data, open government and stimulate localisation;
- Infrastructures are sharing open access and one-build policies to be strengthened and enforced; and
- Need for integrated development – informational development dependent on human development.

It is very clear from the literature study that there had been some initiative to ensure the equitable access to the sustainable ICT services, but none had been successful so far. This study will explore an effective strategy for sustainable ICT development in deep rural environments.

Section 2.3.2 of the literature review also touched on the importance of service neutrality for a successful strategy. Kelly and Rossotto (2012) indicated that technology and service neutrality facilitates technological convergence and encourages new and creative ideas and initiatives by reducing the number of licenses that an operator can apply for to expand the various services which can be offered. They also highlighted that neutrality is likely to contribute to eliminating unnecessary regulatory obligations, such as different reporting standards and requirements catered for under service-specific configurations. However, a country's regulatory body often requires transformation of the custom service-specific licensing to a unified licensing model to accommodate for technology and service neutrality. It has to be noted that if multiple ICT service providers are not sustainable, sharing or consolidation may produce a market monopoly. This will afford operators an opportunity to achieve

economies of scale and reduce investment risks, which is similar to lowering costs (Kelly and Rossotto, 2012). There are also several other ways to reduce costs to service providers in a given area where regulators may reduce the right of way or costs to access facilities.

Section 2.3.3 has outlined the need for effective market competition for an effective strategy to be formulated and implemented. The literature studies indicated at great length that the main principles of the regulatory framework include the creation of environments for effective competition in the provision of ICT networks and services. This undertaking is based on the principle of technology neutrality as well as to support valuable investments in the infrastructure. From a practical and economic viewpoint, regulation should promote infrastructure-based competition, and in the case of access networks, the objective of regulation should be the promotion of competition at the level of services. The study has also highlighted the importance of ease of access to affordable end user devices. Thus, there is an assertion in the literature review that the low ICT availability can also be attributed to the cost of devices and common elements of digital illiteracy. Establishing policy directives to guide initiatives will drive down the cost of end user equipment.

Kirk (2011) emphasises that it is critical that the promulgated policies in emerging markets are relevant to make sure that the majority of the citizens, regardless of income, can benefit from the ICT services. The current approach, common in the policy debates, is one of fibre networks connected to every rural community. However, this focuses on a lot of prominent issues and not least the comparative costs of the various technologies. The political ambitions for significant investment in fibre can ultimately be a costly exercise and inefficient. Thus, a total infrastructure investment and practical connectivity solution will have to be identified.

Section 3.3 of the literature review dealt extensively with the ICT Integrated Rural Development Strategy. Some of the challenges with this strategy was that, as experience has taught us, several provinces had put plans into place to implement ICT projects, but these initiatives are uncoordinated. Thus, the country is likely to spend more resources on projects such as the ICT network roll-out when provinces execute their plans at the exclusion of the national agenda. The DTPS (2012) equally emphasised that municipalities are an important tier of government as they also provide services directly to communities. Therefore, the Department of Cooperative Government and Traditional Affairs plays an important role in strategies for coordinating municipalities for the implementation of ICT interventions. When integrating ICT into the cross-sectoral rural development strategy, it is increasingly

important to understand the local context into which information is expected to be made available and used.

The other important factors that will ensure a strategy for sustainable ICT are the need for legal and institutional frameworks to maximise the impact and use of sustainable ICT interventions. One of these institutional frameworks is the government which could help lower infrastructure expenditure in the targeted underserved areas through low-cost real infrastructure for central facilities. Governments also needed to reaffirm the total importance of rolling out ICT as a vehicle for supporting social and economic development agenda publicly. There is, therefore, a need to define a program around objectives and values that link technology uptake and use for economic and social development. Once the program is developed, it is critical to build common understanding among policymakers and civil society around the importance of ICT usage. Using this shared vision as a foundation, the targets will be defined based on the rigorous analysis of investment and economic returns, as well as policy tools.

The literature review also highlighted that the custodian of the strategy for sustainable ICT is required to provide leadership in monitoring the impact of ICT on the lives of people, both in quantitative and qualitative terms. Systematic data gathering, monitoring and performance review efforts will make sure that the investments made result in the outcomes expected from the start of the program. ICT can contribute to the vision embedded in the strategy.

The Government also adopted the **South Africa Connect** policy. The policy is outlined at great length in Section 3.7.3 of the literature review and states that the creation of effective policy and a regulatory environments is critical to the success of the ICT national project (DOC, 2013a). It also states that the regulatory framework must address the demand-side issues to enable ICT accessibility. This is in addition to addressing the traditional supply-side issues such as interconnectivity, facilities leasing, scarce resource allocation of numbers and spectrum, tariff regulation and quality of control (DOC, 2013a).

The South Africa Connect policy also recognised the need to map current ICT deployment and coordinated operator deployment plans, but it did not specify who should do this, how and by when. Much of the emphasis has been placed on the infrastructure around the one-build approach, but the policy does not specifically mandate infrastructure sharing between utilities (e.g. roads, rails, power lines, pipelines). Moreover, the policy is not integrated into the national economic growth and development plans. Unlike the United States of America (USA), ICT policy in South Africa, which

underpins the economic strategy of the country, has no explicit reference made to its role as a lever for economic recovery, economic stimulation, and job creation. Nor does it make recognition of the linkages between ICT penetration and increases in Gross Domestic Product (GDP).

7.3.1.4 Adoption of ICT

The uptake and adoption of the ICT services are very important for the sustainable ICT strategy. Kirk and Bratt (2011) indicated that the power of relevant content is of paramount importance for the uptake and adoption of ICT services. Accelerating the uptake of services by using smart devices is encouraged due to cheaper prices and relevant content using local languages and this also accelerates the level of economies of scale. The cost of the smart devices therefore plays a critical role for a vast uptake of ICT services.

The National Planning Commission (2012) has further emphasised the economic and employment benefits of ICT access, particularly within the underserved areas, and this outweighs the cost of the deployment of services. The National Planning Commission (2012) also noted that one of the barriers to access mobile services and fixed-lines is limited market competition, and this increases the cost to communicate. The plan also articulated that there are a number of factors which cause constraints on the deployment and adoption of ICT services such as conflicting policies, weak institutional arrangements, and inadequate regulatory framework. The effectiveness of the regulator to enable an open market has been affected by legal bottlenecks and limited human resources expertise.

Another barrier to effective ICT services access by the majority of the rural community was the cost of communication. One of the models which could be explored is the "calling party pays" together with innovative pricing plans which are essential for the ease of adoption of ICT services within the poor communities. There is, equally, a need for aggressive data pricing models for effective delivery of ICT services. The biggest concern is that the lack of policies and regulations around cost might confine access of data services to the most privileged (Kirk and Bratt, 2011).

Change management has also been considered critical for the seamless adoption of the new technology introduced into the rural community and this is fully outlined in Section 2.3.6 of the literature review. It emphasises that the delay of benefits from ICT usage is partly because societies have not extended exposure to technology in general. The need to develop behaviours that are supportive of sustainable technology adoption, before users can realise the full benefits of ICT deployment, are, therefore, critical.

Thus, change management is essential to ensure the seamless introduction of new technologies to deep rural areas.

7.3.1.5 Technology Infrastructure

The literature review highlighted that the National Planning Commission (2012) advocates that the effective dissemination of ICT information requires a network infrastructure that is cost-effective. It also says that the ICT networks are to be viewed as a means for effective delivery of data and fostering innovative ideas, not really about data speed or a specific technology. In other words, the definition of suitable ICT services has to be understood in terms of a capability that is "fit for purpose" and more in the dynamic context that allows capabilities to be extended based on user needs and price differentiation as well as improvements on the supply-side and innovative ideas (The policy paper series, 2011).

Another key aspect highlighted in the literature study was that cost-effective infrastructures can only be rolled out by making more spectrum with better frequency propagation characteristics available to promote wider network coverage. The biggest challenge the regulator faces is enhancing the supply of spectrum with a healthy balance between the spectrum needed for broadcasting and for other ICT services. Section 2.3.1 of the literature review outlined the need for additional spectrum for the successful implementation of the sustainable ICT strategy. The prominent problem is that the spectrum policy is predominantly influenced by the short-term objectives of revenue generation for the government at the expense of developing small business. This leads to policies such as warehousing and spectrum caps businesses. This growth within the sector becomes limited and the cost of ICT services is raised as these demands for revenue generation become more common with various governments (Kirk and Bratt, 2011).

There were many other challenges highlighted which need to be addressed for a sustainable ICT strategy to be achieved. Technology and service neutrality, as outlined in Section 2.3.2 of the literature review, have to be enforced by the regulators with a view to securing maximum utilisation of scarce resources such as the frequency spectrum. Service neutrality is mainly about an undertaking to allow the network service providers to provide services on whatever technology and network infrastructure they choose (Kelly and Rossotto, 2012). In the past, there was a technology limitation where networks were purpose built. The evolution of technology makes it possible for different networks to support similar or substitute services. This evolution allows different technology to use the spectrum most suitable for it to enable more productive uses through voluntary market mechanisms (Kelly and Rossotto, 2012).

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The literature study indicated that for the Strategy for Sustainable ICT to be successful, the focus needs to be with people and not technologies, on what technology can do for the people. It is, therefore, appropriate for all planning and decision-making to start with the people who will utilise the technology and the context in which it will benefit them. The other important aspect which needs to be considered when introducing a new technology is the involvement of the local people. The role of local participation cannot be underestimated as this will ensure an ease of adoption and use of the technology.

One of the other necessary benefits of the ICT infrastructure is to make sure that rural communities and farmers are connected to centres of economic activity to enable local households to be economically viable. Rural feeder roads must link areas which are inaccessible and have poor road conditions with areas of high economic benefits. ICT infrastructure accessibility must empower locals to have better knowledge of the markets and opportunities to sell their produce and procure new tools to increase productivity. Business hubs can also be established for farmers and locals to share helpful and valuable information.

Cost-effective and working technology is also important for ensuring a strategy of sustainable ICT development in deep rural environments. License-exempt technology, such as TVWS, is less costly, preserves a lot of power and affords users a number of technologies and control over the ICT networks and infrastructure they roll-out. These include healthcare facilities, day-patient cardiac monitoring networks, or a smart metering mesh ICT network. However, it has to be noted that there are a number of uses that might compete with this cost-effective spectrum.

7.3.1.6 Funding Model

One of the biggest problems identified was the continued investment in the ICT infrastructure in urban areas with little investment in the rural communities. The reasons given were that there was no sustainable business model for the network operators to roll-out infrastructure in the rural areas due to the limited uptake and the affordability of the services of that particular market. The Integrated ICT Policy Green Paper encourages more investment in the rural areas than concentrating the resources in the already developed urban areas. The policy also encourages more open access wholesale regulations to make sure that more service-based competition is implemented for affordable ICT services.

DTPS (2012) noted during its presentation to the Parliamentary Portfolio Committee of Telecommunication and Postal Services that the ICT Rural Development Strategy was mainly

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constituted by capital investment in network infrastructure in deep rural environments for ease of access to ICT services. This can be realised by means of digital hubs with an intention of creating jobs that will contribute to the New Growth Path Targets. This will also be achieved through partnerships between the government and main role players to ensure affordable access to ICT by all in 2020.

A number of critical factors such as innovation by service providers and content generators around pricing and business model are to be explored for affordable ICT services. The ideal innovation won't place the burden of access cost on the end users. Regulators will have to create environments where the necessary innovations are able to flourish and not be inhibited by unnecessary notions of the right models or pricing. There can be price control by means of effective market competition, which will encourage business to innovate. (Kirk and Bratt, 2011).

Various funding mechanisms were also highlighted and discussed in the Section 2.3.9 of the literature review. The study indicated that the Government has fiscal constraints, and it is impossible to allocate enough resources to all the projects. The ICT sector is fortunate in that it required a small budget for all the infrastructure sectors and a significant portion of the funds needed for actual network deployment is expected to be contributed by the private sector. This places the burden of financing on 'simple' projects to private businesses so that the enabling environments are in place to maximise private sector investment.

However, it is also important to note that with most development projects, the problem is not usually a lack of funding, but the lack of cost-effective projects that make the business case for the investment (SADC, 2012). This can present challenges for social ICT projects which, as with other cross-cutting areas, the full economic and social returns of the investment may not be directly evident within the ICT sector, but will be in the indirect benefit in other areas. Some of the suggested funding mechanisms are the PPPs and joint funding. The joint funding can be between the government and state-owned entities and also private organisations. The Government can also act as guarantees and also offer incentives to promote and encourage private investment.

7.3.2 Findings from the Data Collection

7.3.2.1 Digital Inclusion

There was an unyielding imbalance regarding the reach of the respondents (53%) where women are in the majority. There were a number of factors which can be attributed to this trend. One of these is that

women in the rural communities were, traditionally, expected to stay home and raise children, while men go to the cities to find employment. This trend has, in the process, marginalised rural women when it comes to ICT exposure due to a lack of environments which will expose them to the use and understanding of the ICT technologies. The benefit of empowering and ensuring that rural women champion ICT initiatives is that the skill and capacity will remain in the community for a long time and this will ensure sustained development of the communities. Thus, it will be appropriate for the women to be a target group for development of the rural communities.

The data collection also indicated that the majority of the respondents (38%) were in the age category of between 22 and 30. This is a very critical age category for growth in a developing country such as South Africa. This age group consists mainly of young professionals coming out of the University, which makes it a critical group for developing economies. Most of the respondents came from an economically active age group where the effect of technology can be felt the most and clear benefits can be drawn. It is, therefore, critical that the strategy for sustainable ICT targets this group of young people to ensure the development of the deep rural areas.

United Nations Youth (2013) highlighted that the national policy and regulatory strategy are critical in making sure that the future ICT needs of the young people are met. Not only in terms of access, so that the infrastructure can support increased network data, but also in terms of development and programs earmarked for the improvement of young people. Basic ICT training not only prepares people for jobs in the ICT sectors, but also creates opportunities for them to participate in the fast growing markets such as business process outsourcing, crowdsourcing, and micro work. People with more advanced ICT skills can take advantage of an even wider range of opportunities brought about by the growth of the mobile services, social media, games, and other technology-driven areas, promoting new business ventures in every sector (United Nations Youth, 2013).

There is a good penetration of mobile phones. A huge number of respondents (96%) had access to mobile phones and only (4%) were without mobile phones. The only setback is that the majority of the respondents (96%) have prepaid contracts which under normal circumstances are very expensive compared to postpaid. This also made it difficult for the prepaid contract to always have an Internet service as most of the airtime was used up for voice calls and text messaging. It is also important to note that prepaid contracts did not afford the user an opportunity to have access to a smartphone due to the lack of affordability. This posed a serious limitation on fully exploiting the full benefits of ICT services, and also had an enormous impact on the adoption and uptake of ICT, which affects the

sustainability of ICT infrastructure. There was an assertion in the literature review that the low ICT penetration could also be attributed to the cost of devices and the prevailing digital illiteracy. This can be corrected by developing policies with directives to bring down the cost of end user equipment, stimulate the development and usage of relevant content, and drive aggressive digital awareness campaigns. The ideal would be to propose an integrated approach to promoting digital inclusion.

Equally important is the impact of earlier ICT, particularly radio and TV, although their use as a means of informing and educating the poor is still not fully exhausted. Eighty-six percent of respondents with TV sets indicated that they mainly watch the news. Television has been considered to be a key economic sector which is a crucial source of public value and a service that should be universally available. The new ICT did not substitute the older technologies but can support them and extend their availability, improve and tailor their content, and add new forms of many-to-many communications. Radio and Television can play an important role in preserving and providing access to cultural resources. The access to TV closes the gap in the lack of digital inclusion.

According to the respondents (90%), radio also has good penetration. While Radio is described as older media, it nevertheless remains critical for providing information to people in the rural communities. Access to this traditional form of ICT is still relevant in the information era as it can encourage the achievement of developmental goals such as education, preserving local heritage and promotion of cultural diversity. In developed countries, radio broadcasting uses the latest technologies, such as digital radio, to create better listenership experiences. Thus, this platform has to be fully explored to ensure full benefits to the community and better digital inclusion.

The Government has an obligation to make sure that every household has a postal address and is able to get postal services. The Postal Services Act called for the regulator to license and monitor the SAPO on the attainment of acceptable customer service standards and the implementation of the universal service obligations which will have to include the roll-out and implementation of street addresses and the delivery of retail postal services in the rural communities. It is, however, important to note that about (41%) of the respondents are still without a street address. The Government will have to formulate a policy directive which will speed up the roll-out of postal addresses for improved digital inclusion.

7.3.2.2 Rural Development

It appears that the majority of the respondents (63%) do have access to the Internet and the likelihood is that they mainly have access to social media platforms. The respondents (92%) also indicated that

they access the Internet on cell phones. It is important to note that there are still a significant number of the interviewees (37%) who do not have access to the Internet at all. This indicates that there is still a huge gap in achieving universal services and access. One of the constraints resulting from a lack of access is the lack of demand and the lack of awareness of the benefits that ICT has as an enabler to infrastructure and rural development.

One of the major assignments in rural development is the growth of smaller businesses. ICT has been identified by the government to be one of the major drivers of the development of the SMMEs in information provision, access to national and international markets, and other areas of business development and support. It has to be emphasised though that there is a clear lack of ICT infrastructure to enable optimum operation of small community businesses to obtain supplies online and get them delivered to their business premises. ICT can enable entrepreneurs to manage their businesses efficiently, and thus enhance their competitiveness in the global market. However, the trend has been that most of the community members (97%) physically go and buy supplies. This is mainly due to the lack of access to reliable and affordable ICT services in the area.

One of the abilities of ICT is to unlock the potential growth of the SMMEs to be active participants in growing and contributing to the country's economy. The essential purpose behind the low level of ICT take-up among SMMEs is the constrained access to venture capital and, similarly, high innovation expenses and the absence of training. One of the good things is that the majority of the respondents (47%) have indicated a desire to open their own business once they have acquired the necessary ICT skills. Thus, ICT will be a huge enabler in ensuring that businesses run smoothly, and all processes are optimised.

Thus, it will be critical for the government to come up with policies which that enable SMMEs to easily access ICT services. The majority of the respondents (78%) also indicated that they use public transport to go and buy their grocery supplies. The major concern was that there are no appropriate roads to make sure that the public is safe and reliable. The community had raised concerns that most of the public transport used is not road worthy and not safe. It will thus be very important that appropriate infrastructure is in place to make sure that the SMMEs in the community can order supplies online and get them delivered. The respondents have shown that transport costs are just below R500 per month and this is a clear sign that this is not a safe mode of transport given the cost.

One of the other biggest challenges for the strategy on sustainable ICT is the reliable energy supply to power the infrastructure. Basic passive infrastructure and the existing limitations in the electricity source is a major barrier to ICT penetration and sustainability in countries such as South Africa. All the respondents (100%) said that there is a power grid in the area but (43%) highlighted that the electricity grid is not stable or reliable. This perhaps emanates from the extended power outages due to the strain on the Eskom power generators. One of the solutions to make sure that energy supply is always available and reliable is to develop solar power units connected to batteries to power those infrastructures that are attached to the grid, which might experience regular power interruptions.

Technical training is critical to make sure that there is an understanding of how to use ICT. It is important to note that 68% of the respondents are very keen to attend ICT training. There is a lack of access to ICT infrastructure mainly due to the lack of ICT infrastructure, so people are unable to attend ICT courses online. Digital literacy will thus play a critical role as this will enable local communities to establish what to use ICT for and in the process generate their demand which will promote rural development.

7.3.2.3 Government Leadership

The majority of the respondents (62%) have indicated that they use the MS Office application mainly when using computers. The reason might be that they primarily use it to write a document such as a CV to apply for jobs. There are also some respondents (21%) who have indicated that they use the Internet explorer. e-Readiness is one of the aspects that will make sure that there is the full utilisation of the ICT infrastructure. Government policies will, therefore, be needed to make sure that e-readiness is in place to make sure that the ICT infrastructures rolled out are sustainable and able to benefit the affected majority.

There is a requirement for very progressive and effective policies to be formulated and implemented by the policymakers and regulators. Fifty-six percent of the respondents believe that the country has progressive policies, and most of them are moderately effective according to 68% of the interviewees.

7.3.2.4 Adoption of ICT

There is a high rate of unemployment among the respondents (46%). This is a cause for concern as affordability is one of the aspects which will ensure seamless adoption and uptake of ICT services. The census of 2011 has indicated that the national unemployment rate is 35%, and the youths are the most

affected and constitute about 46% of the total unemployment. There is a clear sign that most of the unemployed are the young people who ordinarily are supposed to be economically active. It is important to note that ICT can have a higher impact once it has reached the critical mass which in this case will be mainly the unemployed young people. Several studies have highlighted the potential of the ICT infrastructure to be an important stimulator of public investment during the economic depression delivering immediate job creation. This will go a long way in solving the unemployment problem for the rural people.

The respondents have shown a high level of being able to read and write. Ninety-seven and a half per cent of the interviewees are literate and this is an indication that most of the community members may have some absorption capacity. This will, therefore, assist with the seamless ICT development for the members of the community. It will do away with the major concern that the digital-illiterate can be marginalised and failed to have access to a fast growing area of employment opportunities. However, in the context of ICT, it is important to note that the ability to adopt and use new technologies require certain expertise and new skills to ensure access to the employment market (Adera, et al., 2014). It is therefore very concerning that the majority of the respondents have achieved a Grade 8 or more but no formal tertiary qualifications. This may have an impact on the ability of the respondents to have the capacity to frame questions, solve problems, and apply knowledge.

South Africa faces a huge rate of unemployment, and the most affected age group is the young people. The study has confirmed that unemployment within the community is still very prevalent as the majority of the respondents (56%) are unemployed. It has to be articulated that one benefit of the roll-out of the ICT Infrastructure will be the direct link to sustainable job and employment creation. The level of unemployment has a direct bearing and impact on the lack of affordability of ICT services, and this will pose a serious challenge to sustainable ICT as the users will not be able to afford the services, and the adoption and uptake will be negatively affected. The government will, therefore, be expected to formulate and implement policies which will make sure that there are clear interventions to ensure affordability of ICT services.

It is, however, important to recognise that the majority of the respondents (75%) are employed are full-time positions. There are also about 21% who are on fixed term contracts, and the rest are part-time employees. Digital capacity is critical for gaining employment or improving one's professional prospects in our society. The level of digital literacy will make sure that citizens become employable,

and this will reduce the rate of unemployment and ensure ICT affordability. It has to be noted though that using ICT to increase employment opportunities for the marginalised and capacitate them with information also requires strategic determination, considerable experimentation, grassroots participation, social learning and strategies for sustainability.

The study has also found that most of the respondents (66%) indicated that they have between one to five years of working experience. A very limited number of those interviewed (19%) have between five and ten years of working experience. This is a clear indication of the sort of salary bracket that dominates in the community, and only a small number of those who are employed are likely to earn decent wages. This is a clear indication that only a limited number of working class can afford the ICT services. There is, therefore, a need to make sure that there is further development to explore the full benefits of ICT for decent jobs for the community members.

There are a number of reasons why most people acquire mobile phones. There is a huge number of respondents (56%) who always use mobile phones for making calls. There is also a huge number of those interviewed (77%) who use the cell phone to receive SMSs compared to (12%) who always send SMSs. There is also a substantial number of respondents (40%) who have indicated that they can browse the Internet on their cell phone. It is, however, important to note that some those interviewed (53%) had stated that they do not use their mobile phones for Internet browsing. The reason for this might be the limitation on accessibility to the Smartphone in the rural community. It is equally important to make an assertion that those who browse the Internet mainly access the social media platforms such as Facebook, WhatsApp and Twitter. There is a clear indication of a greater need to make sure that the community is an e-literate.

The amount of money spent on mobile phones is very little looking at the trend of the respondents (43%) who have indicated that they only spent between fifty (R50) and a hundred Rand (R100) every month for airtime. There is also a small number of respondents (3%) who can afford to buy airtime for up to four hundred Rand (R400). Only (32%) of the interviewees indicated that they buy the SMS bundle. There is a strong indication that airtime affordability is also a huge inhibitor to exploiting the benefits of ICT fully.

One of the aspects that a successful strategy will have to deal with is the awareness of the benefits of ICT and the capability to use ICT as a critical first step in building demand for ICT services. It is therefore key that the users of the ICT services are digitally literate and can use end user devices such

as computers. It is very concerning to note that only (51%) of the respondents can use computers, and that one of the only accesses available to computers is at schools (48%). There will have to be much emphasis on the use of computers to make sure that there is a clear benefit from access to ICT services.

It must be emphasised that cost-effective use of investment in ICT infrastructure and capital assets requires equal commitment on investments in skills, services, and applications that make the ICT a beneficial tool for improving productivity and economic growth. Once again, the use of computers and many other ICT devices has to be clearly understood and used effectively. It is important to note that most of the respondents (74%) use the computer for typing and printing, and only a small number (13%) uses it for Internet access. One of the reasons why only a small number uses the computer for Internet might be a lack of reliable and fast Internet access. Thus, the infrastructure is critical to encourage the use of computer and other devices.

The regulatory requirements must, of importance, address the question of affordability from both the accessibility and end user devices point of view. The respondents spend was analysed, and the trend is that most of the household (63%) can only afford to spend between R1000 to R3000 on food monthly and the majority (60%) buy their groceries only once a month. The cost to communicate is one of the issues which are currently being addressed in South Africa. A thorough revision of the pricing model across the ICT ecosystem will be important to identify structural and cost deficiencies (including dominance, wholesale/retail pricing, funding structures) which promote the high cost of ICT and, hence, create entry barriers to usage and uptake.

It was discovered that most of the respondents have bank accounts (81%), and they have indicated that they have online banking, and I will presume these are services such electronic wallet (e-wallet) or other mobile banking services. One of the interesting trends is that most of the respondents (80%) use cash for accounts payment, and this is posing a serious security risk for them. One of the major reasons why the respondents might not be able to use the technology to manage their accounts is the lack of reliable and affordable ICT infrastructures. There are a small number of respondents using the Electronic Funds Transfer (EFT) payment method. The online payment of accounts will be the most efficient and safe method to pay for services, and this will save the citizens much time.

One of the inhibitors and barriers to market entry is the cost of the ICT end user devices. The trend is that there is a diverse level of expertise on how to use the ICT end user devices, and there is still a huge deficit in the ability to use other devices. The majority of the respondents indicated their various levels

of expertise and skills. It has to be noted that the majority of the interviewees (83%) are well skilled and conversant with the use of their cell phones. A small number of those interviewed (12%) are still learning how to use the cell phones. The interesting trend is that the majority of the interviewees (58%) have never used a personal computer. Only 25% of the respondents are skilled in using the computer and 17% have never used a computer. The majority of the respondents (51%) also indicated that they are well conversant with the use of smart cell phones. Twenty-six percent of the respondents stated that they still learning how to use smartphones. There are also a reasonable number of those interviewed (23%) who have never used smartphones. It is important to note that most of the participants (43%) do not know how to use tablet. There are equally a small number of responses from the respondents (36%) who are skilled in operating a Tablet. Twenty-one percent of the respondents have indicated that they are still learning how to operate a Tablet. Digital literacy is very important in ensuring the expansion and the uptake of the ICT services.

Uptake of ICT will be greatly limited by the lack of appropriate computer skills and digital literacy. It is important to note that the majority of the respondents (81%) are interested in improving their ICT skills. This will help to deal with the lack of ICT qualifications in the community as there is a large number of respondents (72%) who indicated that they have no formal ICT training. It has to be noted that competency in ICT can include basic understanding, which makes it possible for rural users to access information and knowledge through ICT, including a deeper technical understanding which will allow them to create and distribute their information including the new applications and ICT services.

7.3.2.5 Technology Infrastructure

The study has discovered that there is a huge lack of access to fixed-line service by the majority of the respondents (82%). One of the major reasons might be that the terrain is very complex in rural areas and the roll-out of fixed-line infrastructure is very expensive. This is a clear indication that the most suitable solution is the wireless solution. One of the prohibiting factors is the lack of frequency spectrum, as is being used by the broadcasters, which is very suited to the sparse terrain and would ensure affordable services. It is also important to mention that the mobile phones have also surpassed the fixed-line services in recent times, and most of the respondents prefer to use cell phones instead of the fixed telephones.

One of the highlighted trends is the ability of the respondents (86%) to access an alternative mobile phone and that (67%) of these respondents has access to a family member's mobile phone. MTN is the

dominant network operator according to most of the respondents (69%). This is a serious cause for concern as the country cannot afford to have one dominant network operator in any specific sector of the community. This will leave the citizens with little choice and this is not good for competition. The policymakers will have to promote the open access policy which will make sure that the sharing of infrastructure is encouraged and enforced, and the operators can compete on services offered. Open access allows unrestricted access in a technology-neutral framework that promotes innovative, cost-effective delivery to users. Open access will facilitate the use of communication infrastructure of other network operators which will greatly benefit those small businesses who want to start local services and will make sure that there are a few service providers that the end user can choose from.

The adequate availability of ICT infrastructure is one of the catalysts of the ICT uptake and usage. The respondents (41%) are convinced that there is enough network coverage. This is not necessarily an indication that the network is reliable or stable. Thus, there is a combination of respondents (50%) who indicated that the network is either intermittent or is not reliable at all. This is an indication that the wireless network coverage in the area is not reliable. There are various interventions which the government might want to consider, and one of these is the consolidation of cost on the infrastructure. Another is to also encourage roaming among the network operators where one operator rolls out the infrastructure and allows the competitors to roam on their network. This will make sure that there is no sporadic infrastructure from each operator. This will be a very costly exercise, and quality will suffer in the process.

It is important to note that there is an important dimension to ICT adoption that cannot be overlooked. The primary incentive for ICT adoption is communications through email, social network platforms, instant messaging or video chatting. However, only 46% of the respondents have access to an email addresses. One of the reasons why the majority of the interviewees are without email addresses is likely due to the lack of access to reliable ICT infrastructure. ICT adoption and utilisation is not about ownership of a specific piece of technology or subscribing to a service but about making ICT work for people. Email access and communication is one of the most effective communication tools when it comes to cost and time.

One of the biggest problems in ensuring a sustainable ICT is the lack of support and maintenance once the infrastructure has been rolled out. The stability of the network and the quality of service are key issues that affect the degree of uptake and use of ICT services. The majority of the respondents had indicated that they know whom to contact to log network faults with various service providers. About

20% of the respondents, however, stated that they did not know whom to contact when there are network faults. Seventy-one percent of the respondents highlighted that network coverage is the biggest problem and that they had problems with network reliability.

7.4 Conclusion

This chapter reported on the analysis of the data gathered from the literature review, the data collection and a number of areas which needed to be addressed during the formulation of the strategy were considered and expanded on adequately. However, the major research objectives still need to be fulfilled and this will lead to the crafting of the strategy for sustainable ICT development in deep rural environments. This will be dealt with in the next chapter, Chapter 8.

Various areas such as digital inclusion based on gender and youth were extensively diagnosed and analysed based on the literature review and data collection. The study highlighted a great lack of digital inclusion. The area of rural development was also analysed extensively and a greater emphasis was placed on the need to increase the development of the rural areas. The adoption of ICT services was explored, and various requirements were outlined on what will be needed for their increased uptake. The role of the Government was also considered and a greater emphasis on the formulation and adoption of relevant policies was highlighted. The need for viable infrastructure was also explored, and emphasis was placed on the need to improve the infrastructure in deep rural environments for a strategy of sustainable ICT.

Finally, the various funding models were also highlighted and the need for the involvement of more investment in the rural areas was emphasised. This highlighted the need for the private sector to play a prominent role in investing in the rural areas.

7.5 Summary

The chapter dealt mainly with the research findings with a number of observations on the extent of the gender digital divide and the youth lack of development. The findings discovered that women are still discriminated against when it comes to the use of technology. The chapter looked at the demographics where women were in the majority with a large number of youth remaining unemployed. The language spoken is predominantly Xhosa due to the fact that the study was conducted in the Eastern Cape.

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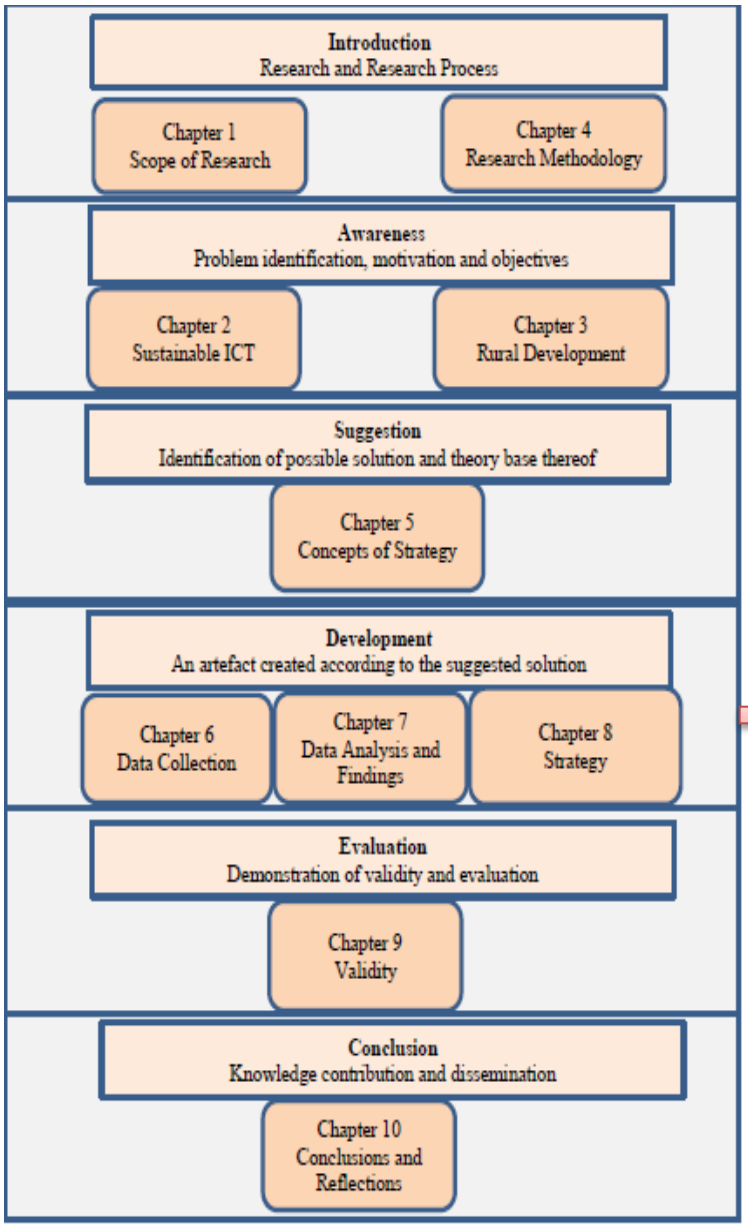
The study also looked into the income profile of the community members and the economic activities in the area and assessed the level of affordability for the ICT services. The study discovered that the majority of the community members are unemployed and mainly depend on the state social security grant. This has an impact on the adoption of ICT. The study also found that the infrastructure was not viable for quality reception of ICT services.

It also highlighted the need for the government leadership to establish some progressive policies to assist in releasing the much-needed digital dividend spectrum to help with the roll-out of cost-effective network infrastructure in the rural areas. The assignment of the spectrum will encourage the service providers to roll-out the ICT services in the most remote rural environments.

The chapter covered the literature review extensively and gaps in the offering of the ICT services were identified. This will form part of the broader strategy for the sustainable ICT development in deep rural environments.

CHAPTER 8: STRATEGY FORMULATION



Chapter 8 Strategy Formulation

8.1 Introduction
8.2 Rural strategy framework
8.3 Objectives
8.4 The environmental assessment and strategy formulation
8.4.1 Diagnosis
8.4.2 Guiding policy
8.4.3 Set of coherent action plans
8.5 Strategy implementation
8.5.1 Government
8.5.2 Regulator
8.5.3 Service providers
8.6 Strategy control
8.7 Conclusion
8.8 Summary

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8.1 Introduction

This chapter deals with and addresses the question: “what is the strategy that will guarantee sustainable ICT development in deep rural environments”. The chapter outlines the strategy based on the information gathered from the literature study and the findings from the data that was gathered and analysed. In this section, the strategy formulation model is applied to the deep rural environments for the development of the AmaJingqi community. In Figure 5.2 a strategy formulation model is devised, based on the theoretical foundations described in Section 5.3. This model addressed a specific problem and the context at hand, and is a strategy for sustainable ICT development in deep rural environments. Contextualising the devised strategy crafting model will end up with the strategy designed as the objective for this study. In this section, the appropriate details of the study are discussed within the context of the guiding model as outlined in Figure 5.2. The chapter will look at the rural strategic framework in Section 8.2, which will outline the process that will need to be followed for the crafting and formulation of the strategy. The chapter will also expand on the framework by defining its various components such as the objectives which will outline the major reasons for the importance of outlining the strategy and this will be covered in Section 8.3. Section 8.4 then deals with the environmental scanning and the strategy formulation and this outline on the data collection exercise which was undertaken as part of the environmental scanning. It is in this section that the number of diagnoses with guiding policies is outlined and expanded, and which will have corresponding coherent actions to address each diagnosis. Then Section 8.5 will deal with the strategy implementation and will outline all the stakeholders involved in the implementation of the strategy. The chapter will also outline the strategy control, which is defined in Section 8.6, and this will outline the mechanisms for monitoring and evaluating the strategy for regular updates on its framework. The chapter will then conclude and provide a summary of the entire chapter.

8.2 Rural Strategic Framework

The strategic formulation approach follows the process as defined in Figure 8.1 below

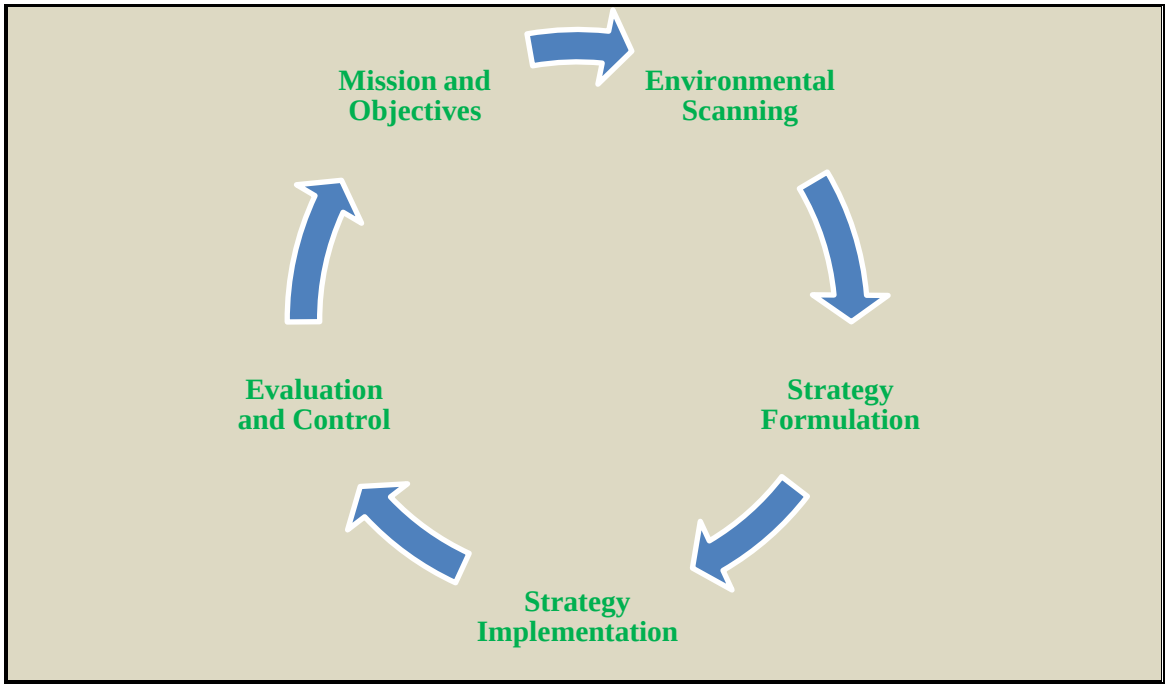

Figure 8.1: Strategic formulation approach (Source: Researcher's adapted design)

Figure 8.1 presents the strategic formulation approach which outlines the various stages that need to be undertaken for the crafting and formulation of strategy. The various steps to be undertaken are:

- Mission and objectives;
- Environmental scanning;
- Strategy formulation;
- Strategy implementation; and
- Evaluation and control.

The strategy outcome mapping is outlined in Table 8.1 where there is a cross reference between the objectives and the literature studies and with clear outcome indicators.

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Table 8.1: Strategy Outcome Mapping

	Dimension	Objective	Outcome indicator	Literature	Interviewee
1	**Access to Information**	To improve access to information and informational capabilities	• Improved access to information • Improved information flows within the community • Facilitate policies to ensure affordability • Improved communication to the outside world • Greater access to ICT services (faxing, email, other telecommunication services)	Kenny et al., (2000), NDP (2012)	Page171, 172, 173, 174, 175, 176, 178, 179, 180, 181.
2	**Digital Inclusion**	To ensure the all-inclusive universal roll-out of services.	• Gender Inclusion • Youth development • People with disabilities access to ICT services • Universal Services and Access	Joseph (2012), Ramilo (2007), Mayanja (2006)	Page168, 172, 173, 174, 175, 178, 182, 191.
3	**Social Development**	To improve access to basic social services	• Increased access to formal and non-formal education (e-learning) • Greater access to health services (improved knowledge about health practices and traditional medicine) • Improved awareness and access to social programs of the government (e – government) • Greater access to online banking services.	UNDP (2007), Joseph (2012), Kapondera and South (2016), UNDP (2004)	Page 170, 171, 187, 188, 189,
4	**Rural Development**	To improve ICT skill base of rural communities.	• Enhance ICT skills • Improve communication skills • Improve ICT knowledge base • The correlation between national budget investment and how it contributes to people's livelihoods	DoC (2011), Chapman and Slaymaker (2002)	Page 170, 171, 172, 184, 185, 189, 190, 192.
5	**Economic development**	To promote economic opportunities	• Access to alternative income • Improved access to markets and commercialisation of products.	Urquhart et. al. (2007), Kwaku Kyem (2010), DED (2009),	Page 171, 184, 187, 188, 191, 194

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	Dimension	Objective	Outcome indicator	Literature	Interviewee
			• Improve productive activities through enhanced knowledge (e.g. better knowledge about agricultural practices) • Enhanced capacity to mobilise resources • Improved access to transfer of funds through improved communication with migrant workers • Targets based on rigorous analysis of investment and social and economic returns.	Broadband Series (2012), Bailey and Ngwenyama (2010), HSRC (2013)	
6	**Business Model**	To make sure that tailor-made business model that suits the rural community is adopted	• A hybrid funding model with a combination of PPP and Government funded initiatives • Development of capable entrepreneurs • Funding mechanism • Operational plan • Wholesale Access regulation • Appropriately structured projects that make the case for the investment.	OECD (2009), Zhen-Wei Qiang (2012), Kelly and Rossotto (2012), SADC (2012), Labelle (2005)	
7	**Cross-Sectoral Coordination**	To make sure that the relevant stakeholders play a meaningful role	• Coordinated Initiatives • Leverage on collaborative networks • Integrated vision • Multilayer Government planning	Chapman and Slaymaker (2002)	
8	**Technology Infrastructure**	Ensure a cost-effective, power-efficient technology get implemented within Rural communities.	• Cost-effective technology • Bandwidths on demand type of technology • People focused solution • Identify alternatives to infrastructure competition through structural separation • Create a common carrier • Service - and technology-neutral licensing regime. • Spectrum neutral technology	Hevner et al. (2004), Kelly and Rosotto (2012)	Page 172, 174, 175, 181, 186, 187, 190
9	**Supply Stimulation**	Encourage that the supply	• Promote competition and investment	Kelly and Rossotto,	Page 170, 171, 172, 174, 175,

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	Dimension	Objective	Outcome indicator	Literature	Interviewee
		indicators are identified and adequately addressed.	• Encourage government coordination • Allocate and assign spectrum • Facilitate access and ensure right-of-way • Facilitate open access to critical infrastructure	(2012),TRAI (2015), DOC (2013a)	178, 179, 180.
10	**Demand Stimulation**	Encourage that the demand indicators are identified and adequately addressed	• Innovation Hubs • Progressive transformation possibilities • Disruptive Transformation • Skills development • Establish relationship between ICT and poverty reduction • Development of mobile applications and open data	Kirk and Bratt (2011),	Page 170, 175, 176, 178, 182, 183, 185, 192.
11	**Government Leadership**	Clearly define the role of Government to make sure that ICT services reach Rural Communities	• Government as a risk-taker • Facilitate completion and private investment • Measure the impact of ICT • Political Leadership • Robust monitoring and evaluation framework	DoC (2011), Dass and Bhattacherjee (2011)	Page 185
12	**Adoption of ICT**	To ensure ease of adoption of ICT technology within the rural communities	• Promote the uptake and Usage • Community to be involved in the design process of the solution • Change Management • Positive attitude to Information, technology and its products • Understand local context • Develop behaviours that are supportive of sustained adoption of technology • Consensus between the Policymakers and civil society. • Relationship between ICT and poverty reduction from the demand-side	OECD (2011), Kelly and Rossotto (2012)	Page 170, 171, 178, 182, 183, 184, 186, 188, 191.

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	Dimension	Objective	Outcome indicator	Literature	Interviewee
13	**Policy Directives**	Policy directives for successful ICT Interventions	• Demand stimulation through Bundled Demand and Subscriber Subsidies • Infrastructure sharing policy to be enforced • ICT Policy to be integrated into national economic growth and development strategies. • Develop the specialised institutional capacity required for the policy responsiveness.	Thanki (2012), Masonta (2013),National Broadband Policy for Rwanda (2013)	Page 185.
14	**Gender Balance**	To ensure growing interest for a more active role in influencing national policy formulations that impact on women and their relationship to ICT.	• Developing gender and ICT indicators • Integrating gender analysis in national ICT policy frameworks and policies. • Building government's commitment to the advancement of women for their ICT platform. • Promoting gender responsive e-governance. • Addressing Universal access issues.	Attwood et al. (2013), Labelle (2005), Ramilo et. al.(2002)	Page 168, 169.

8.3 Objectives

As outlined in Section 5.4, there will be no explicit vision and mission, but rather objectives which will form part of the strategy. The purpose, direction and specific need for the strategy for sustainable ICT development in deep rural environments are outlined.

The main objective of this research is to develop a strategy for sustainable ICT development in deep rural environments. The purpose of the research is to establish and find out what the status is of the ICT infrastructure and if the community is benefiting from sustainable ICT services for the development of the community members.

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To fulfil this objective, four sub-objectives are formulated:

- To define a strategy that will ensure the implementation of sustainable ICT for deep rural environments;
- To clearly define the ICT sustainability;
- To profile different users and outline the definition of deep rural environments; and
- To describe the complete composition of the sustainable ICT Intervention.

These objectives populate Step 1 (Objectives) of the strategy formulation model as per Figure 5.2. The next subsection looks at how the environmental analysis is conducted to fulfil the objectives and sub-objectives stated above.

8.4 The Environmental Assessment and Strategy Formulation

The environmental scanning, as discussed in Section 5.4.2, was done through stakeholder engagement and a meeting was also conducted with the Chief of the Community where the challenges were fully discussed. This involved an extensive case study of the AmaJingqi rural community through the use of semi-structured interviews and questionnaires that focused on the utilisation and integration of ICT. A data gathering exercise was undertaken to explore the status of the ICT infrastructure, its use for the development of the rural environments, and the challenges. Extensive data collection was carried out over a period of four months using the case study method and targeting the important community members within the rural area.

The full extent of the case study is discussed in Chapter 6. The internal environments consisted of the ordinary members of the community, educators and students. The case study is considered to have adequately covered all the information required in the environmental assessment. This current subsection looked at how the environmental analysis (Step 2 from Figure 5.2) is conducted. The next subsection will cover how the outcome of the case study is analysed to pinpoint the challenges, gaps and weaknesses in the ICT infrastructure availability and affordability.

8.4.1 Diagnosis

The outcomes of the environmental assessment furnished important and reliable information to evaluate the position of ICT availability within the rural community of AmaJingqi. The environmental assessment assisted in pinpointing the obstacles, weaknesses and limitations of the current ICT status,

human capacity, policies and regulations together with correct use of the ICT. Subsequent to a thorough examination of the situation, the outcomes are reported in Section 7.2. After a further analysis of the results, these were synthesised into fourteen (15) diagnostics. These diagnostics are listed and explained in detail below.

a) Diagnostic 1: Gender Imbalance (D1)

The research highlighted a huge number of respondents (53%) as women. One of the trends is that women are considered to be minders of the households in the rural areas while men are expected to go to the cities to find employment to support their families. This culture has affected the exposure and development of women on the use and benefit of ICT services. The study has highlighted that digital technologies can empower women economically and socially. Young rural girls and women are targeted for the digital inclusion into the information society as a way to improve their academic, social and economic development in bridging the digital divide and closing the gender gap. The strategy should seek to empower rural women with ICT skills and this will, in the process, make sure that the expertise remains within the communities and ensures sustainable ICT development.

b) Diagnostic 2: Youth Development (D2)

The research indicated that most of the respondents (38%) are in the youth age category between the ages of 22 and 30. This is a very critical age group for the developmental state and developing economies as this the entry level of the economically active citizens. This is an age group where the effects of technology can be felt the most and clear benefits can be gained. It has been highlighted that ICT improves the overall well-being of the community and eradicate poverty, but it can also worsen inequality in the absence of complementary investment. It has been noted that in the African continent alone, 11 million youth is expected to enter the employment market every year within the current decade starting from 2010. These youths, who were born in the information communication era, live in a world full of new existing opportunities given the developmental nature of ICT. National policies are critical to make sure that the future ICT needs of the young generation are met.

c) Diagnostic 3: Unemployment (D3)

There was a high level of unemployment as highlighted by the respondents (46%) in the study. This is a major cause of concern as this affects the affordability of ICT services for the sustainable ICT infrastructure which will result in community development. It is equally important to note that those who are employed (75%) have full time employment and the rest are on fixed-term contracts or part-time positions. This provides a further breakdown showing that many do not have job security as there

is no guarantee that contracts will be renewed after expiry. There are a number of studies which have highlighted the potential of ICT infrastructure as an important area of investment during the economic meltdown, creating immediate employment. These studies have further indicated that the amount of direct employment created by digital technologies is fairly modest, but the amount that could be enabled by it could be considerable. ICT promotes digital inclusion by boosting job creation and earnings in the ICT sector across the economy.

d) Diagnostic 4: Literacy (D4)

There were an overwhelming number of respondents (97.50%) who can read and write. One of the important aspects of ICT adoption is the absorption capacity of the end users. The study has indicated that the skills requirements for one to succeed in the employment market is demanding and the level of today's education and training programs often fall short of meeting the needs of the employment market. The use of ICT demands the cognitive competencies such as digital literacy and numeracy development. This will therefore assist with the seamless ICT development of the members of the rural community and ensure e-readiness and digital literacy.

e) Diagnostic 5: ICT Infrastructure (D5)

The majority of the respondents (82%) did have access to fixed-line services. However, the majority of the interviewed (96%) have access to mobile phones. The only setback was that the majority of the respondents (96%) were on prepaid contracts which under normal circumstances are very expensive compared to post-paid. The respondents (86%) also highlighted that they have access to alternative mobile phones. Thus the cell phone penetration is very good. It is important to note that the majority of the respondents (23%) have never used smart phones and about (26%) were still learning how to use them. This is a clear indication that most of the cell phones are those at entry level without advanced features. The reason for the lack of access to smart phones might be due to affordability and the type of packages which the community can afford. The community (50%) also highlighted the inadequate ICT infrastructures which affect the network quality with intermittent service availability. Thus, there is a great need for wireless technologies to be expanded due to its suitability for the rural terrain. The lack of additional spectrum allocation for last mile connectivity in remote areas remains one of the major obstacles to affordable ICT infrastructure roll-out. It is also important to note that there is still a lack of universal service and access around the postal services as a number of respondents (41%) said they do not have street addresses.

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f) Diagnostic 6: Market Competition (D6)

Most of the interviewees (69%) were MTN subscribers with only (24%) using the Vodacom network. The rest of the respondents were from the Cell C networks. There is an unyielding indication that Telkom Mobile is yet to make some serious inroads into this particular rural community. The trend indicated that MTN is the only dominant Operator in the area, and the rest of the service providers are yet to make sure that there is adequate and acceptable cell phone coverage. The fact of the matter is that cell operators face an increased investment challenge to keep up with the service quality and demands of users, especially on cellular networks, where spectrum is a very scarce resource. To a large extent one of the practical solutions to expand network access is the reallocation of the additional spectrum licenses to competing mobile service providers and Internet service providers. Government will need to include specific network roll-out obligations when considering additional spectrum licensing for the mobile operators.

g) Diagnostic 7: Affordability (D7)

Affordability of ICT services is another element which has been highlighted in the findings. The money spent and the affordability of the respondents were analysed, and the trend is that most of the households (63%) can only afford to spend between R1000 and R3000 on food monthly with the majority (63%) buying groceries once a month. The study also found that the money spent on mobile phones is very small with the respondents (43%) stating that they spend between R50 and R100 every month for airtime. A mere 3% responded that they spent up to R400 monthly on airtime.

h) Diagnostic 8: Other media platforms (D8)

The impact of earlier ICT such as television and radio has been widely recognised, although there were still parts of the country where radio and television are still not available. The majority of the respondents (86%), however, have television coverage while about 14% still have no television reception. The current government digital migration program is able to address all the areas which are currently without television coverage by using satellite television technology. There is also a (90%) radio penetration with the remainder of the respondents still without adequate radio reception. Universal access and services needs to be accelerated for (100%) coverage for both television and radio. The majority of the respondents (71%) have access to newspapers with (49%) reading the news column. It is important to note that most of the newspapers can be accessed online and the availability of the ICT Infrastructure will ensure an increased number of the community members with access to the online news.

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i) Diagnostic 9: Internet access (D9)

The study has highlighted that the majority of the respondents (63%) have access to the Internet and the likelihood is that most of it is access to social media. Many of the respondents (92%) further indicated that they have access to the Internet using their cell phones. Thus the bandwidth hungry Over-The-Top services require bigger network bandwidth and operators will have to invest more on the network upgrades. The biggest threat for the developing countries is different from the usual revenue stream experienced by the developed countries. One other observation from the study is that most of the respondents (50%) do not have email addresses and one of the likely reasons is the lack of computer literacy on how to create and use the account.

j) Diagnostic 10: Policy and Regulatory Framework (D10)

The level of awareness of the government's program and active engagement with the citizens is very important for the successful execution of ICT strategy. However, one of the respondents (37%) observations was that they are not aware that there is an ICT strategy for roll-out of ICT services. It is also important to note that about 46% of the respondents believe that the strategy exists but did not believe that it has yielded an impact on improving lives among rural communities. There were also about 56% of the respondents who believe that the government has progressive policies but according to 68% of the respondents, most of them were moderately effective due to the lack implementation. Policy awareness and its importance will have to be emphasised and sold to the community for effectiveness and necessary impact.

k) Diagnostic 11: Economic Development (D11)

By lowering information barriers and costs, the Internet increases experimentation and gives rise to new opportunities for entrepreneurship and small businesses. Many are in the ICT sector but others are ICT-enabled. One of the major inhibitors around the SMME development is the lack of competency and knowledge of ICT. The majority of the respondents (47%) have indicated a desire to open their own businesses once they have acquired the necessary ICT skills. Moreover, the other trend in the study was that the community does not have access to online shopping and the majority (97%) of the respondents preferred to physically go and buy supplies and groceries. This can mainly be attributed to the lack of adequate ICT infrastructures and access to online shopping or email services to place orders online. It is also concerning that the majority (78%) of those who responded used public transport to go and buy their supplies and most of the vehicles used are not in good condition and some are not roadworthy. The bad condition of the road infrastructure was also highlighted as being one of the biggest problems.

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Eighty-one percent of the respondents also highlighted that they had access to online banking, which we will assume is the e-wallet, but the majority (80%) preferred to use cash to pay for their accounts.

l) Diagnostic 12: Passive Infrastructure (D12)

Some of the things the Government should consider are effective open access rules, topology requirements and investment in passive infrastructure. Reliable energy source is critical in the provision of sustainable ICT development in deep rural environments. The respondents (100%) indicate that there is a power grid in the area but (43%) highlighted that it is not very reliable.

m) Diagnostic 13: Digital Literacy (D13)

Digital literacy remains a foundational skill similar to reading and writing, and these are some of the core competencies of people's personal and professional lives. The biggest challenge in the developing countries is to reach the adults, often in low - literacy populations. The lack of awareness of the potential use of the ICT services remains a hindrance to the usage and uptake of the technology. It is hard to use the ICT services when, even among the youth, more of the users have a level of functional literacy which is below what will enable them to be productively involved. The uptake of ICT is mainly restricted by the lack of computer literacy and digital competencies.

The majority of the respondents (81%) indicated an interest to improve their ICT skills. ICT skills refer to the effective application of ICT services for basic ICT users who are competent users of the mainstream tools necessary in their working space. The research found that the majority of the respondents (51%) had access to computers and it is also important to note that a small number (13%) used the computer for Internet access.

n) Diagnostic 14: Infrastructure support and maintenance (D14)

The trustworthiness of the network on the reliability and quality of service is an important issue that affects the level of the adoption and usage of ICT services. The majority of the respondents had indicated that they knew whom to contact to log network outages with network providers. There is a small number of respondents (20%) who stated that they did not know whom to contact when there are network faults and (71%) also noted that they have a problem on the network quality.

o) Diagnostic 15: Infrastructure support and maintenance (D15)

About 71% of the participants indicated that they have difficulties with the network coverage. This is followed by 17% of the respondents who indicated that they experience a lot of connection problems.

The rest complained about problems with the end user devices. The stability of the network's reliability is a key aspect that affects the level of uptake and usage of ICT services. The lack of reliable ICT services results in the instability of the network. This is widely related to the poor deployment of communication infrastructure, break-ins, unstable power supply and lack of network protection and redundant route, particularly in rural areas. The establishment of a reliable backhaul for the ICT network will mitigate this and ensure a reliable ICT experience for the rural community. The biggest challenge identified is the lack of investment in the rural communities due to lack of a viable business model.

8.4.2 Guiding Policy

The preceding subsection identified and discussed 15 diagnostics of hindrances to the strategy for sustainable ICT development in deep rural environments. To respond and solve the 15 diagnostics that have been identified in the environments, a guiding policy needs to be identified for each of them. These will be discussed in detail below.

a) Guiding Policy 1: Digital Inclusion (GP1)

Section 8.4.1 identified a rural gender imbalance in the access to ICT services and the majority of the rural women feels less empowered. Women empowerment is about establishing a platform in which women are able to develop their full potential and manage productive, creative lives based on their needs and interests. There is a need for the development of technology to shift from a mainly male-dominated perspective to cater to women's needs as well. A number of interventions such as developing gender and ICT indicators to make sure that rural women's particular needs are considered in the planning process need to be considered to address gender parity. Section 8.4.1 indicated a huge gap in the number of unemployed and lack of youth development.

Youth development is important in building the much-needed capacity that is part of the strategy for sustainable ICT and which will benefit the rural community. Youth development, which can be facilitated through access to ICT platforms, must be positioned as a solution for youth empowerment and employment. It will enable small businesses to access information on how to trade products and find the local market. The research findings highlighted a very good penetration of radio in the community. The youth must be provided with technical development on the utilisation of ICT services and applications with participatory and practical learning using the existing local bodies such as schools and community radio stations. This will enable rural communities to establish what to utilise them for

and to develop demands. Policies which focus on youth development on ICT must be promulgated and enforced with clear monitoring and reporting mechanisms to ensure effectiveness.

b) Guiding Policy 2: Rural Development (GP2)

ICT should be viewed as a means of achieving rural development and not only as a way of understanding the complexities of the rural livelihood. Section 8.4.1 indicated that some of the challenges in the rural community are a high level of unemployment, lack of economic development, poor level of digital literacy, and the low level of social development. ICT activities are a fundamental element of any rural development activity. The importance of information reflects who is able to make use of that information and for what purpose.

The process of change is more about the provision of ICT to furnish more information in a cost-effective manner. Economic development is driven by the implementation of the rural initiatives which are more process driven and implemented around alternative mechanisms. ICT is used to disseminate and process information and this contributes to the knowledge economy which is one of the major developmental pillars. ICT is becoming a priority in its usage particularly with the growing use of various ICT technologies (Kamel, 2007). ICT production and usage contribute significantly to economic growth through gains in total factor productivity and increased flows of information and knowledge. Such outcomes will assist in overcoming market failures and asymmetric information sharing. Moreover, with increased information, ICT availability and usage tends to permit greater transparency, accountability and accessibility in the delivery of public services, which in turn helps in efficient allocation of resources (Chen, 2004). Thus, ICT embeds a high probability of exerting a positive impact on economic and human development (Mandour, 2009)

The innovation in ICT in the world has been an important component in socioeconomic development. ICT entrepreneurship has captured the imagination of the youth. The low cost of bootstrapping a business coupled with the creative nature of ICT has encouraged millions to launch their own small businesses. The common impact of ICT for entrepreneurs is the creation of a whole new segment of online business opportunities. Clearly, an open Internet is playing a catalyst role for innovation, growth and job creation. It is, thus, very critical that employment be raised through quicker economic growth, enhancing the quality of education, skills improvement, innovation and enhancing the state to play a developmental and transformative role.

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ICT and, specifically, broadband are general purpose technologies that can be applied to a wide range of economic and social activities. Their positive effects on development have been well documented. More widespread use of ICT translated into more social development and general economic growth. Given the large economic and social positive externalities of ICT, governments should promote their use. This role requires, among other things, making the adoption and use of ICT affordable. Policies should aim to reduce the "affordability gap", defined as the number of people or households who did not access ICT services because they are not able to cover such expenses (A digital economy toolkit, 2016).

The National Planning Commission (2012) articulated that more work is required to make sure that there is a clear understanding of the challenges of the rural areas in South Africa so that proper developmental interventions can be implemented. South Africa must establish a clear comprehension of the changing demographics of who remains where and what impact that has had on the nature of the household structure and livelihood opportunities across the rural population.

c) Guiding Policy 3: Government Leadership (GP3)

Section 8.4.1 outlined the need for effective market competition, ICT infrastructure and policy matters. One of the key parts of catalysing access to ICT involved attention to policy and regulatory environments. ICT policy and regulations play a very critical and important role in determining the market and pricing conditions that determine the extent to which people will have access to ICT. The government needs to ensure an enabling environments for a quicker turnaround of deployment of ICT infrastructures. One of the major stumbling blocks is the cost attached to the right of way, such as the utility providers' processes, which need to be followed to deploy ICT services, must be relaxed. Government should also establish policies for the use of spectrum and facilitate ease of access to passive infrastructures such as poles, conduits, rooftops and rights-of-way, which are critical in the deployment of ICT networks. These assets and resources will have to be allocated and managed efficiently to encourage deployment of ICT infrastructure and lower barriers to market entry.

It was also noted that the literature studies have indicated that the core principles of the regulatory framework include the creation of conditions for effective competition in the provision of electronic communication networks and services. This is based on the principle of technological neutrality together with the support of effective investments in the infrastructure.

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Another of the major inhibiting factors for the operators is the deployment of ICT infrastructures in rural areas as a viable business model. It is, thus, important that the policy and regulations adopt a technology-neutral framework that eliminates barriers to entry for ICT access technologies by avoiding forcing a particular path that will be later overtaken by the market trends. It is important to note that technology restrictions, especially over spectrum rights, will reduce the viability of the business model for prospective operators.

There is also a need for a market review, and some of the fundamental policies which will assist in providing affordable and reachable services are open access, infrastructure sharing, technology and service neutrality, and the reallocation of the digital dividend spectrum. The policymakers will have to promote the open access policy which will make sure that the sharing of infrastructure is encouraged and enforced, so that the operators can compete on services offered. Open access allows for a seamless connection in a technology-neutral framework that encourages innovation, and low-cost delivery of services to users. Open-access enforces the use of the networks of other operators and this ensures that small players have access to affordable local services, so that the end user can choose from a variety of service providers.

The nation's ICT future requires effective national government coordination, commitment and consistency on the part of the entity charged with ICT facilitation and funding. This task is not insignificant and, in the past, ICT planning has not involved interagency coordination within the national government, and among all the three tiers of government, industry, and the public at large.

To improve the timelines and coordination of the permitting process for access to government rights of way and other government infrastructure and facilities, there is a need for a number of improvements and recommendations. A cooperative and transparent working relationship between the local government and the network provider is essential throughout the planning and construction process. To that end, the local government should designate one person to facilitate the permitting process and to step in expeditiously to resolve problems that may arise.

d) Guiding Policy 4: Adoption of ICT (GP4)

Section 8.4.1 again highlighted the challenges of affordability, lack of Internet access and poor digital literacy. The National Planning Commission (2012) noted that the cost of the ICT services and infrastructure remain a significant obstacle to the greater use of mobile devices and fixed-lines, with limited network competition perpetuating the increasing costs.

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Affordability is defined as the difficulty of adding the payment for ICT access, and for a set of benefits experienced from its usage, to our daily income. Thus, ICT affordability can be improved in three different, non-mutually exclusive ways of improving income, reducing prices or increasing the utility derived from ICT access (A Digital Economy Toolkit, 2016).

One of the ways to afford services is to introduce subscriber subsidies. Subscriber subsidies will scarcely be used due to their distortion potential. A subsidy targeted at economically disadvantaged users is one of the suitable uses of this approach. Such a subsidy will address the social inclusion challenges that face the government as is seeking to establish a universal service.

It is also noted that an inhibiting factor for the adoption of ICT is the cost of communication and its affordability for the majority within the rural environments. The "calling party pays" model and highly innovative pricing models are critical for the spread of mobile services to users who have limited means to pay. A similarly effective and creative model has not yet been discovered in the data markets for both fixed and mobile services. An additional innovative data pricing model approach is needed to allow viable provision of access and services to low- income consumers. This is a complicated area in any competitive market and the risk for policymakers is that policy action or limitation may restrict access to data services for those who can afford them (Dewenter and Kruse, 2010).

It is further important to note that another factor is an innovation by service providers and content generators regarding the prices and the investment model. Access to affordable services for low-income users will require creativity that does not place most of the access cost burden on the consumer. Regulators must create platforms for this creativity to flourish and not inhibit it by restrictive notions of the right model for pricing. Competitive policy and regulatory frameworks have also had an impact on the cost-effective delivery of ICT services. Introducing competitive markets into ICT will be able to reduce prices and encourages businesses to be creative (Kirk and Bratt, 2011).

Supply and demand are necessary conditions for the promotion of ICT networks and services. For this to happen, ICT users must have the capacity to understand, learn, and apply the lessons learnt about ICT benefits and capabilities across the economy, and this will require an absorption capacity. Absorption capacity will make sure that the ability of a community to recognise the value of new, external information, and to assimilate that information, is developed and harnessed. This ability is critical to the community innovation capabilities as new technologies are assimilated by organisations to create, improve and transform business processes, products and services.

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The demand stimulation is very critical for the uptake and adoption of ICT services, which is encouraged. The effective policies and funding for the demand-side to facilitate ICT uptake and usage are necessary for the sustainability of the ICT infrastructure in the distant future, notwithstanding the importance of the supply-side. The furnishing of the information online by the state itself can demonstrate the effects of online delivery and interaction, and provide citizens with incentives for the adoption of ICT.

Demand stimulation is thus very important to facilitate the adoption of ICT services. The e-government services are essential to encourage the community members to use the Internet services to access essential services such as registration of newborn babies, application of birth certificates and registration for old grant services.

Sharma and Lucini (2016) highlighted that good practices aim to increase the affordability of ICT services and promote digital inclusion. They outlined three ways affordability can be increased:

- By increasing income through transfer mechanisms for targeted segments of the population;
- Lowering the cost of ICT services through enhanced competition, effective ICT strategies, efficient spectrum allocation, infrastructure sharing models and universal-access programmes; and
- Increasing the utility of accessing the Internet by enhancing digital awareness, literacy and the provision of local content.

The design and implementation of the ICT solutions will have to be people-centric for ease of use and adoption by the community. The needs of the people and the context in which the ICT services will be used to address them needs to be understood. Understanding the context in which the technology will be introduced with regard to people's attitude to information, technology and its products are very important. It is therefore pivotal that the community gets involved in the design of the suitable solution. The role of the community is pivotal and will ensure an ease of adoption and uptake of ICT services. Digital literacy ideally made users aware of the ability to access ICT infrastructure and services. This will, in return, expand the exposure of rural citizens to available knowledge and information, provide new ways of learning and create much-needed jobs. Therefore, the ability to use the end user devices, which includes the computers, becomes crucial.

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e) Guiding Policy 5: Technology Infrastructure (GP5)

Section 8.4.1 has emphasised challenges regarding the lack of quality ICT infrastructure and has also highlighted the challenges around the support and maintenance of ICT Infrastructures. The National Planning Commission (2012) articulated that the ICT infrastructure is not just important for faster economic development and more job creation. They state that it also encourages inclusive growth and provides users with the means to improve their livelihood and increase their incomes. Technology Infrastructure is important for development.

Despite considerable and sustained progress in deploying the latest ICT networks across rural South Africa, some areas of the country remain without fast Internet services. The explanations behind these shocking results are numerous and mirror a variety of difficulties confronting policy makers and service providers. A few areas are geologically remote, others confront critical land challenges and many are meagerly populated. Therefore, these areas are typically viewed as "uneconomic" to serve without some measure of government help.

The government's ICT initiatives are mainly anchored around capital investment for ICT networks in rural and semi-rural areas, making sure of access to ICT services and the development of Digital Hubs. One of the biggest inhibitors is the cost to roll-out infrastructure to rural areas and this can be reduced by infrastructure sharing. Infrastructure sharing will alleviate cost pressures on competing providers. It allows operators to capture economies of scale and reduce investor risk, which is tantamount to lowering costs. Institutions must move away from using dedicated and single-purpose networks that are not available for broader community use, resulting in only the individuals working in those institutions having access to the Internet. Bulk purchasing is another mechanism which needs to be considered, particularly where optic fibre demonstrates large economies of scale. This can drive down the per-megabyte cost of access considerably. Thus, the supply-based approaches, such as demand aggregation in sparsely populated rural areas, remains a virtuous cycle to promote uptake and effective use of ICT services.

One of the other challenges in the rural community is the terrain which makes it costly for a fixed ICT solution to be deployed. The wireless solution provides a cost-effective approach to cover low populated areas and areas which are difficult to reach using traditional wired solutions. This makes providing spectrum for wireless networks an important task for a strategy for sustainable ICT. However, the future spectrum requirements will be determined by the geographical position of each city, population

numbers, average spectral efficiency of a number of technologies, and estimated number of subscribers and behaviour of consumers.

Therefore, wireless technology is a suitable solution for accessibility and ease of adoption. Wireless solutions provide ubiquitous connectivity and it is becoming an increasingly important way to access ICT networks. Moreover, ICT represents a less costly solution to reach sparsely populated rural areas. As a result, the increased availability of the frequency spectrum for ICT deployment can be expected to have a far reaching effect. One of the reasons for the lack of sustained ICT intervention is the absence of resident ICT skills and expertise to operate and maintain the ICT infrastructure.

Literature has emphasised that there will be a need for appropriate competencies to ensure effective maintenance of the ICT strategy infrastructure for sustainable ICT to be successful. The reliability of the network and the quality of service is pivotal to determine the uptake and usage of the ICT services. The availability of operational funding post the implementation of the networks is important for sustainability of the ICT services for the rural communities. It is, therefore, important that big corporations with financial backup are encouraged to invest in the deep rural areas by ensuring that the conditions are conducive to make profit.

Processes for fault reporting and first line support will also need to be improved to ensure a quicker turnaround time of fault resolutions and improved ICT infrastructure uptime. Training of the field technicians will therefore be promoted and implemented. Routine and preventative maintenance will also be pivotal to ensure longevity and the improved lifespan of the ICT infrastructures. Thus, maintenance frameworks need to be developed and implemented and regularly improved for effectiveness and necessary impact. Most government projects do not have reliable monitoring and evaluation mechanisms in place. Robust monitoring and evaluation will guarantee accountability from the stakeholder's point of view for a particular project, and also assist in making constant improvements by means of feedback.

f) Guiding Policy 6: Funding Model (GP6)

Section 8.4.1 indicated the challenge of quality infrastructure within the rural areas and the study has shown that most of the mobile operators are reluctant to invest in quality infrastructure in the rural areas due to the absence of a viable business model.

One of the biggest challenges for the deployment and roll-out of ICT infrastructures in rural areas is the lack of financial investment and funding mechanisms. The state had significant fiscal constraints and this made it very impractical to allocate meaningful financial resources for all its projects. It is therefore important that external donors and PPPs will need to ensure adequate funding is made available. The ICT sector, naturally, requires the smallest amount of funding of all the infrastructure sectors and a significant portion of the funding needed for the number of infrastructures is expected to be raised by the private sector. This puts the responsibility of funding in soft projects to make sure that a conducive environments are in place to optimise the private sector investment. The Government will, therefore, have to make sure that a tailor-made business model that suits the rural community is adopted. It is important to note that for the strategy of sustainable ICT development in deep rural environments, the conditions have to be conducive. There are several interventions which the government must undertake to ensure an effective funding mechanism is adopted.

One of the biggest challenges of deploying ICT infrastructure in rural South Africa is a lack of a viable business model. The service providers should be able to invest in the ICT infrastructure with a guaranteed rate of return on the investment. ICT will only be able to attract private investment with a concrete plan and stable cost recovery mechanism. While one-time grants from communities and regions can be helpful to incentivise ICT service providers, it is important to recognise that the ICT infrastructure needs upgrading and long-term maintenance. It will be uneconomical to build out an ICT network that will not generate enough revenue from its customer base to support the ongoing maintenance of the system.

Since the Government is constrained by the twin challenges of reducing the deficit and meeting some competing demands placed on the fiscal, the PPP will provide an effective solution to this dilemma. The funding model will make sure that the private sector complement the government’s investment with comparable resources of their own. The Private Sector remains a significant contributor to research, technology, skills, investment and the new business models necessary to scale creative solutions. The PPP arrangement will make it possible to implement the rural project with an effective scope and accurate timescales. This will make sure that the public purse is better channeled in the most efficient manner, while promoting the private company’s involvement in improved risk management on investments.

8.4.3 Set of Coherent Action Plans

In section 8.4.1 the key factors affecting the sustainable ICT in the rural areas were discussed. The challenges are categorised and diagnosed in Section 8.4.1. Guiding policies were subsequently identified for each of the diagnostics, as discussed in Section 8.4.2. Given the strategic crafting model, as per Figure 5.2, the guiding policies (Step 3.1.2) should end up formulating a set of coherent actions (Step 3.1.3). These can be used as part of the complete strategy for sustainable ICT in the deep rural area. This subsection discusses this set of coherent actions, which were derived from each of the identified guiding policies, to contribute to the proposed strategy for addressing sustainable ICT development in deep rural environments. The coherent actions stem from the conclusions made following the data analysis which was based on the data gathered in the case study (Section 6.6.3). The following strategy model is thus formulated and expanded in Figure 8.2:

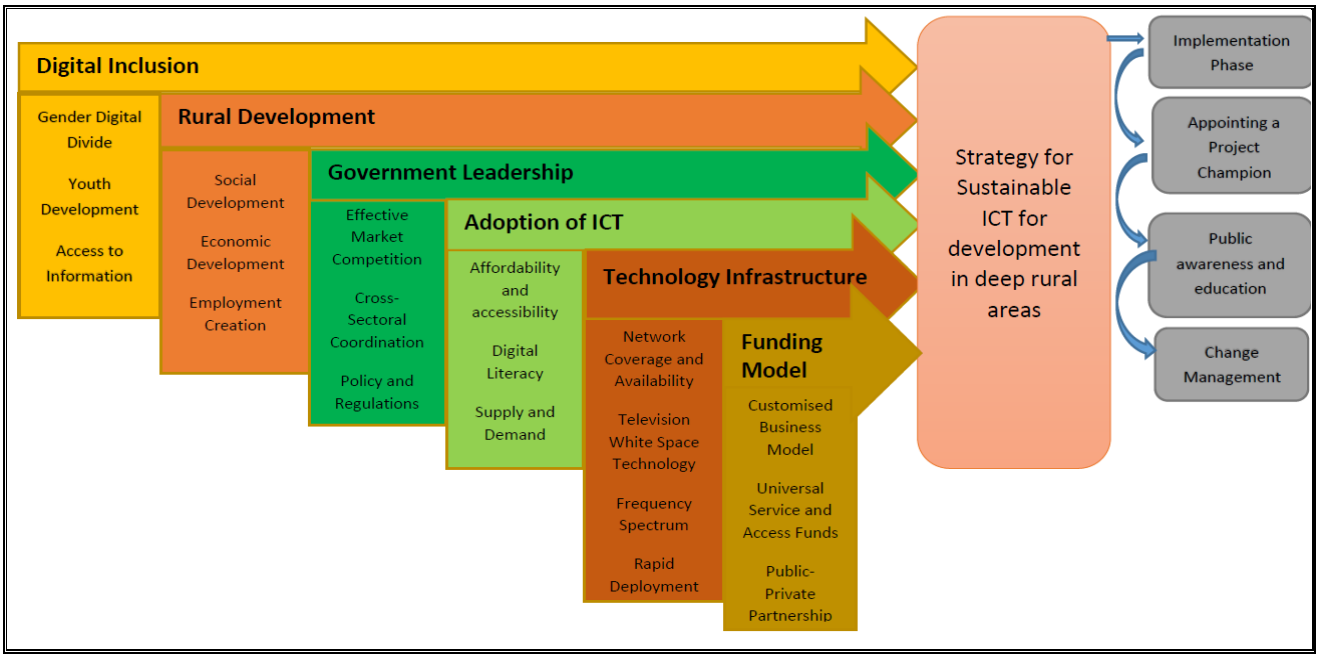

Figure 8.2: Strategy framework model (Researcher's Design)

The Table 8.2 presents a summary of the relationship between the guiding policies, the relevant diagnostics and the related coherent actions which need to be undertaken to address the identified diagnosis.

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Table 8.2: Summary of the relationship between guiding policies, diagnostics and coherent action

	GUIDING POLICY	DIAGNOSIS	SET OF COHERENT ACTIONS
1	Digital Inclusion (GP1)	• Gender imbalance (D1) • Lack of Youth development (D2)	• Seamless access to information (A1.1). • Youth Development (A1.2). • Bridging the gender divide (A1.3|).
2	Rural Development (GP2)	• High Unemployment rate (D3) • Low level of literacy (D4) • Economic development (D11)	• Social development (A2.1) • Economic development (A2.2) • Employment creation (A2.3)
3	Government Leadership (GP3)	• Poor market competition (D6) • Policy and regulatory framework (D10)	• Effective market competition (A3.1) • Cross-sectoral coordination (A3.2) • Policy and regulations (A3.3)
4	Adoption of ICT (GP4)	• Lack of affordability (D7) • Lack of digital literacy (D13)	• Affordability and accessibility (A4.1) • Supply and demand (A4.2)
5	Technology Infrastructure (GP5)	• ICT Infrastructure (D5) • Other media platforms (D8) • Lack of Internet Access (D9) • Lack of passive infrastructure (D12) • Infrastructure support and maintenance (D14)	• Network coverage and ability (A5.1) • Television White Space Technology (A5.2) • Frequency spectrum (A5.3) • Rapid deployment (A5.4)
6	Funding strategy (GP6)	• Lack of viable business model and funding (D15)	• Customised business model (A6.1) • Universal service and access funds (A6.2) • Public private partnerships (A6.3)

a) Guiding Policy 1: Digital Inclusion (GP1)

To enhance digital inclusion, there are various factors that will need to be addressed and these include seamless access to information, youth development and bridging the gender divide. The mapping of the relevant diagnostics with the equivalent guiding policies is outlined in Figure 8.3.

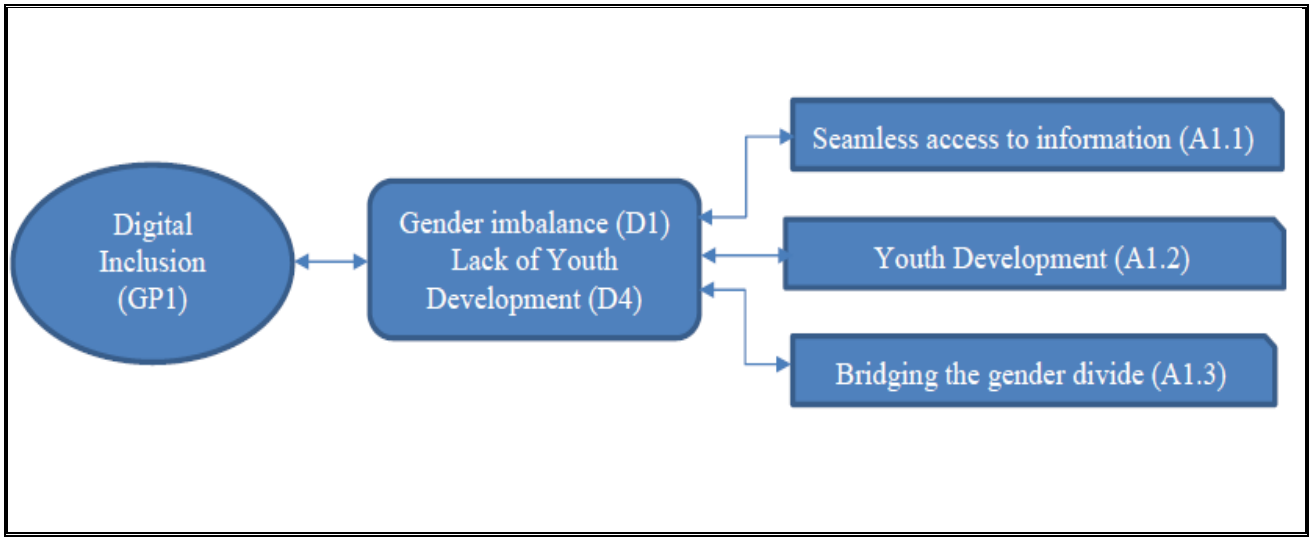

Figure 8.3: Guiding policy – Digital inclusion (Researcher's design)

The set of the relevant, coherent actions is then discussed and highlighted in the following sections:

i. Seamless access to information

Digital technologies play a key role in encouraging access to information, both by improving record keeping and by supplying open access to important public information with a defined open data policy. It is important to assert that improving access to ICT for the previously unconnected works much more effectively when projects are flexible, incorporate locally driven applications and community involvement and react positively to the needs of the targeted beneficiaries. The community needs to be encouraged to develop local content in the dominating language, which is Xhosa, as established during the research findings.

The National Planning Commission (2012) highlighted that pricing of services and the equipment costs remain a significant barrier to the expanded use of mobile phones and fixed-lines, thus limiting access to information. Innovation by service providers and content generators in developing a cost effective business model will drive pricing and affordability down, and access to information will then be promoted. The model, similar to the "calling party pays" for the voice calls, must be explored and implemented in the emerging data market for both mobile and fixed networks.

Another key part of catalysing access to ICT involves attention to policy and regulatory environments. It is, therefore, important to understand the policy challenges that hinder access to and the use of ICT. On its own, improving access through demonstrating social and technical creativity is not sufficient to implement an all-encompassing knowledge society and economy in the developing economy. ICT

policy and regulation play an important role in determining market and pricing models that influence the degree to which people are able to access ICT and also encourage competition (Elder, Emdon, Fuchs and Petrazzine, 2013).

ii. Youth Development

The younger generation is the cornerstone and the core of any developing economy. It is, therefore, important that policies which focus on youth development be promulgated and speedily implemented. Clearly, issues and policies relating to young people are in dire need of attention at the level of the global bodies such as the UN, national governments and all the way down to the local governments. Conspicuously missing from the poverty reduction initiatives of the past are the problems faced by the young generation which have been overlooked and not taken seriously. One of the biggest problems faced by the young people is the increasing unemployment among the young generation as indicated by Statistics South Africa in the Figure 8.4.

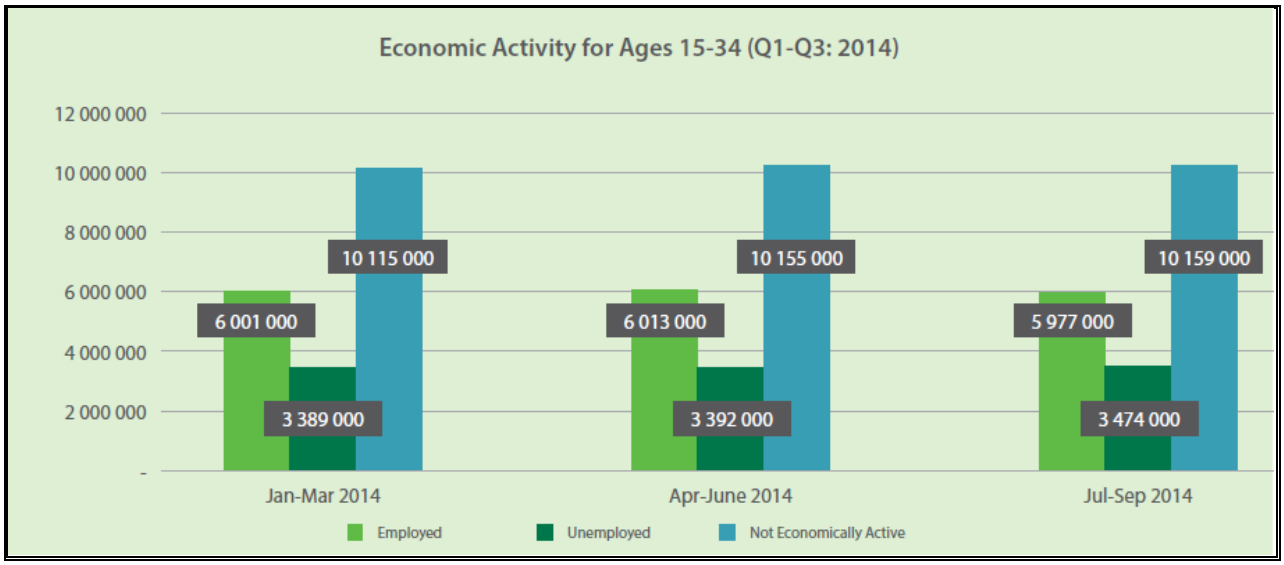

Figure 8.4: Employed, Unemployed, not economically active (Source: Stats SA labour force 2014)

It is important to note that when young people are given access to 21st century skills such as critical thinking, collaboration, and decision-making as part of a strong educational foundation, they are then empowered and enabled to become key participants in solving a range of challenges faced by the country, continent and indeed the world. Thus, the multifaceted stakeholder involvement, which includes both the policymakers and the private sector, must make sure that affordable ICT is achieved and translated in the transformation of the less privileged, particularly the youth in the rural areas who are adversely affected by the lack of adequate ICT Infrastructures. The national policies must prioritise

and emphasise the importance of ICT youth development for effective development of local communities through innovation and entrepreneurship.

Further consideration of digital inclusion must address access to ICT at public places for the benefit of the youth who are unable to afford paying services. Moreover, efforts should be established to support training on the utilisation of ICT accompanied by relevant content that can provide targeted communities with job creation and the means to develop and promote small developing entrepreneurial activities. ITU will be issuing a report: "Youth, Employment and Entrepreneurship: Seizing New ICT-Enabled Opportunities".

iii. Bridging the gender divide

The National Planning Commission (2012) articulated that women constitute a greater number of the disadvantaged, predominantly in the deep rural areas. The approach took gender along with race and geographic location into cognisant, suggesting a range of interventions to promote women's equality.

Throughout the developing world, females are often excluded during the inventions and implementation of ICT, and sometimes lack basic access to technologies such as cell phones in rural communities. This includes countries where there is growth in technology deployment and usage; many females are at a disadvantage. The surprising phenomenon is that women can play an important role in the process of reducing poverty and promoting social cohesion for themselves, their family members and rural communities (Telecommunication Development Sector, 2013).

ICT is an important platform for the social and economic development for women. This can be enabled through the provision of education, promoting literacy, enabling access to health care, and understanding human rights with full participation in government programs. There are a number of reasons why this is necessary including gender discrimination and physical location restriction. Simply put, women, in particular, have minimal spare time and disposable income compared to most men in many developing countries, especially in rural areas. It's important to note that investing in women has a multiplier effect as they tend to reinvest in their families and rural communities. Thus, ensuring digital inclusion and ICT accessibility to women will promote gender equality, empowerment and social development of the whole community.

Joseph (2012) stated that the improved capabilities of rural women depend on the real opportunities that ICT provides and their living conditions. Women empowerment is about establishing environments in

which women can improve their full capabilities and lead productive, creative lives by their needs and interests. The historical background of the rural women is that they have always been left behind to take of the children. However, the development of women will require improved living conditions, political arrangement and socioeconomic conditions. This will influence rural women's capabilities to use ICT. There is a need for the development of technology to shift from a mainly male-dominated perspective and cater for women's needs as well. Women will also have to be located and moved into occupations which require the use of technology so that they can get more familiar with its use.

Thus, a greater diffusion of ICT will have to be enforced commensurate with the national needs, ambitions, specificities and concerns. A number of interventions need to be considered to address the gender ICT disparity. These include developing gender and ICT indicators to make sure that women's particular needs are considered in the planning process. The gender analysis in technology and policy will make sure that the resulting policy and regulations address the needs, requirements and aspirations of women. Conditions and regulations to enable women to maximise suitable ICT possibilities will have to be created. The biggest number of the respondents was women and most of the residents, predominately women, indicated that they would like to own a small business once they have acquired ICT skills.

The training on ICT should be designed in such a way that ICT awareness of the citizens should be increased, computer literacy improved and the digital divide reduced.

To achieve these goals, the government should:

- Make sure that there is a computer-related curriculum for high school education;
- Introduce the internationally recognised certification;
- Develop ICT experts through the introduction of customised ICT training;
- Increase access to e-learning;
- Improve the skills and expertise of the public servants by conducting ICT training;
- Introduce ICT departments into the institutions of higher learning and provide support;
- Establish specialised training for the elderly and people with special needs; and
- Establish an information village to assist in improving of the computer literacy.

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b) Guiding Policy 2: Rural Development (GP2)

To enhance rural development, there are various factors that will need to be addressed and these included social development, economic development and employment creation. The mapping of the relevant diagnostics with the equivalent guiding policies is outlined in Figure 8.5.

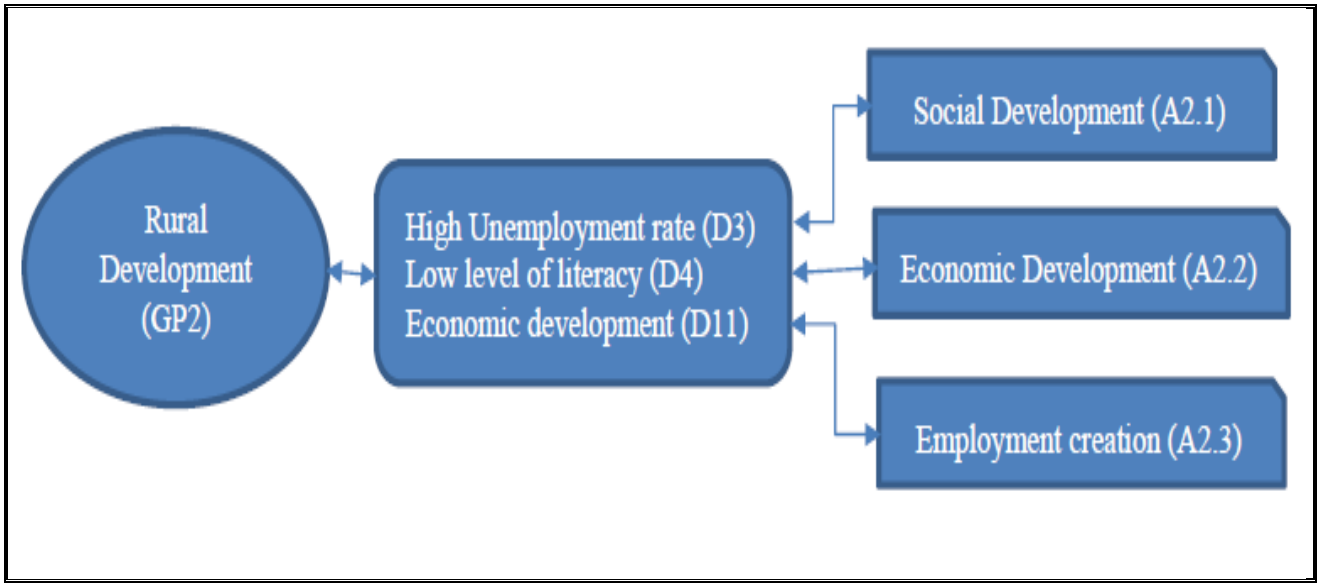

Figure 8.5: Guiding Policy-Rural Development (Source: Researcher's Design)

The set of the relevant, coherent actions is then discussed as highlighted in the following sections.

i. Social development

There is a need to develop alternative models for ICT delivery to poor communities, with the flexibility to adapt to locally specific demands. There is also a need to focus on people and not the technologies and this will require defining common understanding around objectives and value systems that link technology adoption to economic and social development. One such model to be explored will be for the government to expand the mandate of libraries. They would include free or highly subsidised ICT access and build in the practice of some libraries as development nodes in their community, with a social development and change focus (Attwood et al., 2013). Moreover, one of the ways to introduce ICT into indigenous communities is to promote community ICT hubs. These have to be developed for sustainability with the direct engagement of serving the indigenous people. They have to include a selection of appropriate technology with relevant local content to address cultural and economic activity as well as train of members of the rural communities (Telecommunication Development Sector, 2013).

ICT and specifically broadband are general purpose technologies that can be applied to a wide range of economic and social activities. Their positive effect on development has been well documented. More

widespread use of ICT translates into more social development and general economic growth. Given the large economic and social positive externalities of ICT, governments should promote their use. This role required, among other things, making the adoption and use of ICT affordable. Policies should aim to reduce the "affordability gap", defined as the number of people or households who do not access ICT services because they are not able to cover the expenses (A digital economy toolkit, 2016).

The governments which prioritise economic and social development, supported by policies that incorporate ICT, particularly broadband, position their communities for development best. The policy directive that underpins the social development of the community of the AmaJingqi will be very important to make sure that ICT benefits the community by ensuring e-government services. If the existence of the ICT infrastructure is accompanied by innovative technological ideas on the biggest possible scale and in all socioeconomic development, there will be a greater phenomenon in the growth of economic and social development and progress in the well-being of the rural community.

ii. Economic development

ICT has a multiplier effect on economic growth at a number of levels. First, the introduction of ICT across different business environments improves efficiency by facilitating the adoption of more effective business processes. Second, extensive roll-out of ICT accelerates innovation and creativity by introducing new consumer applications and content. Third, ICT leads to a more efficient functional implementation of enterprises by maximising their reach to a pool of resources, access to raw materials, and end users (Broadband Series 2012). The dominating goal of the ICT policies is to enhance the socioeconomic development through maximum implementation of ICT in all sectors, and the provision of ICT services to the far reaching rural areas. Economic growth and development will achieve less potential if economies are not able to exploit new technologies and reap their benefits (ITU, 2015).

ICT represents one of the greatest pillars in establishing a knowledge-based economy through facilitating the dissemination and processing of information. With the increased use of various forms of ICT, there is a major drive to utilise the technologies in serving socioeconomic developmental agenda (Kamel, 2007). ICT implementation and adoption is able to significantly contribute to economic growth through gains in total factor productivity and a greater dissemination of information and knowledge, which gets translated into reducing uncertainty and transaction costs (Mandour, 2009).

The following initiatives can increase social and economic development, including the implementation of e-communities:

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(a) e-government

One of the purposes of the ICT networks in the deep rural areas will be to offer improved public services to rural communities by disseminating important information more efficiently and effectively and offering essential government services. E-government combined with this will encourage a greater sense of community involvement, and improve informed decision-making and developmental program implementation.

(b) e-business

Through the application of the technology, small enterprises in the rural area will achieve improved productivity and profitability, reach more markets, reduce their transaction costs and manage inventory more effectively. On the consumer side, ICT will make sure that consumers have greater satisfaction through their interaction with an increased number of potential suppliers, beyond the constraints of location. This will in the process create much-needed jobs.

(c) e-learning

A reach to develop material and increase knowledge is critical for economic, social and cultural development, and is a way of self-development, community advancement and improved business processes. Implementation of affordable and universal educational programs, content, ICT networks and hardware must be promoted to ensure seamless adoption of ICT by the rural community of the AmaJingqi.

(d) e-health

Access to healthcare information and services is a basic right. Many communities in South Africa lack enough healthcare facilities and human resources, particularly in the most underserved and remote areas. The use of ICT will encourage social inclusion of all community members by providing an equitable access to important services, as well as empowering the community members to better manage their own health and to be involved more effectively in the healthcare process. The community can therefore explore the potential of ICT to make sure that the community reaps the economic benefits which can be derived from the application of the ICT infrastructure within the AmaJingqi community.

iii. Employment creation

Adapting ICT for improved job creation opportunities for the rural community members and empowering them with information and knowledge also requires strategic objectives, and well-coordinated experimentation, local resources involvement, social learning and plans for improved

sustainability. The application of ICT across all economic sectors is creating new demands on the users and the workforce skills. The improved skill sets are creating more employment opportunities and also introducing new requirements in the rural communities. In today's employment market, basic ICT expertise is considered necessary for people entering the job market and for those trying to find better employment. Governments consider ICT skilled workers to be a critical asset that is able to contribute to the economic development, enforced competitiveness, and improved business productivity. Community economic well-being is dependent on both the effective use of ICT for small enterprises, industrial processes and on the knowledge, competencies, and skills of current and new employees (European Commission, 2004).

One of the number of initiatives that can be undertaken is the recommendation of the establishment of multiple partnerships to provide training to those from disadvantaged rural communities, including elderly people, people with special needs and youth looking for employment. Moreover, it also needs to be specified that these partnerships will bring together local governments, the ICT sector, the local job centres, Chambers of Commerce and a conglomerate of SMMEs could implement the leading ICT skills and resources with corporate of wider business expertise and job creation support services. Such collaborations should also provide access to training for rural internships and work experience in local SMMEs.

c) Guiding Policy 3: Government Leadership (GP3)

To enhance rural development, there are various factors which will need to be addressed. These include effective market competition, cross sectoral coordination, and policies and regulations. The mapping of the relevant diagnostics with the equivalent guiding policies is outlined in Figure 8.6.

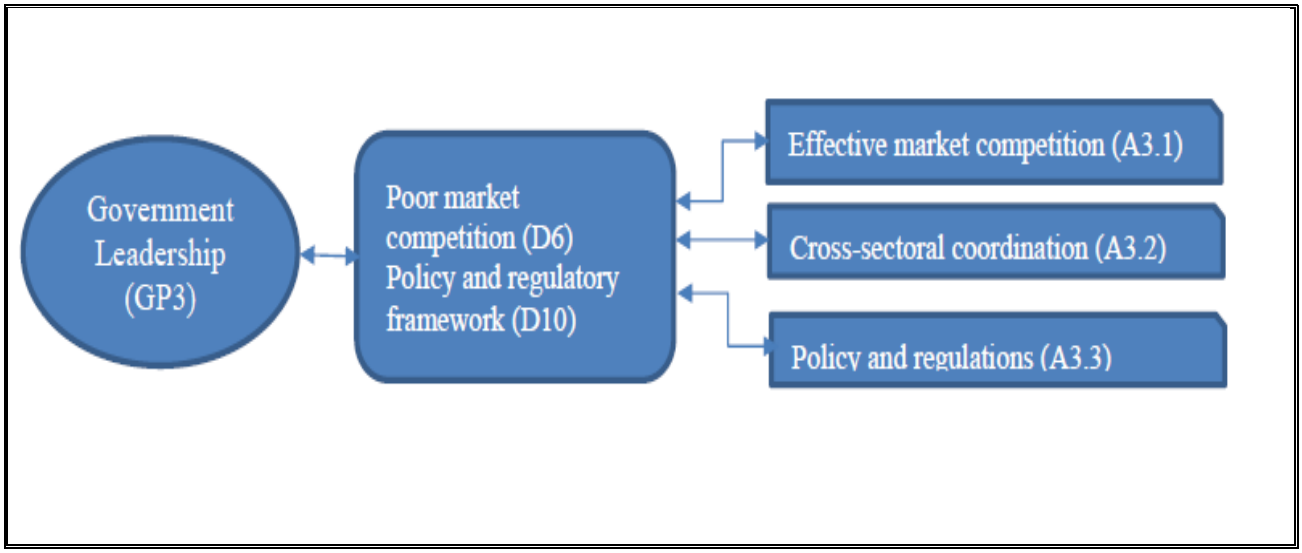

Figure 8.6: Guiding Policy – Government Leadership (Researcher's Design)

The set of the relevant, coherent actions is discussed and highlighted in the following sections:.

i. Effective market competition

One of the interventions which the government will have to undertake is to make sure that the playing field is levelled and that the market competition is fully regulated. Before making public investments in implementing ICT infrastructure, the State should first look at the regulatory mechanisms that might improve entry and market competition, and thus maximise what the market is able to deliver.

The State will also have to make sure that the policy and regulations of open access are formulated and enforced. When the State decides to grant an intervention in the markets by subsidising the ICT infrastructure, the implemented infrastructure should be available by means of open access guidelines. This will enable network providers to offer capacity or access to all market players on an equal and non-discriminatory basis and conditions.

Open-access allows a wide variety of physical infrastructure and applications to utilise an open architecture. It allows seamless connection in a technology-neutral environments which encourages innovation and low-cost delivery of ICT services to users. To provide ICT services in the rural communities, governments must promote open access in its regulatory tools. Open access will stimulate economic development, innovation and entrepreneurship and will benefit the rural community through delivery of low-cost ICT. Open access will facilitate the use of the transmission networks of other service providers. This will greatly benefit those enterprises that want to start local services and will make sure that consumers can choose from the available Service Providers.

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ii. Cross-sectoral coordination

Cross-sectoral coordination ensures minimal duplication of resources and quicker turnaround time on the main project implementation and is critical to ensure a successful strategy. These coordinated initiatives will ensure full leverage on the collaborative networks, an integrated vision and realisation of the full benefits derived from the ICT services. Multi-layer government planning is, therefore, encouraged to ensure effective implementation of the main ICT projects.

Coordination of expertise and resources is essential for the success of initiatives and programs that come out of the strategy. With the number of agencies involved in the local communities, and elsewhere across the provincial government, there is a considerable risk that, in the absence of meticulous planning, a number of actions might be redundant with an existing program. These actions could be inefficient, unnecessarily costly, or otherwise in conflict with other provincial activities. As such, it is incumbent upon the various role players to adhere to basic planning when implementing new programs or creating new partnerships to address a particular ICT issue. Do no harm to existing programs, do not be wasteful and do not unnecessarily replicate efforts that have already succeeded or failed.

The "silo thinking" mentality needs to be addressed so as to allow a more cost-effective approach that will include various sectors in the recognition of the cross-cutting nature of ICT. Implementation remains one of the major challenges with a need to encourage a more consolidated approach for effective coordination and implementation of ICT services. Some strategies have been developed as landmark events to assist clear mandates and place the regulators in the spotlight.

Controlled decision-making is critical for effective public investment in ICT network and for promulgating ICT policies to promote government information sharing and dissemination, and one-stop access to public information and services. As the governments are typically the biggest information providers and ICT users, coordinated efforts will minimise duplication in data collection and ICT network investment and development by various public entities. At the same time, coordinated efforts will focus on the much-needed resources required to improve the relevance, quality, and use of the Government information.

The Government must also develop and finalise a strong governmental "Dig Once" policy framework. The framework should recommend the establishment of policies to promote an efficient rollout of the greenfields ICT infrastructure. The rollout should include cost-effective "dig once" policies that will make the fiscal funding of the highways, roads and bridges projects contingent on the Government and

local service providers and allow joint deployment of ICT, particularly in rural areas. ISPs should be notified well in advance about laying the middle mile or last mile conduit while the roadbeds or other local government right-of-way paths are open. The deployment of fibre in this manner will greatly reduce the cost of rolling out infrastructure in the rural areas and bring high-speed ICT to the communities.

iii. Policy and Regulations

The key regulatory barriers are:

(1) A lack of solid leadership and policies for the development and implementation of the ICT agenda, (2) the absence of awareness and education of how best to use ICT strategies to promote government programs, and assist provinces to promote their programs similarly, (3) silos in which the various entities operate within the sector; and (4) lack of investments for ICT initiatives.

The government put legislation in place to address and promote universal access to telecommunications and access to information and services. Chapter 14 of the Electronic Communications Act 2005 (ECA, 2005) is the legal framework that drives the mandate to provide all persons with universal access and service to electronic communications networks, including any elements or attributes thereof (ECA, 2005). The Electronic Communications Transaction Act, 25 of 2002 (ECA, 2005 recognises the importance of the information society and knowledge economy (ECA,2005).

The most needed regulatory directives for the reallocation of the digital dividend spectrum is critical to make sure that valuable spectrum gets allocated for the affordable roll-out of ICT services and the sustainable ICT strategy. ICASA (2014) is vested with control, planning, administration, management of the use of, and licensing of the radio frequency spectrum except as provided for in section 34 of the ECA (ECA, 2005). Section 34 deals with the radio frequency plan and provides for the Minister to perform a number of significant roles, arguably undermining ICASA's position as an independent regulator. In this regard:

- The Minister is supposed to approve the national radio frequency plan developed by ICASA which is to pave the specific bands designated for use by particular services;
- ICASA is required to consult with the Minister in preparing the national radio frequency plan; and
- ICASA has a discretion to hold public hearings on the proposed national radio frequency plan.

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ICASA recently published an Invitation To Apply (ITA) in the licensing process for International Mobile Telecommunications (IMT) spectrum bands (700MHz, 800MHz and 2600MHz). However, the Minister of Telecommunications and Postal Services indicated that the Department intends to oppose the process from going ahead as it was not consulted and the spectrum is the government's assets. It is very important that this spectrum band is licensed and that it has some desirable and suitable propagation characteristics for the strategy for sustainable ICT for the development of the deep rural areas.

Wireless technology is changing rapidly and the intention of the proposed additional spectrum is both to keep pace with technological change and also to make decisions that accommodate future developments. The demand for more efficient use and improved regulation of the spectrum, to avoid artificial scarcity and enable the use of a variety of ICT and electronic services, requires approaches that differ from the traditional allocations and assignments. The scarcity of radio spectrum has been touted as the major hurdle to opening the market to more players and to more sophisticated wireless technologies (Ikeda, 2002). However, it has been shown that the economic inefficiency inherent in current spectrum management techniques, such as auctioning, may have created barriers to entry (Madden, Saglam and Morey, 2011). Spectrum auction models may not be the best approach to maximising broadband access for social uses such as education.

Wellenius and Neto (2005) critiqued the traditional rule-based spectrum management practices which give insufficient attention to the economics of wireless services and ICT use. What is required, therefore, is "a new system for spectrum management that permits different approaches of spectrum licensing to coexist so as to promote economic and technical efficiency" (Cave, 2008). Such a system should allow new market entrants operating in the digital services and media markets to have build or access to small wireless networks.

The regulator should not set out with the sole intent of gaining revenue, thus considering only regulatory tools such as spectrum auctions and other spectrum pricing models. It should adopt a position of valuing spectrum, regulating in a way that ensures that spectrum is effectively utilised to get high-speed broadband connectivity to public and educational institutions and households, through the design of affordable broadband pricing models.

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d) Guiding Policy 4: Adoption of ICT (GP4)

To enhance rural development, various factors which will need to be addressed and these include affordability and accessibility, supply and demand. The mapping of the relevant diagnostics with the equivalent guiding policies is outlined in Figure 8.7.

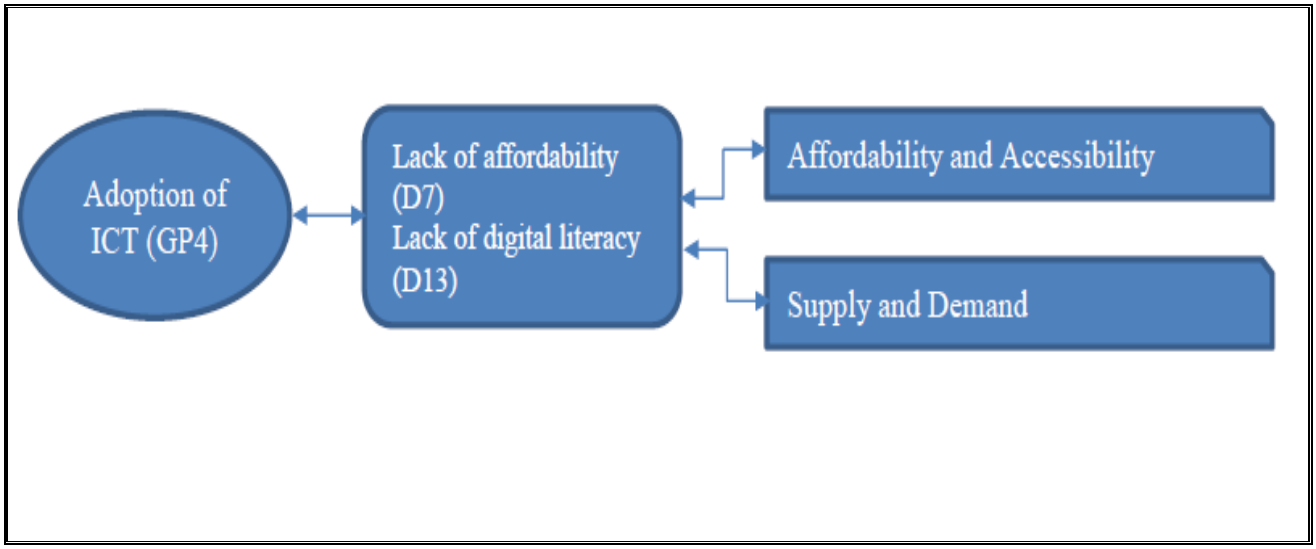

Figure 8.7: Guiding Policy – Adoption of ICT (Researcher's Design)

The set of the relevant, coherent actions is now discussed in the sections which follow.

i. Affordability and Accessibility

It is noted that an inhibiting factor for the adoption of ICT is the cost of communication and the cost-effective ICT for the greater population within the rural environments. The 'calling party pays' plan and creative pricing plans are critical for the increase in mobile users who are unable to afford to pay. Similarly, the important and innovative model for both fixed and mobile phones has not yet emerged in data markets. More creativity in data pricing is necessary for cost-effective delivery of access to ICT services by low-income consumers. This is a difficult area in any competitive market and the risk for policymakers is that policy action, or inaction, may subject access to data services to those who are well off only.

It is important to note that another factor is innovation by service providers and content generators regarding their pricing models and business cases. Cost-effective services for low-income users will require creativity that does not place most of the burden of costs on the consumer of services. Regulators

must create environments where this innovation will be able to flourish, and not throttle it by preconceived notions of the right model or pricing (Kirk and Bratt, 2011).

One of the other challenges for low-income users is the low consumer base demographics of the rural environments, along with the potentially more challenging geographical landscape, which has contributed to the costly exercise of connectivity in those rural areas. Reaching these rural areas using fixed-line network is investment-intensive; therefore, low short-term return on investment (ROI) levels will make providers be hesitant to consider such business cases.

Wireless technology is a cost-effective solution to be explored in deep rural environments as the technology to be implemented. Wireless networks provide ubiquitous connectivity, and as the popularity of the smartphone demonstrates, it is proving to be an effective way of accessing the data network. Moreover, in deep rural areas, ICT represents a cost-effective enabler to serve the sparsely populated rural areas. The benefits of ICT in the studies noted that some of the challenges are only increasing with the wireless network roll-out, due to the inherent mobility of the service. As a result, an increased availability of radio spectrum for ICT deployment can be expected to have far-reaching effects on the access to ICT services in deep rural environments.

ii. Supply and Demand

One of the highlighted problems which inhibits the uptake and use of ICT services is the lack of access to advanced end user devices. Thus, the demand-side will need to be stimulated by ensuring affordability and access to devices. The implementation of the backbone infrastructure will be rendered effectively only with affordable end user devices such as mobile phones which connect to the ICT networks, thereby enabling Internet access. High taxes on the ICT equipment contribute to the high cost of these infrastructures, resulting in unaffordability for the majority of the poor rural communities. Relevant authorities should set up incentives to allow the availability of cheap end user devices. The Government will, therefore, have to come up with intervention measures for seamless access to end user devices.

Bundled demand is one of the tools that the Government can effectively use to ensure adoption of the ICT services. The best way to introduce private investment in ICT infrastructure is to use “bundle demand”. The State will not need to intervene in an artificial way in the market and can serve as an anchor tenant for guaranteed revenues during the introductory phase of ICT implementation. Local authorities must proactively coordinate “bundled demand” for ICT services for public institutions,

public safety, local learning centres, and healthcare centres by establishing an "anchor tenant". Once the bundled demand "consortium" is properly modelled, the state must negotiate a wholesale cost-effective rate accompanied by a long-term contract with ICT service providers for flow of revenues which will ease the initial economic pressure with reduced investment risk.

On the supply side, Infrastructure roll-out constitutes a major portion of the capital expenditure, and this is also one of the inhibitors of the accessibility of the ICT services. To reduce the costs for the backbone networks, infrastructure sharing such as the backbone backhauls and high sites must be encouraged and established. Infrastructure sharing will alleviate the cost element on the competing network providers. If multiple ICT infrastructure providers fail to be sustainable, sharing or consolidation of services will ensure a seamless ICT access. It allowed service providers to realise the economies of scale and minimise investor risks, which is equivalent to reducing of costs. Thus, the infrastructure sharing policy will have to be reviewed and properly regulated to ensure effective implementation.

As a last resort, if the private funding is not injected after appropriate incentives are granted, governments will serve as a risk-taker without opting for public ownership. One of the possibilities is to subsidise the incumbent ICT carrier and upgrade ICT access to "utility" status. In Greenfield situations, the Government will contract for the deployment of a universal access network. This might introduce strong competition for the State's contracts and reduce the initial costs of operations.

To further stimulate the supply side, the government will have to offer incentives on the procurement of ICT goods and services. Incentives can spur competition in ICT services in most of the technologies, particularly in markets with no ICT providers or just a few providers. The competition promotes a variety of services and enough facilities, affordable costs to the users, and improved quality of service. Local governments should be granted a permit to offer ICT services if there are no operators who are in a position to provide these at speeds below the broadband policy of the country benchmark at an affordable rate.

e) Guiding Policy 5: Technology Infrastructure (GP5)

To enhance rural development, there are various factors which will need to be addressed and these include network coverage and availability, and Television White space technology. The mapping of the relevant diagnostics with the equivalent guiding policies is outlined in Figure 8.8.

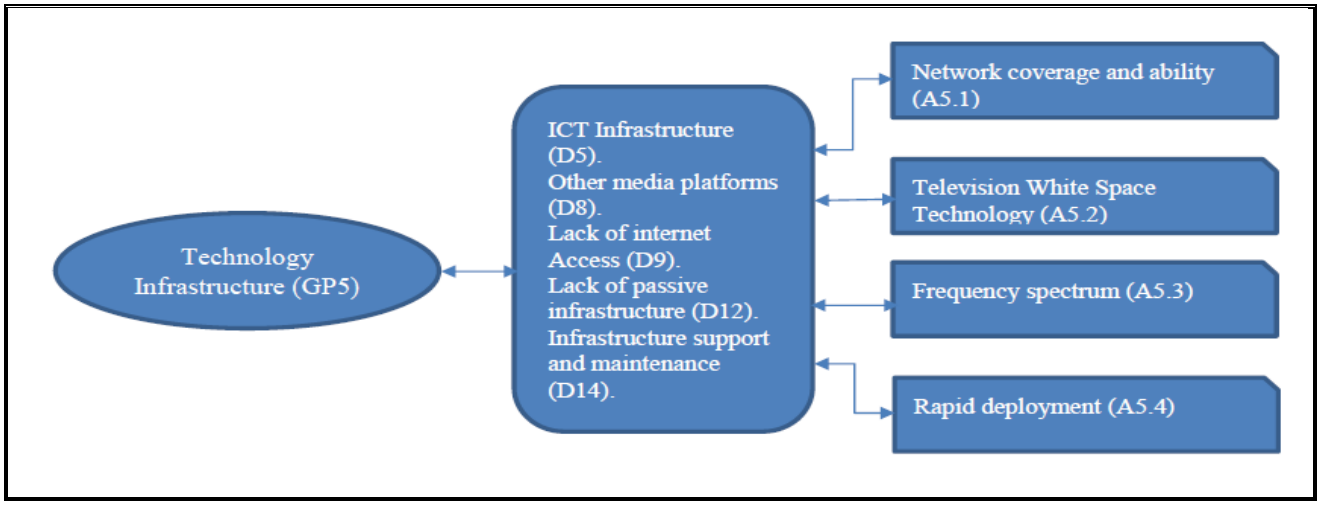

Figure 8.8: Guiding Policy – Technology Infrastructure (Source: Researchers Design)

The set of the relevant, coherent actions is then discussed as highlighted in the sections which follow below.

i. Network Coverage and Availability

There is a need for a market review, and some of the fundamental policies which will assist in providing affordable and reachable services are open access, infrastructure sharing, technology and service neutrality, and the reallocation of the digital dividend spectrum. The policymakers will have to promote the open access policy which will make sure that the sharing of infrastructure is encouraged and enforced, and the operators can compete on services offered. Open access allows a seamless connection in a network-neutral framework for innovative, cost-effective delivery of services to users. Open access will facilitate the use of transmission networks of other service providers, which will greatly benefit small businesses who want to start a local product offering. It will make sure that there are some service providers the end user can choose from.

To reduce the backbone costs, infrastructure sharing must be enforced and encouraged. Infrastructure sharing reduces the pressures of additional expenditure on infrastructure for competing providers. If the number of ICT operators is not sustainable, sharing of resources will produce ICT access "utility". It assists operators to capitalise on the economies of scale and minimise the investor risk, which is similar to lowering costs. This will ensure a consolidated approach to the provision and sharing of infrastructures by operators, and this will ensure profitable investment and the lower cost of implementing new infrastructures.

Infrastructure sharing can be entered into on agreed business terms. However, accepting this alternative arrangement will need to be followed with a strict evaluation of the implications on overall network roll-out. While accepting the need for sharing infrastructure, the regulator has to make sure that such arrangements do not impact on market competition and that it in no way reduces the growth of ICT within the community.

The digital dividend spectrum, which will be made available after the implementation of the Digital Terrestrial Television (DTT) has proven to be suitable for the difficult terrain of the rural areas. The DD is a term used for the portion of the radio spectrum, which will be released after the switch-over from analogue to DTT in the frequency bands from 174 to 230 MHz (Very High Frequency- VHF) and from 470 to 862 MHz (Ultra High Frequency - UHF). This is practical because DTT technology uses spectrum a lot more efficiently than the analogue TV. The DD spectrum is precious as it consolidates excellent physical characteristics, such as propagation over large distances and penetration into the buildings, with enough capacity to deliver a variety of wireless services.

In the market driven approach, there is an argument that the market approach, similar to an auction for main allocation and secondary trading, can be used to determine the optimal allocation of the 470-862 MHz band for effective purposes. As a standard rule, this is likely to be reflected in the users' evaluation of the spectrum where growth and creative prospects for new competitive entry are strongest. Thus, auctions should direct spectrum to the highest value uses and users. Given the large size of this band and breadth potential uses, any policy intervention alongside the market approaches are necessary to promote growth, creativity and competition in downstream services. The UHF band of the spectrum (470-862 MHz) is more suited to rural consumers. Signal propagation is excellent, which means that transmissions can be received many kilometres from the wireless network tower, and signals are of reasonably great quality in penetrating buildings, allowing reception inside the homes as well.

ii. Television White Space Technology (TVWS)

Several literature studies have indicated that the most viable last mile for the roll-out of ICT services within the low-income communities is the wireless solution. One of the biggest challenges in rolling out affordable ICT solutions within these communities is the lack of a cost-effective wireless solution due to the sparsely populated target communities. One of the proven benefits of the TVWS spectrum band is that can cover larger distances due to the favourable propagation characteristics of the lower frequency blocks.

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The World Bank Group (2016) has indicated that the primary benefits of low-frequency spectrum over higher frequencies for cellular networks is that for the same levels of power transmitted at base stations and handsets, a greater range in terms of coverage can be achieved. One of the technologies that can be used by the low-income users is the TVWS Wi-Fi which can give benefits in many rural environments, where it is difficult to implement Internet connectivity using existing technological solutions due to the topography and geographical challenges. TVWS Wi-Fi can be one of the technologies to overcome these geographical limits as it can cover a longer and wider range with approximately the same network power outputs. It will provide adequate bandwidth and more consumer benefits at affordable access costs and reduced power consumption. Also, consumers will be able to have access to more bandwidth with their ever increasing bandwidth requirements, and Internet providers will be able to provide more throughput speed in more places and with more consumers.

The adoption of TVWS will make sure that much-needed ICT services reach the low-income users and this, in turn, will make sure that people within the underserviced communities will receive the much-needed services. This will make sure that the communities become economically active.

iii. Frequency Spectrum

The National Government must implement initiatives to encourage more efficient use of the frequency spectrum and this will free up spectrum for reassignment. Network operators today have limited incentives to use frequency spectrum more efficiently. This means that some operators might be relying on less efficient, outdated systems which may be using more frequency spectrum than they otherwise require, thus preventing that frequency spectrum from being allocated to commercial wireless operations. Operators, for instance, must be motivated to use frequency spectrum more efficiently and provide access to funding unrelated to spectrum auctions to cover costs and to evaluate frequency spectrum relocation, efficiency, and sharing.

The government must perform an overseeing function by creating and establishing best practices for entities to adopt. These best practices can require entities to, among other things: (1) evaluate the profitable use of commercial facilities for access to passive infrastructures, (2) explore further sharing among Service Providers, (3) investigate upgrading to the latest efficient technologies, and (4) consider frequency spectrum as an economic commodity during the budgeting process. If entities take these steps, they will free up valuable frequency spectrum that can be repositioned for ICT use in deep rural environments, an essential prerequisite toward expanding ICT deployment.

The government will need to expedite the allocation of the digital dividend spectrum which is currently being used by analogue television. This is the spectrum which has better propagation characteristics and will be more suitable for the roll-out of cost-effective ICT wireless infrastructure in deep rural environments. The last mile on the broadband value chain had proven to be a challenge and a bottleneck due to lack of affordable technology for the rural community. The wireless solution will be suitable for the AmaJingqi community due to challenging terrain and a sparsely populated community.

iv. Rapid Deployment

The government noted the complications of attracting ICT carriers in most areas due to a lack of both market competition and resources to meet the given incentives. Effective use of "right of way" can lower these challenges, but some service providers, including the State owned entities are currently unable to take advantage of this approach. The government will have to mandate all service providers to install their underground conduits in the same trench, at the same time on a shared-cost basis.

In most instances, the biggest cost parameter of the initiative, which involves rolling out the underground fibre optic cable, is the excavation and repair of the main roads. "Dig Once" broadly refers to "requirements designed to reduce the number and scale of repeated excavations for the installation and maintenance of ICT facilities in rights of way." Coordinating the freeway and major road projects with the laying of ICT networks could bring down costs, especially in an area where the whole rights of way is paved and the only option for installing cable is underneath the ground. Coordination can also help to reduce roll-out time by eliminating the need for duplicate permits for work done at the same location.

For the cross coordination to be well executed, there is a need for concerted efforts to share information on relevant policies and processes among all the parties involved. The joint trench agreement is one of the approaches that the government can enforce and encourage for local planning or transportation agencies to work with ICT services and share passive infrastructure, which avoids duplication and waste in financial resources. This approach will make sure that all service providers will install their infrastructure in the same trenches and conduits and share the costs for doing so accordingly. One good example is that the Eskom power infrastructure footprints are all over the country including the deep rural areas, and use of Eskom poles will assist in the quick ICT service offering turnaround.

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f) Guiding Policy 6: Funding Strategies (GP6)

To enhance rural development, there are various factors which will need to be addressed and these include a customised business model, universal service and access funds and public-private partnership. The mapping of the relevant diagnostics with the equivalent guiding policies is outlined in Figure 8.9.

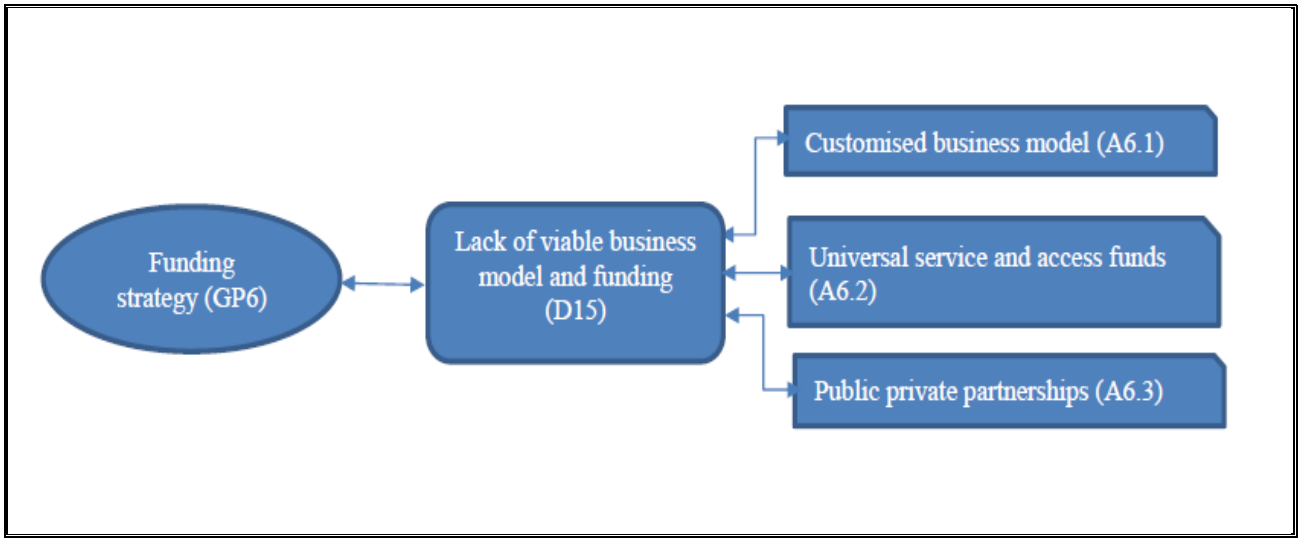

Figure 8.9: Guiding Policy –Funding strategy (Source: Researcher's Design)

The set of the relevant, coherent actions is discussed as highlighted in the following sections:

i. Customised business model

One of the biggest impediments in rolling out infrastructure in the most rural environments is the lack of viable business models and incentives. Business will have to be certain of their rate of returns before investing business resources in the implementation of affordable ICT infrastructure. To attract private investment in the less business viable rural areas, the government will have to devise a clear cost recovery mechanism which can provide the ongoing support for sustainable and affordable ICT infrastructure. One of the sustainable aspects which will have to be considered is that ICT systems will need regular upgrades and long-term maintenance and support, and this can be achieved by means of one-time grants from rural communities. Thus, the ICT systems which are built will have to be economically viable and be able to generate enough revenue.

In the absence of the ongoing financial support, it will be very difficult to implement temporary financing methods such as the one currently adopted by USAASA where the subsidies are limited to two years and the solution is expected to be self-sustaining for ICT afterwards throughout the entire rural communities. The public-private ecosystem is one of the viable business models which can ensure

clear returns on the investment for all the stakeholders. The private sector will require a long-term commercial viability of the investment while the government will be more interested in the social returns in the form of employment generation and skill building in the rural communities.

It's important to note that technology restrictions, especially over spectrum rights, will reduce the viability of the business model of prospective operators. The business model should also encourage demand aggregation to further lower the cost to communicate and ensure affordable services. The institution must move away from using dedicated and single-purpose networks that are not available for broader community use resulting in only the individuals working for those institutions having access to the Internet. Bulk purchasing is another mechanism that needs to be considered, particularly where optic fibres demonstrated large economies of scale, and this can drive down the per-megabyte cost of such access considerably. Thus, the demand-aggregation in sparsely populated areas can be one of the viable approaches for sustainable business models with returns for businesses, and this will also encourage take-up and effective use of ICT services.

ii. Universal Service and Access Funds (USAF)

One of the funding mechanism inventions is the USAF which will need to be accompanied by a clear definition of the overall USAF strategy and objectives for the funds to be put to the use for which they are intended. The funds have had several challenges such as the lack of competent management personnel, and the lack of appropriate skills and background required for the effective use of the funds and their administration.

Another challenging aspect is that there are other infrastructures needed to support the ICT systems to render the USAF effective. These resources include adequate power sources, access to clean water, security, and the ongoing support and maintenance of the infrastructure. Lack of passive infrastructure will render tele and community centres to a limited use if they can’t be adequately maintained and supported. It is, therefore, critical to check on the state of readiness of the implementation of ICT services and conduct baseline and pre-audits before some of these projects are implemented (Telecommunication Development Sector, 2013).

One of the objectives of USAF should be to address the lack of digital inclusion and promote the accessibility to ICT services for youth and women, indigenous people and children. This can include accessibility to ICT services for people with disability, network roll-out to under-serviced areas

populated mainly by the women and indigenous people, subsidies for handsets and minutes, the construction of training manuals and other relevant content, and raising of awareness activities on the prominence of digital inclusion for the covered rural communities. USAF Managers should consult with the local communities to determine the needs for the implementation of the relevant projects. The "nothing about us without us" rally of persons with special needs had to apply for people with special needs and disabilities (Telecommunication Development Sector, 2013).

USAASA is the custodian of the USAF in South Africa and it is pivotal that a clear audit of areas is conducted where there is a clear gap in terms of access to ICT infrastructure. This will make sure that the money contributed into USAF is channelled and used in the most needed areas in the deep rural areas. A clear strategy for the distribution of this fund will be very important to bridge the digital divides.

iii. Public-Private Partnerships (PPPs)

The National Planning Commission (2012) highlighted the role of the State and Institutional Capability to encourage trust between the public and private sectors. The government should encourage collaboration between the public and the private sector, which should be treated as partners in policy design and implementation, and the private will then have to respond to the realisation of the national agenda.

Careful investigation of which investment method is likely to yield more value for money will be very critical. The optimum investment of resources to roll-out in the deep rural areas is very important, and a pre-test to evaluate a relevant procurement option is required. The proper pre-test procurement option will assist the government to verify whether it is prudent to invest resources within a certain rural area. The government should always make sure that the risk is transferred to those that can best manage it and this is the private sector. The management of the possible risk should be defined, identified, measured and carried by the party where it costs the least to prevent or costs less. Those who are responsible for the procurement should be ready for the operational phase of the PPPs. To guarantee value for money, there will be a level intensity required as that is necessary during the pre-operational phase. Stakeholders should be careful when switching to the operational phase of the PPPs as there is a tendency for the actors on the public side to change.

The PPP funding model will make sure that the private sector brings the necessary expertise and skills on board to complement the government's investment with comparable resources of their own. The private sector has had a considerable investment in research work, new technologies, development of

skills and the new business models necessary to scale innovative solutions. The expertise of the PPPs can be leveraged to implement the rural ICT projects within the appropriate scope and the accelerated timelines. This will guarantee the maximum use of the public funds and the involvement of the private sector to absorb the risk, and PPP should not only be seen as a financial model. These arrangements will enable the public sector to transfer risk and speed up the process of rolling out the necessary rural ICT infrastructure which the service providers require to be in place before providing ICT services for the rural communities. The advantage of PPP is that it provides a tailored made funding solution to meet the specific requirements that exist in a particular rural community.

The political will is pivotal for ICT projects to be implemented and prioritised. This is due to the number of competing investment priorities which then became the responsibility of the government to define and pursue strategic goals. The investment in major projects should support the whole government agenda and should be separated from how to purchase and finance those projects. There should be no predetermined notion or accounting bias to either to be in favour of or against the PPP financing model. The government will have to maintain absolute value for money when negotiating PPP arrangements. The private sector should be compensated only in cases where there will be discretionary public policy, such the spectrum reassignment policy, which might cause the government to consider some compensation for the private sector. All the negotiations should be done openly and be subjected to the ordinary processes of acquiring PPP approval. Clear, predictable and transparent rules for dispute resolution should be in place.

8.5 Strategy Implementation

It is widely acknowledged that many written materials alluded to the fact that strategic plans failed because of implementation challenges. The major challenges and hurdles commonly experienced during implementation are not necessarily an indication of the efficacy of the plans. One of the interventions for successful implementation will be a detailed Implementation Plan which will include major programs and timelines along with considerations for governance, funding, change management and stakeholder engagement.

The agreed-upon actions and processes are converted into action steps to achieve strategic goals and objectives. This involves channelling resources, creating required structures, and defining processes and action plans to be followed in attaining the set objectives. It is important to note that strategy formulation and implementation are closely linked but fundamentally different. This is because strategy

formulation takes place before action to solve a problem while implementation takes place during the problem-solving action, and requires meticulous coordination.

Strategy implementation involves short-term plans for carrying out the projects agreed on in the strategy formulation. It involves obtaining resources, creating structures, and defining action plans and processes to be followed to achieve the set objectives. It requires precise coordination, as it takes place as a problem-solving action. The implementation of a strategy also identifies the role-players for each sub-objective, and it explains the steps they must take, and what resources must be in place to action a specific sub-objective.

One of the major entities to play a meaningful role in the implementation of the ICT interventions is the Department of Cooperative Government and Traditional Affairs. It suggests that to integrate ICT into a cross-sectoral rural development strategy, it is increasingly important to have a clear understanding of the local context and economical needs into which information is expected to be made available and implemented.

It has to be added that the ICT networks will not deliver value if the State is not actively involved as a partner with private players. A strong business model with financial returns for each stakeholder will require a strong public-private ecosystem. The State will require sustainable job creation and skills development as a form of social returns from its investment in ICT infrastructure.

Coordination of efforts and resources will-be essential for the success of any initiative or program that evolves out of the strategy. With several agencies involved locally, and elsewhere across the provincial government, there is a significant risk that, in the absence of meticulous planning, a particular action by the stakeholders might be redundant in an existing program, inefficient, unduly costly, and otherwise in tension with other local government programs. Figure 8.10 outlines the strategy implementation steps.

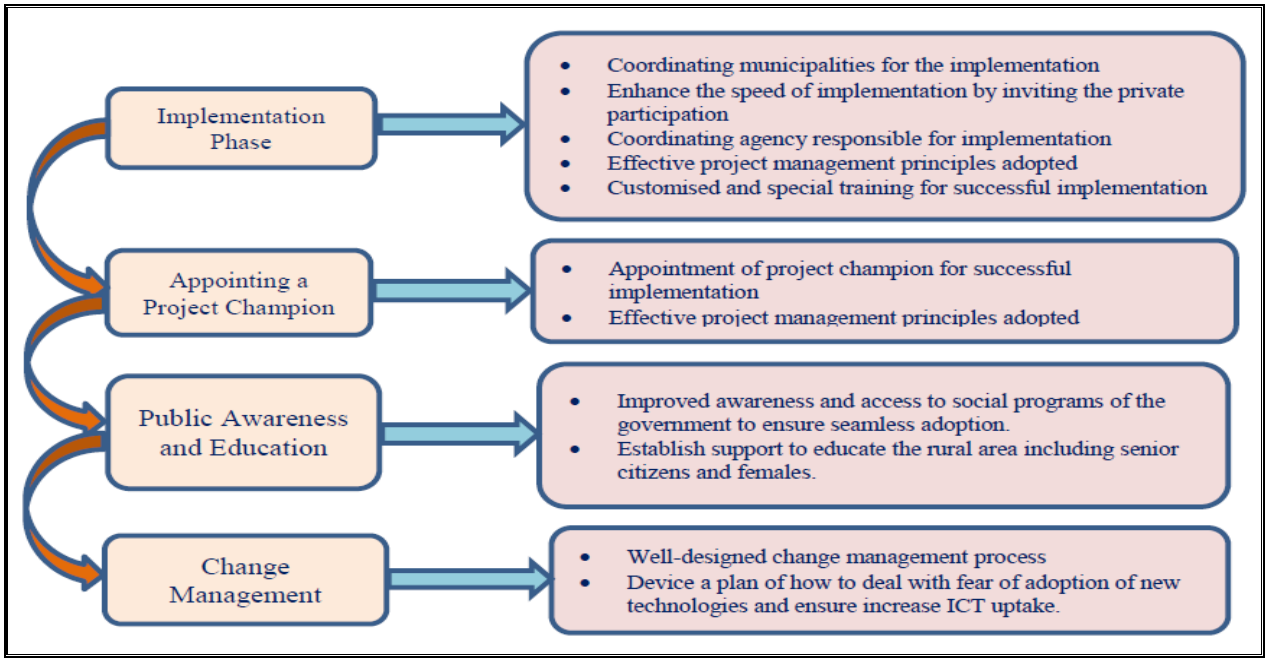

Figure 8.10: Strategy Implementation Steps (Source: Researcher's Design)

The adoption and outlining of the coherent set of actions involved the inputs and position to be adopted by the government, the regulator and the operators. This roll-out of the coherent set of actions is considered to consist of three layers: government, regulator, and service provider management as illustrated in Table 8.2.

8.5.1 Government

The government sets, addresses and monitors the requirements for the implementation of the ICT strategy. The requirements can include the actions that the government needs to perform before the ICT infrastructure can be successfully implemented in deep rural environments. The stakeholder involvement will be pivotal in this layer which requires the government to facilitate as the strategy will be guided by the concept of stakeholder engagement. During policy formulation and implementation, there should be a high level of participation amongst those who designed and implemented the policies and those affected by them. Stakeholder engagement can be in the form of either partnership or participation as these two are involved a two-way interactive exercise, shared accountability and responsibility. Stakeholder engagement ensures that the concerns of the rural communities and of other beneficiaries are addressed.

Key features of the governance structure for implementation of the Strategy include:

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- Overall responsibility for the National Integrated ICT strategy resides with the Department of Telecommunications and Postal Services;
- Creation of the national ICT Council to constitute a steering and advising body appointed by the senior executive politicians
- Creation of a National ICT Secretariat within the Department of Telecommunications and Postal Services, with the responsibility for the implementation and execution of the ICT strategy; and
- Strengthening the Department of Telecommunications and Postal Services to manage intra-governmental ICT initiatives.

8.5.2 Regulator

This layer is concerned with the implementation and enforcement of government policies and legislation through the Independent Communications Authority of South Africa (ICASA, 2014). ICASA implements government policies within the sector through the enforcement of regulatory frameworks.

The Regulator role is the creation of environments with a sound regulatory and institutional framework which will facilitate seamless ICT roll-outs whilst preserving the public interests. It is equally important for the state to harness the potential of ICT by establishing and rationalising existing state-owned companies. Any administrative bottlenecks hampering the network build will have to be removed and coordinated to avoid unnecessary duplication, particularly of civil works.

The key identified regulatory barriers are:

- a lack of cohesive leadership and policies for the development and the implementation of the ICT agenda;
- a lack of awareness of how best to use ICT strategies to promote government programs and assist provinces to promote their programs similarly;
- silos in which the various agencies operate within the sector; and
- lack of funding for ICT initiatives.

To provide ICT services in the deep rural areas, the State must promote open access and network-neutrality in its regulatory framework. Open access and network-neutrality will stimulate the establishment of small businesses and innovation, and will benefit the community through delivery of

low-cost services. Open access and network-neutrality will facilitate the use of ICT systems of other operators. This will greatly benefit smaller businesses who want to start local services and will make sure that there are some network operators which the end users can choose from.

8.5.3 Service Providers

The strategy recognises the role and engagement of all the role players and stakeholders such as the responsible departments, including the representative from the private sector. There will be an ongoing review and consultation at the prescribed and agreed time frequency. Monitoring and evaluation of the strategy success are encouraged and success indicators will be established, shared and suggested changes incorporated and finalised in an open and consultative forum which involves the relevant stakeholders.

The policy framework which called for bridging the digital divide is the major effort to reach out and include everyone in the information and knowledge economy. The funding model to meet the obligation of universal access and services will have to be discussed and negotiated with the service providers and the government, which includes the state-owned companies responsible for the roll-out of ICT. Operators are obligated to contribute to the cost of the implementation of cost-effective ICT services in deep rural environments as part of the license obligation. Table 8.2 outlines the detailed implementation framework

Table 8.2: Detailed implementation framework

Role Players	Guiding Policies	Diagnostics	Set of Coherent actions	Key Agencies
Regulator	GP1	D1	A1.1 and A1.3	Department of Telecommunications and Postal Services (DTPS) National Youth Development Agency (NYDA)
		D2	A1.1 and A1.2	
	GP4	D7	A4.1	Department of Telecommunications and Postal Services (DTPS) National Electronic Media of South Africa (NEMISA)
		D13	A4.2	
Government	GP2	D3	A2.3	Department of Telecommunications and Postal Services (DTPS)

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Role Players	Guiding Policies	Diagnostics	Set of Coherent actions	Key Agencies
		D4	A2.1	Department of Rural Development and Land Reform (DRDLR) Department of Social Development (DSD)
		D11	A2.2	
	GP3	D6	A3.1	Department of Telecommunications and Postal Services (DTPS) Independent Communications Authority of South Africa (ICASA)
		D10	A3.2 and A3.3	
Service Providers	GP5	D5	A5.3	Department of Telecommunications and Postal Services (DTPS) Department of Communications (DOC) Independent Communications Authority of South Africa (ICASA) Council for Scientific and Industrial Research (CSIR) Network Operators and State Owned Entities
		D8	A5.2	
		D9	A5.1	
		D12	A5.4	
		D14	A5.1	
	GP6	D15	A6.1, A6.2 and A6.3	Department of Telecommunications and Postal Services (DTPS) Network Operators and State Owned Entities

8.6 Strategy Control

The following subsection deliberates on how the strategy will be managed. Strategic control will take place regularly at all levels to make sure that the strategy went as planned and that weaknesses are corrected before they negatively affect the strategy implementation.

The strategy will recognise the role and involvement of representatives of all stakeholders such as the responsible departments, including the role players from the private sector. There will be an ongoing review and consultation on the prescribed and agreed time frequency. The monitoring and evaluation of the strategy success are encouraged and indicators of success established, shared, commented on and agreed upon in an open and consultative fashion that involves relevant stakeholders.

The department of telecommunications and postal services should preside over the implementation of ICT services. The national ICT committee must be established, preferably under the tutelage of the leader of the government. Quarterly timelines should be prescribed and enforced for each milestone to ensure timely corrective measures. Monitoring mechanisms should be set up for each stage of the project so that the outcomes are quantitatively measured after completion of each milestone.

8.7 Conclusion

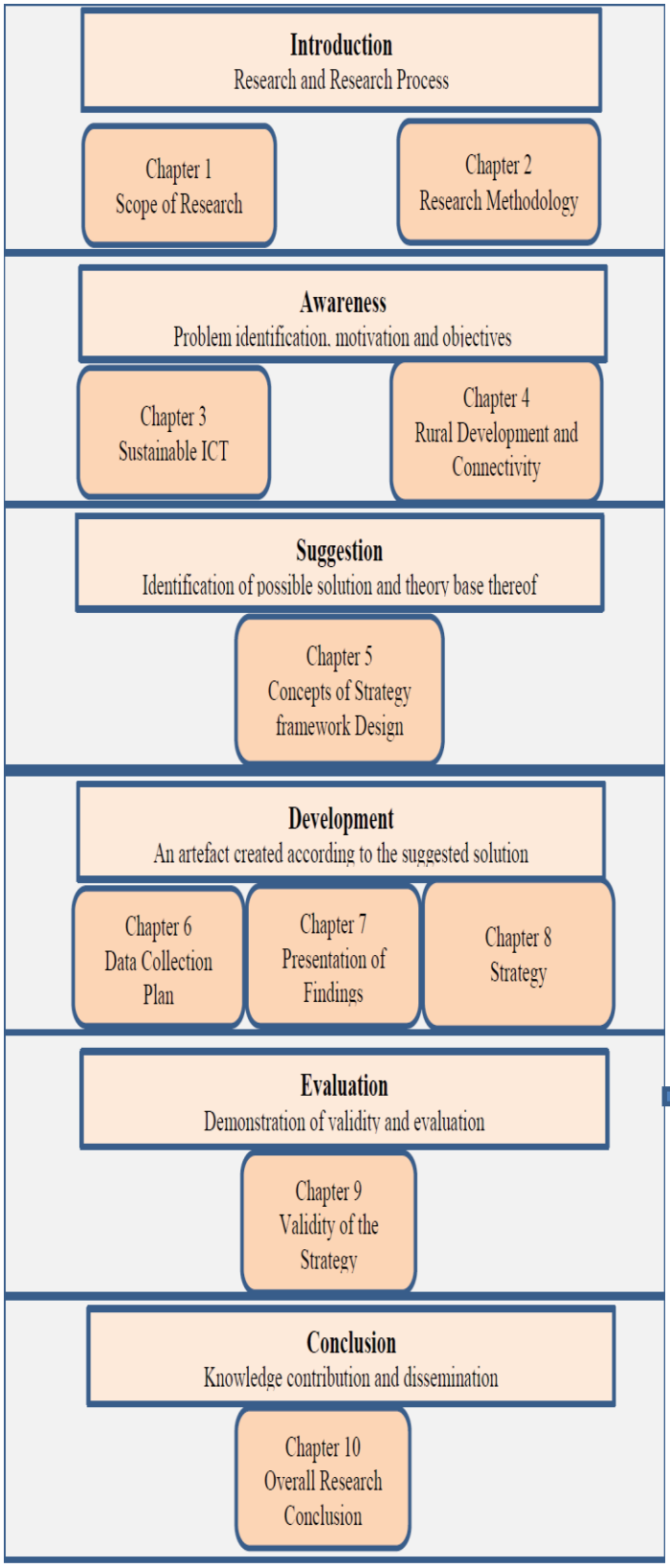
This chapter outlined the number of factors which were followed to formulate the strategy for sustainable ICT and this was crafted based on the strategy formulation framework. There are a number of dimensions in the strategy that have been thoroughly diagnosed and analysed to provide context for what was going to constitute the strategy. The diagnosis highlighted a number of areas of importance which needed analysis and these were fully explored and discussed. These diagnoses investigated a number of areas which needed to be addressed as part of the strategy and these resulted in a number of guiding policies which translated into a number of coherent actions to be undertaken to address areas of the strategy. The various dimensions are presented in a tabular format that provides the attributes of the strategy. These were fully defined as part of the strategy formulation. The implementation of the strategy is very important and three key stakeholders were identified and fully outlined in the implementation of the strategy.

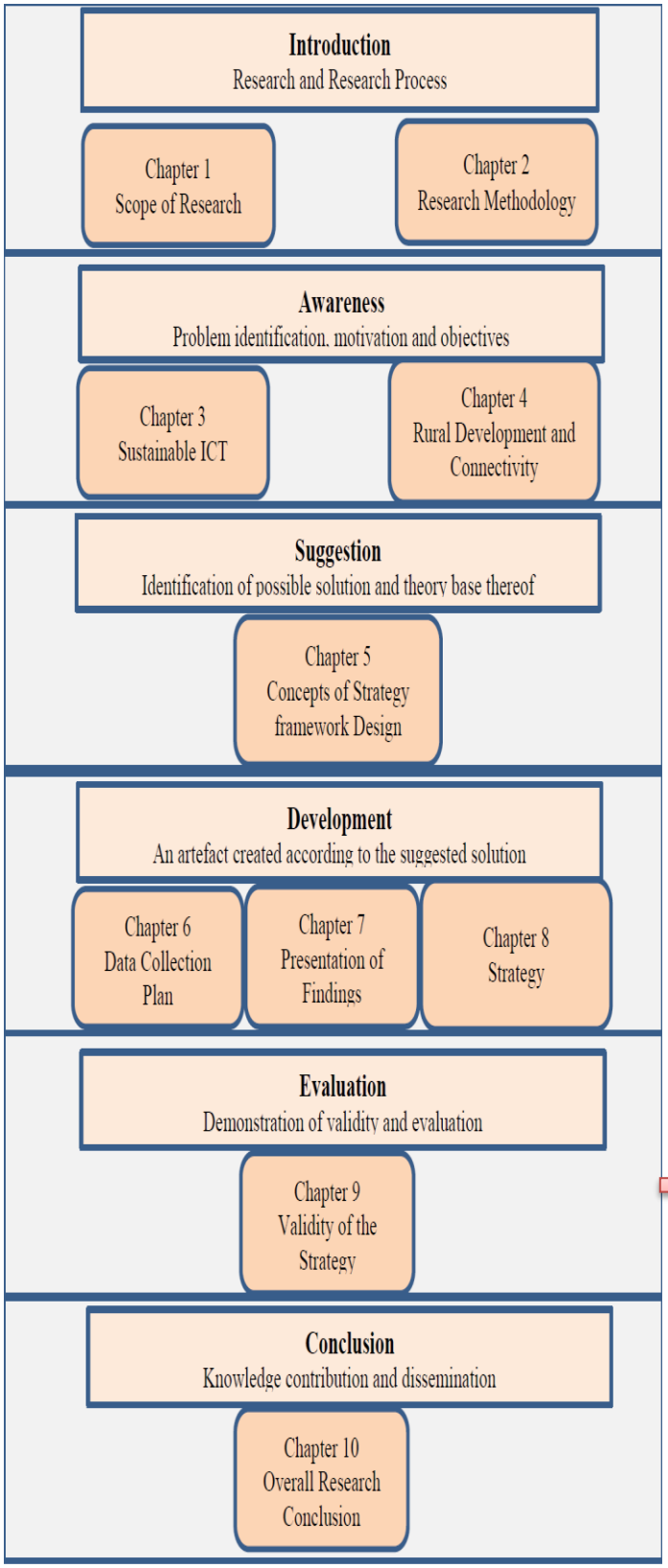
8.8 Summary

The main purpose of this chapter was to gain insight into the strategy formulation process and the design of a strategy for sustainable ICT. Various definitions of the concept of strategy and the strategy formulation processes were discussed and clearly outlined. Consequently, the definition and strategy formulation process were developed in this research. The subsequent strategy formulation was then applied and resulted in the development of a strategy for sustainable ICT development in deep rural environments. Several interventions in the form of guiding policies and a set of coherent actions have been presented. The development of the strategy fulfilled the major research objectives, which are to craft a strategy for sustainable ICT development in deep rural environments. It is therefore maintained that the sound implementation (Step 4 of Figure 5.2) and control (Step 5) of the formulated strategy (Step 3) can definitely address the problems and shortcomings experienced in strategy for sustainable ICT development in deep rural environments of AmaJingqi. The next chapter will conduct the

evaluation of the strategy by engaging the industry experts and all their comments are incorporated in the overall strategy.

CHAPTER 9: VALIDATION OF THE STRATEGY





9.6.5 Technology infrastructure
9.6.5.1 Network coverage and Availability
9.6.5.2 Television white space
9.6.5.3 Frequency spectrum Rapid deployment
9.6.5.4 Dynamic Spectrum Sharing Technologies
9.6.5.5 Training of Locals for basic Maintenance
9.6.5.6 Interoperability
9.6.6 Funding model
9.6.6.1 Customised business model
9.6.6.2 Universal service funds
9.6.6.3 Public-private partnership
9.6.6.4 Incentives
9.7 The concluding remarks

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9.1 Introduction

The previous chapter presents a strategy model. The model is based on the information collected from the literature review, observations and focus groups. The main purpose of this chapter is to evaluate the proposed strategy model. This chapter confirms whether the proposed strategy model presents a reasonable theory to experts in related disciplines. This chapter defines the term evaluation, and then describes the steps followed during the evaluation and this is outlined in Section 9.2. Section 9.3 elaborates on the set-up of the expert reviews and the participants chosen to conduct the evaluation; while Section 9.4 presents the findings. Section 9.5 then outlines the revised strategy. Section 9.6 presents the concluding remarks, and the summary is presented in Section 9.7.

9.2 Evaluating the Strategy

Evaluation is defined as the systematic analysis of the worth or merit of some object (Alkin, 2004; Christie and Alkin, 2008). Rosana and Asfaroh (2017) defined evaluation as the systematic way of obtaining information about an object and then using it to form judgments, which in turn are to be used in making decisions. Both definitions concurred that evaluation is a systematic venture, and both used the phrase "object", which Mark et al. (2000) asserts can refer to a program, policy, technology, person, need, or activity. Good evaluation utilises measurements and observations that are accurate, reliable, and valid, gathers evidence systematically and analyses the results objectively. Evaluation is more clearly pragmatic and, most important, it explicitly seeks to produce judgments of value, worth, or merit (Rossi, Lipsey and Freeman, 2003; Morra and Friedlander, 1999). There are numerous reasons for evaluating information systems. The most common reasons are: to assess the value, to measure the success of a system, to determine its benefits (Pammett and Goodman, 2013). The purpose of this evaluation is to determine whether or not the proposed strategy will be valuable and effective, whether it has been comprehensively developed, whether it fulfils the needs of those who will utilise it, and to get comments and suggestions that will improve the strategy.

9.2.1 Evaluation Phases

Evaluation is implemented in a sequence of phases, and it typically includes: the formulation of the major objectives or goals of the object, the conceptualisation and operationalisation of the major components of the evaluation, the design of the evaluation detailing how these components are to be co-ordinated, the analysis of the qualitative and quantitative information, and the utilisation of the evaluation results (Alkin, 2004). This is clearly outlined in Figure 9.1.

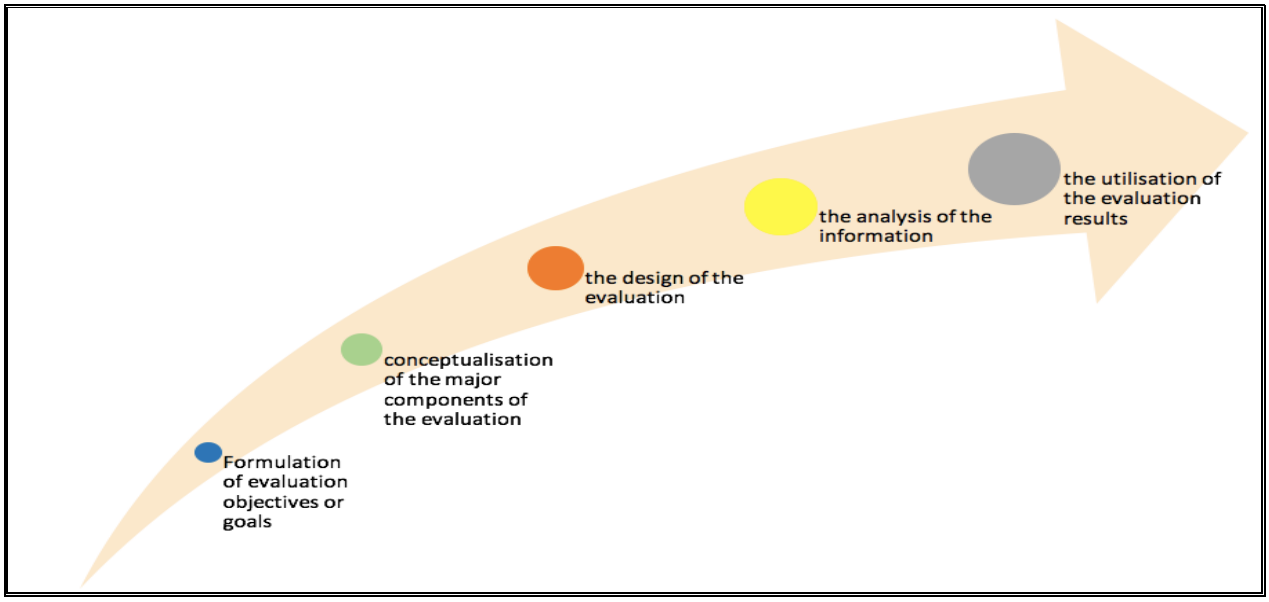

Figure 9.1: Evaluation Phases (Alkin 2004)

9.2.2 Expert Reviews

An expert reviewer is an evaluator that uses his perceptual sensitivity, past experiences, refined insights and his abilities to assess an object and effectively communicate their assessments (Stufflebeam, 2000). The main focus of an expert review is to identify any issues pertaining to design in any product, and to identify specific areas where these issues occur. In an expert review, the reviewer brings in his expertise in a given substantive domain, and also sometimes his personal choices or biases (Tory and Moller, 2005). Vesper, Reves and Herrington (2011) suggests that to get the best out of expert reviews, one must involve multiple (ideally 3-5) evaluators working independently of one another.

9.3 Evaluating the Proposed Strategy

Expert reviews as an evaluation tool with subject domain experts are conducted to evaluate the usefulness and applicability of the proposed strategy. Five participants are selected to evaluate the proposed strategy model. All the participants had five years and more of experience in their domain. The participants consisted of two academics also involved in the ICT research and three non-academic experts from legislation, policymaking and the NGO advocates dealing with universal access and services for the rural poor. The participants evaluated the proposed elements of the strategy and provided feedback on how they perceived the strategy to be useful and applicable to solve the defined problem.

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Table 9.1: Expert review – participants' profile

Field	Position	Experience
ICT Sector Champion	Non-Government Organisation	The Reviewer serves as a volunteer activist with a leading role in the telecommunications focus group of the Right2Know campaign and is employed part-time to coordinate the Zenzeleni project partnership between R2K and UWC's Computer Science Dept. "Is also a Masters student in UCT's Computer Science Dept., researching the use of Wikipedia in disadvantaged schools where the Internet is provided by UCT, as well as being an organiser of a global Wikipedia event planned for Cape Town."
Academic	Competency Area Manager (CSIR)	The Reviewer holds a PhD (Computer Science) in biographic data with the following specialties: academic, conferences, delivery, English, information systems, leadership, lecturer, management, mathematics, meeting facilitation, mentoring, networking, programming, project management, research, supervisory skills, teaching, writing.
Academic	Director: CoLabs for e-inclusion and social innovation.	The Reviewer is responsible for strategy development and operationalisation of the CoLabs initiatives in support of the mandate and priorities of the Ikamva National e-Skills Institute (iNeSI). Full responsibility for all resource management (financials, people, and infrastructure), client relationships and management, facilitating the legal and contractual engagement between national government and the university project implementations.
Government Legislator	Member of Parliament	The Reviewer is a Member of Parliament and has served in various portfolio communities, including Telecoms and Postal Services. Joined the Rand Daily Mail in 1971. Her journalism career continued at The Star in 1974 where she focused on human rights and social welfare issues. She is on the team that reported from Alexandra, north of Johannesburg, during the June 1976 student uprising. During her journalism career, she also worked for the Sunday Tribune, Sunday Times and Sunday Express, before venturing into Information Technology (IT) trade journalism. In 1984, She won the first IT Journalism of the Year award for editing South Africa's first magazine aimed at business users of IT and the following year, she started a public relations consultancy specialising in IT.
Government Policy Maker	Deputy Minister	The Reviewer has been the Deputy Minister of Telecommunications and Postal Services of the Republic of South Africa from 26 May 2014. She has served as a member of Parliament since 2009. She is a founder member and a trustee of the Children and Violence Trust since 1995 and she has been a trustee of the Malibongwe Business Trust from 2005. She is a Chairperson of the Peace Commission of the South African Women in Dialogue since 2004; she also Treasurer General of the African National Congress (ANC) Women's League (WL) and became the member of the National Executive Committee of the WL in 2008.

9.3.1 The Evaluation Tool

Once the evaluation tool was developed and ready, it was reviewed by the research supervisor prior to conducting the reviews. This tool had been designed for the experts to validate the proposed strategy for sustainable ICT development in deep rural environments. The main purpose of this evaluation tool is to assess the proposed strategic framework. Additionally, it aims to gather factors that might influence the successful strategy for the rural community in the deep rural Eastern Cape.

There are five parts to this tool (Parts A - E). You are currently in PART A which includes the main aim of this tool, instructions on how to use it and a brief description of the elements of the proposed strategy. Part B asks for biographical information and PART C presents the factors identified as influencing the successful implementation of strategies for sustainable ICT development in deep rural environments with a view to obtaining your comments about them. PART D briefly describes and defines the components of the formulation of strategies for sustainable ICT, and PART E seeks to validate the proposed strategy as a whole.

9.4 The Findings

Part B: The Background Information

This section of the evaluation collects the background and biographical information of the reviewers. The total number of females (60%) with the total number of males (40%) as highlighted in Figure 9.2.

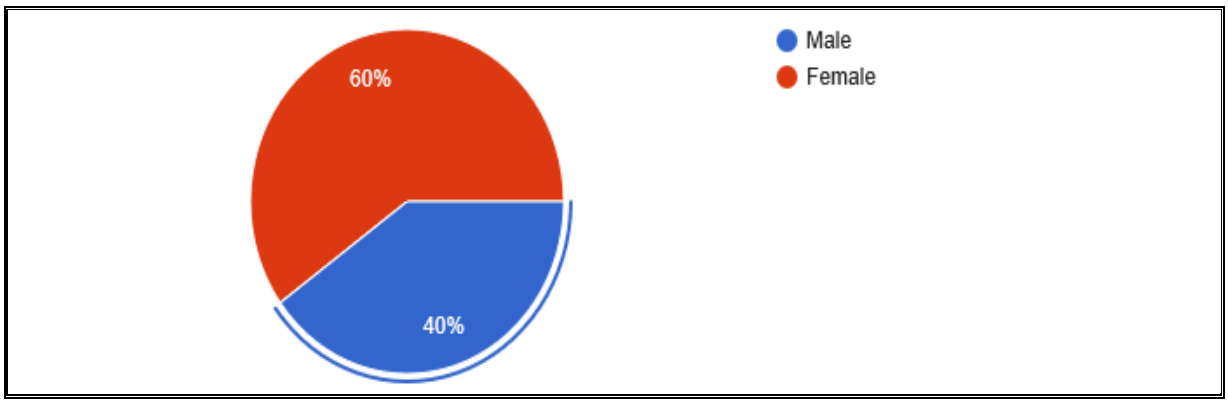

Figure 9..2: Gender of Respondents

Figure 9.3 shows that 80% of the participants are over the age of 50, while the rest (20%) are in the age range of between 41 and 50.

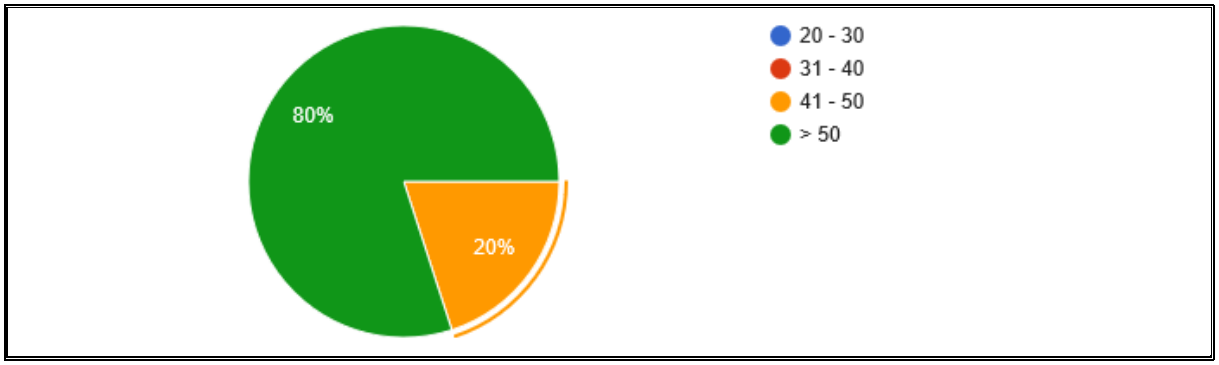

Figure 9.3: The Age group of Respondents

Figure 9.4 highlights the years of service. Two experts had between 5 to 10 years of experience, one expert had between 11 and 20 years of experience, while the other one had between 21 and 30 years of service and the last expert had over 30 years of experience.

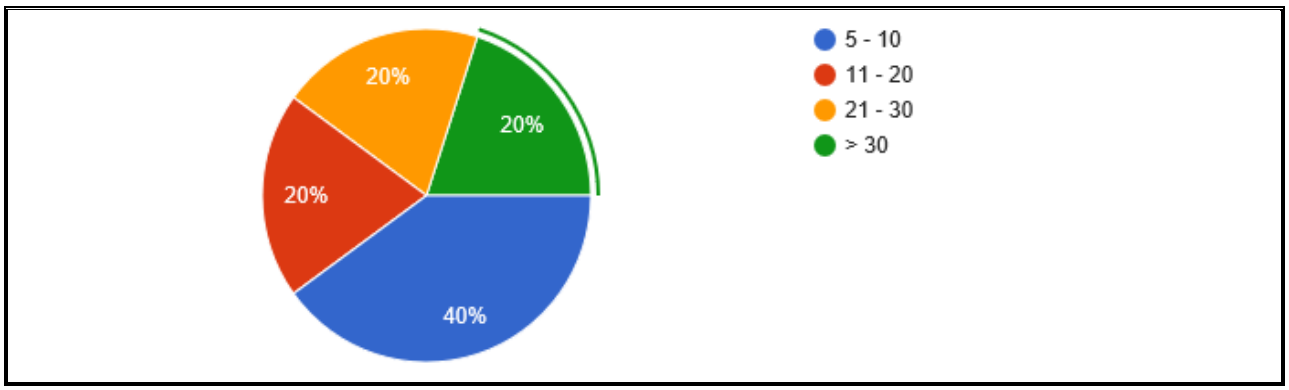

Figure 9.4: The Respondents years of service

Part C: Framework Evaluation

This section of the evaluation tool assesses the proposed factors for the strategy. The research variables are measured against a 4-point scale, from "very important", "important", and "not important" to "least important". The results reveal that most reviewers agreed that the factors proposed in the strategy for sustainable ICT are either very important or important. The factors that are evaluated by the experts are listed in Table 9.2, together with a percentage measure for each factor.

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Table 9.2: Strategy evaluation of importance

Strategy factors	VI	I	LI	NI
Digital Inclusion				
Gender Digital Divide	40%	40%	20%	0%
Youth Development	60%	40%	0%	0%
Seamless Access to Information	60%	40%	0%	0%
Rural Development				
Social Development	40%	60%	0%	0%
Economic Development	60%	40%	0%	0%
Employment Creation	80%	20%	0%	0%
Government Leadership				
Effective Market Competition	40%	40%	20%	0%
Cross-Sectoral Coordination	40%	60%	0%	0%
Policy and Regulation	40%	60%	0%	0%
Adoption of ICT				
Affordability and Accessibility	80%	20%	0%	0%
Digital Literacy	40%	60%	0%	0%
Supply and Demand	20%	80%	0%	0%
Technology Infrastructure				
Coverage and Availability	80%	20%	0%	0%
Television White Space	20%	80%	0%	0%
Frequency Spectrum	40%	60%	0%	0%
Rapid Deployment	20%	60%	20%	0%
Funding Model				
Customised Business Model	0%	80%	20%	0%
Universal Service and Access fund	60%	40%	0%	0%
Public-Private Partnership	40%	40%	0%	20%

The factors for strategy are also assessed in terms of their relevance, and they are measured against a 4-point scale, from “very relevant”, “relevant”, “not relevant” to “least relevant”. The factors are listed in Table 9.3, with a percentage measure of each factor.

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Table 9.3: Strategy evaluation of the relevance

Strategy factors	VR	R	LR	NR
Digital Inclusion				
Gender Digital Divide	20%	60%	20%	0%
Youth Development	60%	40%	0%	0%
Seamless Access to Information	60%	40%	0%	0%
Rural Development				
Social Development	20%	80%	0%	0%
Economic Development	60%	40%	0%	0%
Employment Creation	60%	40%	0%	0%
Government Leadership				
Effective Market Competition	40%	40%	20%	0%
Cross-Sectoral Coordination	60%	40%	0%	0%
Policy and Regulation	20%	80%	0%	0%
Adoption of ICT				
Affordability and Accessibility	60%	40%	0%	0%
Digital Literacy	20%	80%	0%	0%
Supply and Demand	0%	80%	20%	0%
Technology Infrastructure				
Coverage and Availability	80%	20%	0%	0%
Television White Space	20%	60%	0%	20%
Frequency Spectrum	60%	40%	0%	0%
Rapid Deployment	20%	80%	0%	0%
Funding Model				
Customised Business Model	0%	100%	0%	0%
Universal Service and Access fund	40%	60%	0%	0%
Public-Private Partnership	40%	40%	0%	20%

The results in Table 9.3 revealed that most of the reviewers agreed that the factors proposed for strategy for sustainable ICT are either very relevant or relevant. The experts are requested to indicate, which factors from the proposed factors, they will recommend to be removed (not important at all). The data is presented below.

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Digital Inclusion: from the proposed factors, which factors will you recommend be removed (not important at all), and which factors will you add? Table 9.4 highlights the factors to be removed or added.

Table 9.4: Factors to be removed or added digital inclusion

Factor/s to be removed		Factor/s to be added
Gender Digital Divide	20%	External Power Generation
Youth Development	0%	Behavioural Economics
Seamless Access to Information	0%	Local Indigenous knowledge
None	80%	

Reasons for the amendment:

One of the experts suggested that the Gender Digital Divide be removed as in the age of mobile telephony and mobile broadband, gender digital divide no longer exists as in many rural and urban communities both girls and boys have the same exposure to mobile phones. It is, therefore, not relevant to consider this as a metric for assessing digital inclusion. However, 80% of the Experts agreed that Gender Digital Divide is important and hence this will be considered to be important and will remain part of the study. The expert suggested that other power generation sources outside of the power grid must be added. They said that none of the strategy elements can be applied unless strategies are in place for rural communities to have reliable access to electricity or the means to generate their own, such as solar/biogas/generators. Aspects like behavioural economics and the impact of group dynamics on behaviour and belief patterns of individuals within communities are also suggested to be added. Finally the local indigenous knowledge is also suggested as an additional strategy element.

Rural Development: from the proposed factors, which factors will you recommend be removed (not important at all), and which factors will you add? The factors to be added or removed are highlighted in Table 9.5.

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Table 9.5: Factors to be removed or added rural development

Factor/s to be removed		Factor/s to be added
Social Development	0%	Education Exposure
Economic Development	0%	Partnerships
Employment Creation	0%	
None	100%	

Reasons for the amendment:

The expert recommended that none of the factors should be removed. It is further recommended that education and support must be added together with the need to be qualified teachers to impart literacy, life skills and digital literacy to ensure all ages/gender groups can swiftly become competent at using schools, and to encourage developmental innovation. One of the experts also suggested that partnerships will be very important to ensure a successful strategy for sustainable ICT.

Government Leadership: from the proposed factors, which factors will you recommend to be removed (not important at all), and which factors will you add? The factors to be added or removed are highlighted in the Table 9.6.

Table 9.6: Factors to be removed or added government leadership

Factor/s to be removed		Factor/s to added
Effective Market Competition	0%	Collaboration with Rural Communities
Cross-Sectoral Coordination	0%	Project Timeframes
Policy and Regulation	0%	
None	100%	

Reasons for the amendment:

The experts suggested that none of the factors should be removed. They also suggested that the Government must be willing to collaborate and, if necessary, cede control of the ICT solution to community entities, tertiary institutions, small businesses and NGOs. Experts also recommended project timeframes to be included as part of the strategy. The funding model and mechanism is also recommended to be added as part of the strategy.

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Adoption of ICT: from the proposed factors, which factors will you recommend to be removed (not important at all), and which factors will you add? The factors to be added or removed are highlighted in the Table 9.7.

Table 9.7: Factors to be removed or added adoption of ICT

Factor/s to be removed		Factor/s to added
Affordability and Accessibility	0%	Community Ownership
Digital Literacy	0%	Affordability
Supply and Demand	0%	
None	100%	

Reasons for the amendment:

The expert recommended that none of the factors be removed. The experts recommended that community ownership be added as one of the strategy factors. The experts also recommended interoperability as one of the key factors.

Technology Infrastructure: from the proposed factors, which factors will you recommend to be removed (not important at all), and which factors will you add? The factors to be added or removed are highlighted in the Table 9.8.

Table 9.8: Factors to be removed or added technology infrastructure

Factor/s to be removed		Factor/s to added
Network Coverage and availability	0%	Dynamic Spectrum Sharing Technologies
Television White Space	20%	Training for basic maintenance
Frequency Spectrum	0%	Interoperability
Rapid Deployment	0%	
None	80%	

Reasons for the amendment:

One of the experts recommended the removal of the Television White Space and to be replaced by the Dynamic Spectrum Sharing Technologies. The other expert recommended that the locals be trained on support and maintenance of the infrastructure. Affordability is also recommended.

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Funding Model: from the proposed factors, which factors will you recommend to be removed (not important at all), and which factors will you add? The factors to be added or removed are highlighted in Table 9.9.

Table 9.9: Factors to be removed or added funding model

Factor/s to be removed		Factor/s to be added
Customised Business Model	0%	Incentives
Universal Service and Access funds	0%	
Public-Private Partnerships	20%	
None	80%	

Reasons for the amendment:

One of the experts recommended the removal of the Public-Private Partnerships. It is important to note that 80% of the experts highlighted the importance of the PPPs as one of the funding strategies. One of the Experts recommended that incentives be added as one of the factors.

Part of the evaluation tool also assessed the proposed components of the strategy formulation process. The strategy components are measured against a 4-point scale from "very important", "important", "not important" to "least important". The results reveal that most reviewers agreed that the components proposed in the strategy for sustainable ICT are either very important or important. The components that are evaluated by the experts are listed in Table 9.10 below, together with a percentage measure for each factor. The components of the strategy which are important or less important are highlighted in the Table 9.10.

Table 9.10: Strategy formulation components on importance

Strategy Components	VI	I	LI	NI
Objectives	80%	20%	0%	0%
Environmental Assessment	80%	20%	0%	0%
Strategy formulation	60%	40%	0%	0%
Strategy Implementation	60%	20%	20%	0%
Control and Monitoring	40%	20%	20%	0%

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Most of the Experts believe that the components of the strategy formulation are very important with very few having responded that the strategy implementation and control and monitoring are least important as highlighted in Table 9.11.

Table 9.11: Strategy formulation components on relevance

Strategy Components	VR	R	LR	NR
Objectives	60%	40%	0%	0%
Environmental Assessment	40%	60%	0%	0%
Strategy formulation	40%	60%	0%	0%
Strategy Implementation	20%	60%	20%	0%

Most of the experts believe that the components of the strategy formulation are all relevant. There is only one who thought that the component of strategy implementation is least relevant. One of the experts emphasises the importance of control and monitoring as part of the strategy components: *"Monitoring and evaluation and proper public feedback".* This part has been covered extensively as part of the overall strategy formulation.

9.5 The Revised Strategy

From the data analysed, three factors are recommended for removal, or as an additional item as highlighted in the Table 9.12.

Table 9.12: Strategy formulation components on relevance

Items	Recommend %	Do not recommend %
Gender Digital Divide	80%	20%
Television White Space	80%	20%
Public-Private Partnership	80%	20%

Gender Digital Divide: One of the reviewers recommends that the Gender Digital Divide factor be removed: "*In the age of mobile telephony and mobile broadband, gender digital divide no longer exist as in many communities rural and urban both girls and boys have the same exposure to mobile phones. It is therefore not relevant to consider this as a metric for assessing digital inclusion".* However, 80% of the reviewers felt that the factor is important and will have to be retained and hence it is not removed.

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Television White Space: One of the reviewers recommends that the Television White Space relates to the broadcasting unused frequency spectrum and recommends that the factor be replaced with dynamic spectrum allocation*: "I will add Dynamic Spectrum Sharing Technologies in place of TV white spaces. TVWS refer to the sharing of broadcasting spectrum dynamically through secondary access for other uses, such as broadband and Internet of things, which is less important than the general concept of dynamic spectrum sharing which will encompass sharing in many other bands including the high-demand spectrum. In fact, both TVWS and Frequency Spectrum do not belong here as they are both not the technologies, but resources that can be used to enable radio communication".* However, about 80% unanimously agree that the Television White Space is important and will have to remain. I have decided that the Dynamic Spectrum Sharing be added as part of the factors strategy for sustainable ICT.

Public-Private Partnerships (PPPs): One of the reviewers recommends that the PPPs be removed as one of the factors for strategy for sustainable ICT: "Research to determine which the most sustainable business model is for each community, based on best practise from other countries, elsewhere in South Africa, using components of successful business model. This will ensure relevance to the community and buy in. *Research to determine which the most sustainable business model is for each community, based on best practice from other countries, elsewhere in South Africa, using components of successful business model. This will ensure relevance to the community and buy in*". However, majority of the reviewers agree that the Public-Private partnership must be removed as one of the factors of strategy for sustainable ICT. I have also recommended that the research to determine the appropriate funding model must be added as of the strategy for sustainable ICT.

9.5.1 Additional Strategy Factors

There are number of factors which are recommended to be added as part of the strategy for sustainable ICT. The table below outlines the additional recommended factors. The factors which are recommended to be added as part of the strategy are being categorised as follows in Table 9.13.

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Table 9.13: Factors to be added to the strategy

Factors to be added
Digital Inclusion
External Power Generation
Behavioural Economics
Local Indigenous knowledge
Rural Development
Education Exposure
Partnerships
Government Leadership
Collaborations with Rural Communities
Projects Timeframes
Adoption of ICT
Community Ownership
Affordability
Technology Infrastructure
Dynamic Spectrum Sharing Technologies
Training of Locals for Basic Maintenance
Interoperability
Funding Model
Incentives

It is important to note that some of the recommended changes such as partnerships and affordability have been addressed extensively as part of the initial strategy formulation and will therefore not be repeated under the revised strategy. The rest of the recommendations will be addressed as additional factors to form part of the initial strategy outlined in Chapter 8.

It is also important to note that one of the experts also suggests that there is a need for monitoring and evaluation and proper public feedback. However, this strategy component has been dealt extensively and there is no need to review the strategy formulation in Chapter 8.

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9.5.1.1 Digital Inclusion

External Power Generation: For the most remote rural areas, energy sources are a greater challenge for the successful roll-out of the ICT infrastructure. Other sources of renewable energy such as solar power may be much more expensive than the ICT devices. Even in grid-connected remote areas, stable energy source availability and quality remain variable and hamper the ICT networks roll-out. Power efficient ICT solutions are required, especially for the most rural environments.

The National Planning Commission (2012) notes that South Africa's electricity plan must, ultimately, offset the increased use of new and renewable energy sources with established and less expensive technologies providing security of supply.

The need for power has evolved over the years together with the need for power for ICT devices like handheld mobiles, which are minuscule compared to the old desktop devices. Technology, however, still needs to come up with devices that are more power efficient to promote a higher penetration of ICT end user devices. The wireless mesh technology has recently been adopted and implemented with improved significant energy savings.

It has been proven that energy transmission increases for every square kilometre distance of the ICT infrastructure. Thus, if an intermediate node is added halfway, there can be a cut on energy requirements per node by a factor of four. Even though twice as many nodes are needed, the lower energy requirements have greater implications for battery or energy requirements. It is also important to note that the lower power transmission also reduces interference between the neighbouring nodes which allow a higher throughput.

A number of solutions can be explored to address the risk of unreliable power sources such as a combination of rooftop and electricity storage, which will make some of the local network operators be less dependent on the power grid and not necessarily on the grid itself. The current high demand on the power grid should encourage the government to offer incentive programmes to promote the construction of renewable energy infrastructure for the rooftop network operators' usage and at the utility scale.

Behavioural Economics: Xavier and Ypsilanti (2010) stated that behavioural economics is not a replacement but a complement to conventional neo-classical economics in pursuing improved policymaking or formulation of regulations. Behavioural economists generally agree that markets are better understood by relying on the behaviour of individuals. However, behavioural economics argue

that behavioural bias is systematic and predictable, so it can be considered to generate better analyses and policies. Behavioural economics helps to find ways to encourage rural people to access the Internet, make use of available online resources, share communication and computing, and treat service providers as trusted brokers. They point out different aspects of human behaviour, such as the motive effect of certain monetary policy incentives and the way in which the money is invested in separate intellectual accounts (Dini, Milne and Milne, 2012).

One of the arguments of the behavioural economy is that when competition develops in the ICT market and users have a wider range of service providers, some regulators have paid more attention to demand. For example, one aspect of demand-side in many countries is the requirement of "portability", which facilitates consumer "change of service providers" in the mobile phone market. Such an interest in consumer demand-side is timely, as knowledge-based consumers are ready to choose between competing suppliers, which is indispensable for encouraging companies to innovate, improve quality and competition (Gentzoglanis and Henten, 2010). Ideally, the strategy should also looks at behavioural to empower the community with important information that will assist them in decision-making when acquiring and spending money on ICT services.

Local Indigenous knowledge: Literature showed that one way to bring ICT closer to the indigenous population is to promote community ICT and to develop the direct participation of indigenous peoples in sustainable development. The selection of technology and local content, as well as the training of indigenous members would contribute to this as well (Telecommunication Development Sector, 2013). The community will then need to be encouraged to develop local content in the dominating language, which is Xhosa, as established during the research findings.

Thus, in a rural community, the Internet infrastructure should explicitly cater for the capturing and packaging of indigenous knowledge (Ndlovu, Terzoli and Pennels, 2006). This can increase the amount of local knowledge through the use of information and communication technology services and help make it more context sensitive and culturally relevant.

9.5.1.2 Rural Development

Education Exposure: While establishing new services and projects, there is a risk that the Government may further promote the digital divide by assuming a level of ICT access or ICT literacy that will practically speaking leave certain underserved portions of the population behind. In these circumstances, endeavours to harness the benefits of ICT to ensure access to services and advance value

may inadvertently fuel existing divides. Because of this, it is important that the Government intentionally get ready to enhance ICT access, or progress digital proficiency while executing new arrangements that depend on Internet services.

Expanding the digital literacy training programmes to the impoverished and rural communities will bring positive changes and bridge the digital divide. Many rural communities and areas know what ICT or the Internet is in general terms. However, they lack the basic understanding of how these services can be of value to their daily lives. ICT literacy programmes must be adopted to educate participants in small-scale rural community-based economies by providing lower rates on the services they will normally use based on their individual free market economy. This will make sure that the users of the ICT services are fully equipped to get full benefits from the use of ICT services.

9.5.1.3 Government Leadership

Collaboration with Rural Communities: Richardson and Paisley (1998) noted that what comes through clearly from the literature and discussions from those working with empowering rural communities through the use of ICT is the overwhelming need to focus on people and not technology. However, it had to be more on what ICT technology can do to empower the people. They further pointed out that this depended on several factors, namely, the type of technology implemented, where it was implements, the size of the community and how it would benefit the community Concentration in this way marked the beginning of all thinking and decision-making with people who use technology and the context in which they use it. Richardson and Paisley (1998) again emphasised that this means facilitating communities to define their needs regarding communication, information and training and in the process ensuring that sustainable and suitable ICT services are implemented and used effectively by the less privileged. People are therefore pivotal and need to be considered when deciding what type of ICT is suitable.

Project Timeframes: One of the biggest delays in the roll-out of ICT services is the granting of permits to build new infrastructure. An excessive number of projects are behind on schedule because there is no set turnaround time for a permit application and the communication with the applicant is poor. Once a permit has been filed for the roll-out of facilities on municipal lands, the regulator should consider setting recommendation on activating "shot clocks" to obtain a quicker response on the progress of the permit application. The municipality involved in the permit process should be expected to respond back to the applicant within a short period of time to avoid unnecessary delays in the project implementation

timelines. If additional environmental surveys are required, municipalities should indicate the specific requirements in their initial response, as well as an anticipated completion date.

Additionally, local governments should be required to report back to the applicant regularly on the progress of the surveys to make sure that ICT infrastructure construction can be completed on time. Coordinating the time of construction of projects with public utilities can be a challenge because it requires a joint effort to share information about policies and processes among all interested parties.

9.5.1.4 Adoption of ICT

Community Ownership: Information and communication technology resources are considered community resources that do not belong to individual households; the concept of domestic use of telecommunications is a completely inadequate frame of reference that can be used to meet the needs of those communities. The fact of the matter is that a detailed and sophisticated knowledge about the issue exists within the community. Community members are always keen to know what is happening in their communities, to take ownership and ensure involvement in development projects. Recognising the fundamental role played by the local leader in the adaptation of the ICT infrastructure and services to local needs, and the importance of the appropriation of information society programmes is important for sustainable development.

Affordability: It should also be noted that the prevention of the introduction of information and communication technology is the cost of communication and the affordability of Internet services to the mass market in rural areas. The "calling party pays" model of the caller and the highly innovative pricing plans are essential for the spread of mobile phone users who have a limited ability to pay. In the same way, a radical and innovative model for both fixed and mobile phones has not yet entered the information market. The lowering of data prices is critical to make access and services viable for low-income users. This is a complex area in all markets based on competition, and the risk for policymakers is that policy action or inactivity can limit access to data services with only the privileged getting full benefit.

9.5.1.5 Technology Infrastructure

Dynamic Spectrum Sharing Technologies: It is increasingly recognised worldwide that the dynamic allocation of spectrum provided by geolocation databases has significantly increased the availability and access of ICT, especially in less profitable areas such as rural communities. Taking into account

greater transparency, technological advances to allow dynamic spectrum sharing and increased demand for spectrum. Technology now offers the opportunity to increase the intensity of spectrum use in these unregulated frequency bands through the use of self-protection systems. Dynamic channel selection avoids interference that enters the band and minimises transmission over the other signals within the same bands (Cave, 2008).

To increase capacity without losing its sparse architecture, mobile networks require increased amounts of frequencies. Policymakers and regulators must assess whether such an approach is justified to meet future data requirements, which poses a significant risk of increasing the concentration of spectrum ownership and the relatively inefficient use it has As a measure of protection against this risk, policymakers should also allow for greater spectrum allocation and licensing for spectrum release in different areas (Thanki, 2012). The approach will make sure that there is a cost-effective solution of implementing the last mile connectivity to the home, which is one of the expensive parts of the ICT value chain. Thus, as part of a clear position to fulfilling the increasing demands for data, policymakers must enforce dynamic spectrum allocation and license-exempt access across the frequency spectrum. This will require a new policy directive and regulations to be promulgated to optimise the use of the frequency spectrum.

Training of Locals for basic maintenance: The risk is clearly more prominent in areas where potential customer numbers are low and ICT deployment costs are high as is the situation in the deep remote areas, for example, the AmaJingqi rural community. The cost of even a little group to implement a competitive network infrastructure keeps running into a large number of rand, notwithstanding the progressive expense of manpower, upkeep of the network services, and necessary improvements to the infrastructure.

Literature has emphasised that for a strategy of sustainable ICT to be successful, there will be a need for appropriate competencies to ensure effective maintenance of ICT infrastructure. The reliability of the network on the quality of service is pivotal to determine the uptake and usage of the ICT services. Therefore, the creation of ICT infrastructures in rural areas is a prerequisite for the provision of ICT services, with adequate funding which should be able to cover the operational costs of support and maintenance in the first implementation stages. It is, therefore, very important that big corporations with financial backup are encouraged to invest in the deep rural areas by ensuring that the investment conditions are conducive to making a profit.

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Processes for fault reporting and first line support will also need to be improved to ensure a quicker turnaround time of fault resolutions and improved ICT infrastructure uptime. Training of the field technicians will therefore be promoted and implemented. Routine and preventative maintenance will also be pivotal to ensure longevity and the improved lifespan of the ICT infrastructures. Thus, maintenance frameworks need to be developed and implemented and regularly improved for effectiveness and necessary impact.

It is equally important to note that not all anchor institutions, including rural communities, have staff with the technical know-how to build and manage ICT networks. Ownership of infrastructure does not mean that anchoring institutions and communities operate and control ICT networks on their own. Contracts of communication technology services, as well as information and concluded with a third party are common and offer individual organisations and consortiums the opportunity to evaluate and secure the most cost-effective rates for these services. Traditional service providers with skills and competencies can also provide such services. This acquisition of third party services for a limited period of time must be accompanied by compulsory skills transfer to the local communities so that they can be able to provide such services once the service provider has left the area.

Interoperability: This refers to the ability to make systems and organisations work together to encourage shared infrastructure. The Shared Technology Infrastructure should form the basis to support and incubate initiatives. Shared infrastructure reduces the cost of supporting new businesses and facilitates the administration and deployment of data networks. The development of shared technology also guarantees interoperability, which is important to create solutions for the global market. The interoperability framework should be based on a common infrastructure. The DoC (2013b) notes that to date South Africa has not explored additional features on the Internet that can support more sustainable data management and digitisation. In addition, the government has several information management activities that are not necessarily interoperable or effectively interconnected. That is why centralised coordination is needed to guarantee interoperability. One goal of interoperability is to encourage the national roaming agreement of network operators through internetworks.

During the data collection process, the respondents indicated that MTN, Cell C, and Telkom Mobile have serious network coverage in the area, and the likelihood is that the majority of the interviewees might be the subscribers of the same networks. One of the suggested solutions is to recommend roaming across the networks. Some of the reasons of why the availability of the sites is limited might be due to certain imposed restrictions or the business model might not be sustainable for some of the operators.

As a result, the quality of the wireless service is affected. To solve this situation, one of the solutions might be to identify these areas and identify them as Critical Infrastructure Sites (CIS) and enforce sharing. Subsequently, the sharing arrangement can be made in mutually agreed commercial terms. Roaming if authorised in the contingency of weak or no signal will solve the problem by riding over other networks.

9.5.1.6 Funding Model

Incentives: Incentives for capital investment remain critical to productivity growth and overall economic recovery for the rural communities. The current environments do not contribute to the informal economy of South Africa. The expected growth in ICT infrastructure can, however, encourage a much better environments for innovation in an informal economy and succeed if easier environments can be created (DOC, 2013b). The Government should provide incentives for service providers to offer services to areas which are less lucrative to big corporates. Incentives can foster competition in ICT in all technologies, particularly in markets where there are no ICT service providers or only one service provider. The competition promotes appropriate tools, reduces consumer prices and improves the quality of service. Local administrations should be empowered to provide adequate incentives to provide ICT services if there are no service providers that wish to offer such services at an affordable price.

9.6 The Overall Strategy

9.6.1 Digital Inclusion

9.6.1.1 Gender Digital Divide

The National Planning Commission (2012) articulates that women make up a large part of the poor, especially in rural areas. The plan took into account the race, gender and geographic location, and suggested a series of measures to promote equality for women. Most of the community members who were interviewed for the survey are predominantly women who form the majority in the community. There are 53% of women who responded compared to 47% males. The expansion of the capacities of rural women through ICT has a direct impact on their operation and gender-based development. The development of rural women directly allows the development of rural areas in South Africa.

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9.6.1.2 Youth Development

The responses are made mainly by young people between the age of 22 and 30 years. The majority of the participants (38%) are in the young adult 22 – 30 age range. The younger generation is the cornerstone and the core of any developing economy. It is, therefore, important that policies which focus on youth development be promulgated and speedily implemented.

9.6.1.3 Seamless access to information

Access to information is predominantly possible with access to the Internet infrastructure. The majority of the respondents (63%) indicate that they had access to the Internet, but it has to be pointed out that most of the Internet access being referred to the social media. It is important to remember that web access is mainly through the respondents (92%) cell phones. There is a very small amount of access to the Internet through the ADSL (4%) and Community Centres (1%). This is a clear indication that there is a huge lack of affordable ICT infrastructure within this community. There is a need for the provision of infrastructure.

9.6.1.4 External Power Generation

Forty-three per cent of the respondents stated that the power grid is very stable. The reason for the huge number of respondents indicating that the electricity grid is not reliable might be due to the recent power outages experienced over the Eskom power grid. One of the continual challenges to guarantee sustainable ICT is reliable power to run the infrastructure. As a result, there is a need to develop solar energy units connected to batteries to power those infrastructures not attached to the national electricity grid. The rechargeable batteries must be connected to the network for an improved uptime of the infrastructure connected to it. Charging a handheld device also proves to be a challenge, and this requires the distribution of solar cells, which may be used to recharge the mobile devices.

9.6.1.5 Behavioural Economics

Behavioural economics will assist to explore ways on how the rural community can be encouraged to take up Internet services, make the most of available online resources, share their communications and information efficiency, and treat service providers as reliable intermediaries. In this way, they draw attention to various aspects of human behaviour, such as the motivating effect of some monetary incentives, and the way in which money is invested in separate mental accounts (Dini et al., 2012). It will be ideal if the strategy could also look at behavioural economics to empower the community with

important information which will assist in decision-making when acquiring and spending money on the ICT services.

9.6.1.6 Local Indigenous Knowledge

The literature has established that one way to bring ICT closer to indigenous people is to promote community ICT and develop it in accordance with sustainable development. This is done by involving the direct participation of the indigenous people in the relevant choice of technology and local content, and the training of indigenous community members (Telecommunication Development Sector, 2013). The community will then need to be encouraged to develop local content in the dominating language, which is Xhosa as established in the research findings. All the participants in the survey are Xhosa speaking, and this is due to the fact that the survey is undertaken in one of the biggest rural environments in the Eastern Cape.

9.6.2 Rural Development

9.6.2.1 Social Development

The policy directive that underpins the social development of the community of the AmaJingqi will be very important to make sure that ICT benefits the community by ensuring e-government services. If the availability of ICT infrastructure is linked to innovative technologies on a large scale and in all socioeconomic areas, the growth of economic and social development and the progress of individual welfare will be important.

9.6.2.2 Economic Development

The objective of the ICT policy is to promote socioeconomic development by increasing the widest possible integration of ICT in all sectors and the provision of ICT services in the rural areas. Economic growth and development are always below potential if countries cannot exploit and benefit from new technologies (ITU, 2015). The production and use of ICT can contribute significantly to economic growth, in principle, through increases in productivity and greater knowledge and information flow, translated into uncertainty and the reduction of transaction costs (Mandour, 2009).

The study found that the number of unemployed participants is (46%), and the lowest number of self-employed participants is (8%). It is equally important to note that the youth constituted (10%) of the participants and the majority of these are high school pupils. The current figure of the South African unemployment is (25%), and it is important to note that youth constituted about (46.9%) of the total

unemployed individuals according to the 2011 Census. Thus, the 46% of the unemployed respondents mainly constituted the youth, and this must raise some serious concern for a developing country such as South Africa. Table 7.7 further illustrated that there is a small number (8%) of respondents who are self-employed, and this is an indication that there are not many entrepreneurial activities within the communities. Studies have shown that there is a direct link between the roll-out of ICT infrastructure and job creation to the small businesses. The development of the SMMEs will be pivotal to sustainable and decent job creation.

9.6.2.3 Employment Creation

The application of ICT to increase the employment potential of the poor and increase their knowledge and learning needs also requires a strategic purpose, considerable experimentation, grassroots participation, social learning and strategies to improve scalability and sustainability. The diffusion of ICT in all sectors of the economy imposes new demands on the skills of employees. The area of varying competence is expanding employment opportunities and introducing new requirements for disadvantaged groups. In the current labour market, knowledge of basic skills is considered essential for the workforce and entrepreneurs and for the best recipients of work. Governments consider training IT as a strategic force that promotes economic growth, promotes competitiveness and improves corporate productivity.

Several indicators highlighted the ability of the ICT network as a prominent space of public funds investment during the economic depression, ensuring immediate job creation, and this will go a long way in solving the unemployment problem. The government, therefore, is expected to formulate and implement policies which will ensure there are clear interventions and ensure affordability of ICT services.

9.6.2.4 Educational Exposure

While implementing new services and projects, there is a risk that the Government may further promote the digital divide by assuming a level of ICT access or ICT literacy that will, practically speaking, leave certain underserved portions of the population behind. In these circumstances, endeavours to harness the benefits of ICT to ensure access to services and advance value may inadvertently fuel existing divides. It is, therefore, important that the State intentionally gets ready to enhance ICT access or continue to progress digital proficiency while executing new arrangements that depend on Internet services. A large percentage of the respondents (72%) indicated that they do not have any ICT

qualifications. This is a major concern, and the adoption and use of ICT will be greatly limited by lack of appropriate computer skills. However, the majority of the respondents (81%) indicated that they will be interested in improving their ICT skills. There is a spectrum of digital skills that increase in complexity as users gain expertise.

9.6.2.5 Partnerships

There is lack of funding from financial institutions for ICT projects. The value proposition for Information Technology and Communications in the financial sector seems to be very limited and this may be the reason why the financing of projects related to ICT is limited. To solve this problem, it is necessary to promote private sector investment and public-private partnerships in the ICT sector. The expected result will be an increase in investment in the ICT sector, particularly in relation to information and communication technologies. ICT networks cannot deliver value without active government partnership with private players. The provision of the necessary ICT in the ecosystems of the public and private sector requires solid business models with clear revenues for each stakeholder. Although the state requires concrete social returns in the form of employment and skills development for the rural population, private sector companies aim for long-term commercial viability.

9.6.3 Government Leadership

9.6.3.1 Effective Market Competition

One of the interventions which the government will have to undertake is to make sure that the playing field is levelled and that the market competition is fully regulated. The government will have to look into the regulatory tools which are meant to increase entry and the market competition to maximise what the market can deliver if the government is to make any public investments to roll-out the ICT infrastructure.

The respondents had indicated that MTN, Cell C, and Telkom Mobile have serious network coverage problems in the area, and the likelihood is that the majority of the interviewees might be the subscribers of the same networks. One of the suggested solutions is to recommend roaming across the networks. Some of the reasons of why the availability of the sites is limited might be due to certain imposed restrictions or a business model might not be sustainable for some of the operators. As a result, the quality of wireless service is affected. To overcome this situation, one of the solutions can be to identify such areas and term them as Critical Infrastructure sites (CIS) and mandate sharing.

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9.6.3.2 Cross Sectoral Coordination

Cross-sectoral coordination to ensure minimal duplication of resources and quicker turnaround time on the main project implementation is critical for a successful strategy. These coordinated initiatives will ensure full leverage on the collaborative networks and will ensure an integrated vision and realisation of full benefits derived from the ICT services. Multi-layer government planning is therefore encouraged to ensure effective implementation of the main ICT projects.

9.6.3.3 Policies and Regulations

The key regulatory barriers are (1) a lack of cohesive leadership and policies on the development and the implementation of the ICT agenda, (2) lack of awareness of how best to use ICT strategies to promote government programmes, and assisting provinces in promoting their programmes in a similar way, (3) silos in which the various agencies operate within the sector, and (4) lack of funding for ICT initiatives.

The majority of the respondents (56%) believe that there is a progressive ICT policy, but 68% also believe that the policies are moderately effective. There are a small number of the respondents who believe that the policies are highly effective. It has to be emphasised that educational strategy-setting for ICT diffusion starts with an assessment of human and technical capacity.

9.6.3.4 Collaboration with Rural Communities

Richardson and Paisley (1998) had noted that what comes through clearly from the literature and discussions with those working with empowering rural communities through the use of ICT is the overwhelming need to focus on people and not technology, but it had to be more on what ICT technology can do to empower the people. Richardson and Paisley (1998) further point out that this applied on what implementation and use of technology to take place at national or local levels, within communities, with large or small numbers of people, and how will this benefit the communities. Concentration in this way marked the beginning of all thinking and decision-making with people who use technology and the context in which they use it. Richardson and Paisley (1998) again emphasised that this means facilitating communities to define their needs regarding communication, information and training and in the process make sure that sustainable and suitable ICT technologies are implemented and used effectively by the less privileged. People are therefore pivotal and needed to be considered when a determination is made on the type of suitable ICT technologies.

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9.6.3.5 Projects Timeframe

One of the biggest delays in the roll-out of ICT services is the granting of permits to build new infrastructure. An excessive number of projects are behind on schedule because of no due dates set for permits application turnaround time and for poor or absence of correspondence back to the applicants. Once a permit has been filed for the roll-out of facilities on municipal lands, there regulatory should consider setting a recommendation on activating "shot clocks" to obtain a quicker response on the progress of the permit application. The municipality involved in the permitting process should be expected to respond back to the applicant within a short period of times to avoid unnecessary delays in the project implementation timelines. If additional environmental surveys are required, municipalities should indicate the specific requirements in their initial response, as well as an anticipated completion date.

9.6.4 Adoption of ICT

9.6.4.1 Affordability and Accessibility

It was also important to note that an inhibiting factor for the adoption of ICT is the cost of communication and the affordability of Internet services for the mass market within the rural environments. The “calling party pays” model and the highly innovative pricing plans are essential for the spread of mobile phone users who have limited ability to pay. In the same way, a radical and innovative model has not yet entered the information market, both fixed and mobile. The additional infrastructure requires data prices to access services by lower-income users. This is a complex area for any competition in the market and the risk for decision-makers is that policy or inactivity around policy can limit access to data services by the less privileged.

According to Table 7.17, the majority of the respondents (43%) spent between R50 and R100 to buy airtime every month. There is just a mere (3%) who can afford to spend more than R400 on airtime every month. Only (32%) buy an SMS bundle every month and rest did not buy any SMS bundle, and most of the respondents (98%) can write their SMSs. It looked like airtime affordability is also one of the huge inhibitors of fully exploiting the benefits of ICT.

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9.6.4.2 Digital Literacy

Table 7.25 indicated that only a mere 51% of the respondents have used a computer, and almost half of the interviewees had never used a computer. This is very concerning as there is a clear indication that a huge number of respondents are still not computer literate. There will, therefore, be a need for ICT education to make sure that an uptake and usage of the ICT services is encouraged.

9.6.4.3 Supply and Demand

Kelly and Rossotto (2012) further emphasised that a full scope of the rural challenges will have to be fully explored by the policymakers and regulators to come up with approaches which will stimulate and promote ICT development. Some of the identified challenges tended to be multifaceted with number of layers and mainly include the need for stimulation for supply and demand of the ICT services.

One of the major problems identified is the lack of basic infrastructure such as roads and the ICT networks. Kelly and Rossotto (2012) indicated that the availability of the infrastructure within the rural communities is the first step to be explored where the supply-side will have to be addressed and then the uptake of the services which will be promoted by ensuring that there is a demand within the deep rural communities. The ICT services uptake by the non-ICT sector is also one of the areas which can be encouraged to enhance further network deployment.

9.6.4.4 Community Ownership

ICT resources are considered community resources that are not part of individual households: "... the concept of using telecommunications in the home is a completely inadequate framework for addressing the needs of these communities (Casson et al. 2002). The fact of the matter is that the detailed and sophisticated knowledge about the issue exists within the community. Community members are always keen to know what is happening in their communities to take ownership and ensure involvement in development projects. It recognises the fundamental role played by local leaders in adapting ICT infrastructure and services to local needs and the importance of ownership of the ICT programmes, which is important for sustainable development.

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9.6.5 Technology Infrastructure

9.6.5.1 Network Coverage and Availability

It is important to note that the majority of the respondents (73%) had indicated that they have access to the Internet. The likelihood is that the respondents to refer to access to social media. The respondents (98%) mainly use their cell phone access the Internet. The government has advocated universal access in the broadband policy. It is, therefore, the responsibility of the government to promote the widespread availability and accessibility of quality ICT through the operationalisation of the Universal Service Fund, identification of universal access programmes for implementation and fostering of diverse and cost-effective funding mechanisms. This will be through design and implementation of universal service initiatives; ensuring the availability of diverse, affordable, quality and secure ICT services throughout the country to all persons.

9.6.5.2 Television White Space

One of the solutions to the South African problem to roll-out the cost-effective solution for the low-income community is the use of TVWS technology. The adoption of the TVWS will make sure that the much-needed ICT services reach the low-income users and this, in turn, will make sure that people within the underserviced communities will receive the much-needed services. This will make sure that the communities become economically active.

9.6.5.3 Frequency Spectrum

The National Government must implement mechanisms to promote more efficient utilisation of the frequency spectrum and this will release some of the spectrum propagation for reallocation. Cellular operators have a minimal incentive to encourage the use of the frequency spectrum efficiency. This means that some network providers are still using less efficient or potentially obsolete systems, or may not be using the frequency spectrum efficiently, preventing it from becoming available for commercial network operators. Operators, for instance, must be encouraged to use spectrum more optimally and supplied with funding unrelated to spectrum auctions to cover expenses, including research and development, to evaluate spectrum reassignment, efficiency, and sharing.

9.6.5.4 Rapid Deployment

The Government noted that there is an unfortunate reluctance by telecommunication companies to invest in the rural communities due to a lack of a viable business case and since the market for ICT

services is inadequate to provide incentives. Better use of the right of way can eliminate these barriers, but some service providers, including state entities, cannot take advantage of this approach at present. The government will have to mandate all service providers to install their underground conduits in the same trench, at the same time on a shared-cost basis.

9.6.5.5 Dynamic Spectrum Sharing Technologies

The rural areas called for effective technologies to be implemented due to the sparsely populated landscape. Mobile networks will thus require large quantities of spectrum to cover such areas. Policymakers and regulators will have to put a mechanism in place to assess whether more allocation of spectrum will result in inefficient use which will be entailed by such an action. Policymakers can circumvent this risk by enabling the increased use of dynamic frequency spectrum sharing and ensuring that more license exempt spectrum is made available across a number of bands (Thanki, 2012). This approach will make sure that there is a cost-effective solution for implementing the last mile connectivity to the home, which is one of the expensive parts of the ICT value chain. Thus, the policymakers will have to adopt a balanced approach to meet the growing demands for data services and this will necessitated by encouraging dynamic spectrum sharing, and license-exempt spectrum will be allowed. This will require a new policy directive and regulations to be promulgated to optimise the use of the frequency spectrum.

9.6.5.6 Training of Locals for Basic Maintenance

The sustainability of services is pivotal to determine the uptake and usage of the ICT services. Thus, to establish a solid ICT infrastructure in rural areas as a prerequisite to the provisioning of ICT-related services requires adequate funding. Literature has emphasised that for a strategy of sustainable ICT to be successful, there have to be appropriate competencies to ensure effective maintenance of the ICT infrastructure. The network and its quality have to be reliable so as to cover the operational cost of support and maintenance during the early stages after the implementation.

9.6.5.7 Interoperability

This refers to the ability to make systems and organisations work together and to encourage shared infrastructure. The Shared Technology Infrastructure should form the basis to support and incubate initiatives. Shared infrastructure reduces the cost of supporting new businesses and facilitates the administration and deployment of data networks. The development of shared technology also guarantees interoperability, which is an important solution to create solutions for the global market. The

interoperability framework should be based on a common infrastructure. There is, therefore, a need for centralised coordination to ensure interoperability. One aspect of interoperability will be to encourage network operators to have a national roaming agreement across the networks.

9.6.6 Funding Model

9.6.6.1 Customised Business Model

The obstruction to implementing ICT in the remote areas is an absence of monetary motivation. For operators to invest capital to implement a cost-effective ICT infrastructure, it is sensible for service providers to acquire a rate of profit from that investment venture. A steady cost recuperation instrument to give continuous help to reasonable, moderate ICT is important to draw in private venture. While one-time grants allow for groups and locals to be useful as a boost to ICT service providers, it is critical to perceive that ICT frameworks require overhauls and long haul upkeep. It is uneconomical to work out of a rural system that doesn't create enough income from its client base to help the continuous upkeep of the system.

9.6.6.2 Universal Service and Access Fund

The USF's significant definition of the strategy and objectives of the USAF is essential to make sure that USF funds are channelled for their intended use to enable them to achieve the desired results of control and management. Many funds have been abused or even misused due to incompetent administrators lacking the required experience and the necessary background to effectively administer the funds and this situation has led to mismanagement of the USAFs.

9.6.6.3 Public-Private Partnership

Careful investigation of which investment method is likely to yield more value for money is critical. The key risk factors and characteristics of certain projects should be evaluated by carrying out the procurement procedure. The prospect of an acquisition opportunity should allow the board to decide whether it is discretionary to explore the PPP option further. There is a need to shift the risks to those who control them better. Risks must be defined, identified and measured and transported to the party that will cost the least to manage it, or to whom the realisation of the risk is the least.

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9.6.6.4 Incentives

Incentives for capital investment remain critical to productivity growth and overall economic recovery for the rural communities. The current environments are not conducive for innovation for the informal economy in South Africa. In the current environments, the informal economy in South Africa has little or no support for innovation. The expected growth in ICT infrastructure can, however, encourage a much better environments for innovation in an informal economy to succeed if an easier environments can be created (DOC, 2013b). The Government should provide incentives for service providers to offer services in areas which are less lucrative to big corporates. Incentives can spur competition in ICT services in all technologies, particularly in markets with no ICT service providers or just one provider.

9.7 The Concluding Remarks

The purpose of this chapter is to evaluate the proposed strategy. The evaluation is implemented in a sequence of phases, and it made use of the evaluation phases recommended by Alkin (2004). Table 9.14 presents the evaluation phases, and how they are implemented in this study.

Table 9.14: Evaluation phases of the study

Evaluation Phase	Implementation in the Study
Formulation of the objectives of goals	As already stated the main aim for this evaluation is to determine whether or not the proposed conceptual framework is needed, if it has been fully developed, if it meets the needs of those who will use it.
The conceptualisation of the major components of the evaluation.	The evaluation made use of five experts: NGO, CSIR Researcher, Government Policymaker, Parliament Legislator and Academic.
The design of the evaluation	An online evaluation tool is developed using Google forms (Appendix B).
The analysis of the information	The data collected from the evaluation are analysed both qualitatively and quantitatively
The utilisation of the evaluation results	The analysed data is used as recommendations to improve on the proposed strategy.

The proposed strategy is evaluated by five professionals with diverse expertise and experience: the NGO, Academic, Research Institution (CSIR), Government Legislator and Government Policymaker. The researcher developed an evaluation tool to assess the strategy. The online evaluation tool was developed using Google forms. The results revealed that most of the reviewers agreed that the factors proposed as influencing strategy are very important and relevant.

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One of the experts suggests that the **gender digital divide** be removed as the gender digital divide no longer exists in the age of mobile telephony and mobile broadband, as in many rural and urban communities both girls and boys have the same exposure to mobile phones. It is, therefore, not relevant to consider this as a metric for assessing digital inclusion. However, 80% of the experts agreed that Gender Digital Divide is important and, hence, this will be considered to be important and will remain as part of the study. The expert also suggested that other power generation sources outside of the power grid must be added. They said that none of the strategy elements can be applied unless strategies are in place for rural communities to have reliable access to electricity or the means to generate their own, such as solar/biogas/generators. Aspects like **behavioural economics** and the impact of group dynamics on behaviour and believes patterns of individual within communities are also suggested and added. Finally, the **local indigenous knowledge** is also suggested as an additional strategy element.

The experts further recommend that **education and support** be added as one of the elements of ICT. Partnerships have been dealt with extensively as part of the discussion during the strategy formulation process.

The experts again recommend that government must be willing to collaborate and, if necessary, cede control of the ICT solution to community entities, tertiary institutions, small businesses and NGOs to ensure **community ownership**. Experts also recommend that the **project's timeframe** be included as part of the strategy. The **funding model** and its mechanism are also recommended as part of the strategy. It is important to note that the funding model is also discussed extensively as part of the strategy formulation process.

The experts also recommend that **community ownership** must be added as one of the strategic factors. They recommend **interoperability** as well as one of the key factors of the strategy.

One of the experts recommends the removal of the **TVWS** and that it should be replaced by the **Dynamic Spectrum Sharing Technologies**. The other expert recommends that the locals be trained on **support and maintenance of the infrastructure**. **Affordability** of the ICT services is also recommended. However, affordability is discussed extensively as part of the initial strategy formulation.

Furthermore, one of the experts recommends the removal of the removal of the **PPPs**. It is important to note that 80% of the experts highlight the importance of PPPs as one of the funding strategies. One of

the experts recommends that **incentives** be added as one of the strategy factors. The strategy was accordingly amended as recommended by the subject domain expert, and a number of the strategy factors added to the final strategy.

9.8 Applicability of the Strategy

Strategy implementation involved short-term plans for carrying out the projects agreed on in the strategy formulation. It involved obtaining resources, creating structures, and defining action plans and processes to be followed to achieve the set objectives. It required precise coordination as it takes place as a problem-solving action. The implementation of a strategy also identified the role-players for each sub-objective and explains the steps to take and what resources must be in place to action a specific sub-objective. The implementation of this strategy required the interaction of three components, as identified in Chapter 7, namely, the government, regulators and the service providers.

For the strategy implementation to be successful, it is necessary to get the buy-in of the entire spectrum of government structures and the relevant service providers.

The stakeholders who are using this strategy in their roles as healthcare workers include, but are not limited to:

- National Government departments;
- Provincial departments;
- Local governments;
- Regulators; and
- Service providers.

The involvement of these stakeholders ensures that the strategy for sustainable ICT development in deep rural environments is implemented and guided by government policies. The stakeholders listed above normally are more literate than the people with whom they consult. They should thus make sure that the person knows how to use the technology intervention and understands the implications of the intervention.

The stakeholders that will be involved in the implementation of this component will be the:

- Traditional council and leaders;
- Non-governmental organisations;

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- Local businesses; and
- Community members.

9.8.1 Strategy Scenario at the Rural Community Level

There are a number of levels, as highlighted in Table 8.1, that the strategy for sustainable ICT can be applied based on the requirements of the rural community. The following levels will be explored to ensure development of deep rural environments.

- Societal level;
- Business Level; and
- Administrative level.

Table 9.15 Types of interaction enabled by ICT among the main actors in rural regions

TO **FROM**	**Individual/Citizen**	**Business**	**Administration**
Individual/Citizen	**C2C** **Citizen to Citizen** e.g. social networks, e-communities	**C2B** **Citizen to Business** Citizens as clients – access to marketplace or businesses Citizens as employees	**C2G** **Citizen to Government** e-government (access of citizens to public services e.g. tax offices)
Business	**B2C** **Business to Citizen** e.g. e-marketing, e-commerce, e-banking	**B2B** **Business to Business** e.g. e-commerce, networking – virtual enterprise	**B2G** **Business to government** (access of business to public services)
Administration	**G2C** **Government to Citizen** e-government – provision of public services	**G2B** **Government to Business** e-government	**G2G** **Government to Government** e-government **G2E** (e-governance – government to employee)

Table 9.15 maps the different types of interactions and levels among the main actors in the rural areas and these are fully outlined below:

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a) Societal Level

This is a level where citizens and consumers improve the quality of their lives and access better services and valuable information. This will make sure that the peripheral and outermost regions have improved opportunities for access to competitiveness and remove obstacles to geographical distances which are in isolation.

Access to information will require that the end users get capacitated to make sure that they are able to explore the full benefits of ICT. The e-Learning applications are quite useful both at the educational level (school) and the community level. The impact of e-learning programmes on society is also difficult to distinguish from many other factors that affect society. The potential impacts of e-learning that offer disadvantaged groups access to high quality education are very critical.

The computer lab is one of the recognisable e-learning techniques. The computer lab usually consists of many personal computer stations. This is a general arrangement found in schools around the world. There are many training programme packages available that can be installed for student use. The separate positions allow individual students to move at their own pace through the material.

The research findings also indicated a good penetration of Mobile/Smart Phones. The cellular coverage is available in the rural communities with the major concerns being the slower broadband speed offered on those networks. One of the other major barriers is the cost of smart phones which will still need to be driven down for the communities to afford end user devices. The smart phones can also be used as an e-reader, or for communicating with other members of the community for information sharing.

Mobile phones/Smart phones can also be recharged from a solar system. In the schools, on the electricity network, energy is regulated to guarantee the work of users and the safety of the devices. Other models of e-learning can be studied, such as tablet-type laptops and classroom projectors. Teachers and community leaders training, student and community involvement in content development must be part of the implementation process. The systems should be used for various activities including social and professional networking, research, class preparation, class and school administration, tutorials and educational games.

One other application of the strategy within the rural community is the e-libraries for access to information and knowledge repositories. Mobile technology is developed for a variety of applications, and features allow the interaction of potential users in various ways (Southwood, 2010). At the same

time, libraries have changed their approach to customer-centric services in recent years, particularly the provision of reference digital information services (Griffey, 2010). The starting point was that the communities had an Internet connection in one way or another and this would be assisted by the development of the concept of digital content generated by users that is compiled in an indigenous online database. The implementation of the strategy should operate as an integral part of the local public library and information services within the local municipality in the rural community of the AmaJingqi in the Eastern Cape, using both conventional desktop and the latest mobile technologies.

b) Business Level

ICT enables small businesses in rural areas to produce higher productivity and profitability, reach a broader market, reduce transaction costs and monitor stocks more efficiently. ICT on the consumer side provides greater consumer satisfaction for interaction with many potential suppliers as well as limiting their location. This creates very necessary jobs in the process.

Businesses and small-medium enterprises with the potential of ICT evolve into more efficient management and organisational structures, with direct access to employee training and other services, direct online interaction with customers and suppliers, and include opportunities for collaboration. .

The global development of ICT has created a paradigm of new agricultural development that promises to change agricultural performance and improve rural livelihoods in developing countries. In recent years, the country has witnessed a rapid change in the production of public services based on information technology and high-tech communications with major innovations in key development sectors. The growth of e-agriculture is considered a driving force to accelerate agriculture and rural development, promote food security and reduce rural poverty. This chapter examines e-agriculture initiatives in South Africa. It describes ICT to improve the quality of agricultural management decisions, the agricultural market information system, electronic packaging, product traceability and online marketing so that they can benefit from the global wine markets productive.

Given the strategic importance of agriculture in supporting the livelihoods of the rural population in the Eastern Cape, the successful deployment and effective use of ICT are essential for the development of sustainable agriculture and raising the standard of living in marginalised communities. The growth of e-agriculture is considered a tool and a viable alternative to accelerate agricultural development, promote food security and facilitate rural relaxation in the new millennium. Modern ICT is able to

increase the agricultural production of small-scale households through the exchange of knowledge and information and by providing access to the market and resources. Small farmers should use ICT to obtain market information. It is interesting that farmers who use ICT receive higher prices than farmers who do not use ICT to obtain market information. The Kenya Agricultural Commodity Exchange Limited collects and disseminates current market information to farmers through SMS.

The research findings also show that a number of small businesses still prefer to use the conventional method of placing orders for their businesses. There is a widespread availability of cellular networks within the rural community of the AmaJingqi and this will enable the small businesses to place orders online and get their stock delivered to their stores. One of the major barriers is the lack of computer skills and the limited use of the smart mobile devices.

The literature review argued that the prevalence of low ICT can also be attributed to the costs and prevalence of digital illiteracy team through the establishment of policy directives to guide initiatives for reduced cost of end user's equipment.

c) Administration Level

E-Government service is about transforming the government to be more citizen-centred. Technology is, therefore, a tool in this activity. The success of e-Government services requires the way in which the government functions, how it handles information, how officials analyse their work and interact with the public to change. E-government services also require active partnerships between authorities, citizens and the private sector. The e-government process requires continuous contributions and comments from "clients" of the public, companies and officials that use it. Their voices and ideas are essential for the functioning of e-government services.

The aspect of social development and the dividend is also an agenda which is promoted by the government. The use of ICT has been proven to be an enabler and a tool which, if used, will improve the livelihood of the deep rural development. The strategy for sustainable ICT will ensure an improved knowledge and access to social programmes of the government (e-government) which will ensure regular interaction between the people and the state, and this, in turn, will ensure improved service delivery with the improvement of people’s lives.

One of the objectives of rural ICT is to provide the poor with better public services through a more effective and efficient dissemination of information and the provision of essential public services. Electronic governance creates a greater sense of commonality and improves the decision-making process based on knowledge and the development programme.

The research findings highlighted a huge number of community members who depend on the social grant. The e-government services is essential to encourage the community members to use the Internet services to access essential services such as registration of newborn babies for the application of birth certificates and registration for old grant services. Through the implementation of e-government initiatives, the South African government should aim to provide higher quality and faster service to the public.

9.9 Conclusion

This chapter dealt with the validation of the strategy to fortify its strength and validity. The expert reviews agreed to affirm most of the assertions and components of the suggested strategy with a few added amendments that needed to be included as part of it. The evaluation addressed the validation of the strategy formulation and this was largely confirmed as an appropriate approach on the formulation of the strategy. This also resulted in the amendment of the strategy to justify its legitimacy and effectiveness. There were a number of important aspects which were added into the strategy and this included the provision of the external power sources, education, exposure, partnerships, community ownership and collaboration with rural communities. The overall strategy is then inclusive of other important components such as behavioural economics, local indigenous knowledge, economic development of the local communities and employment creation.

9.10 Summary

This chapter presented an evaluation of the proposed strategy and the overall conclusion of the validation is positive. The proposed strategy is considered important and relevant, as well as useful and valuable by experts in the related fields. The experts stated that the strategy is adaptable and customisable, and required little improvement. They confirmed that the strategy is ready for implementation and they recommend it for adoption. The proposed strategy remains unchanged with minor adaptations based on the proposed changes to add a few factors, as suggested by the subject domain experts. The chapter also outlines the applicability of the strategy within the rural area of the

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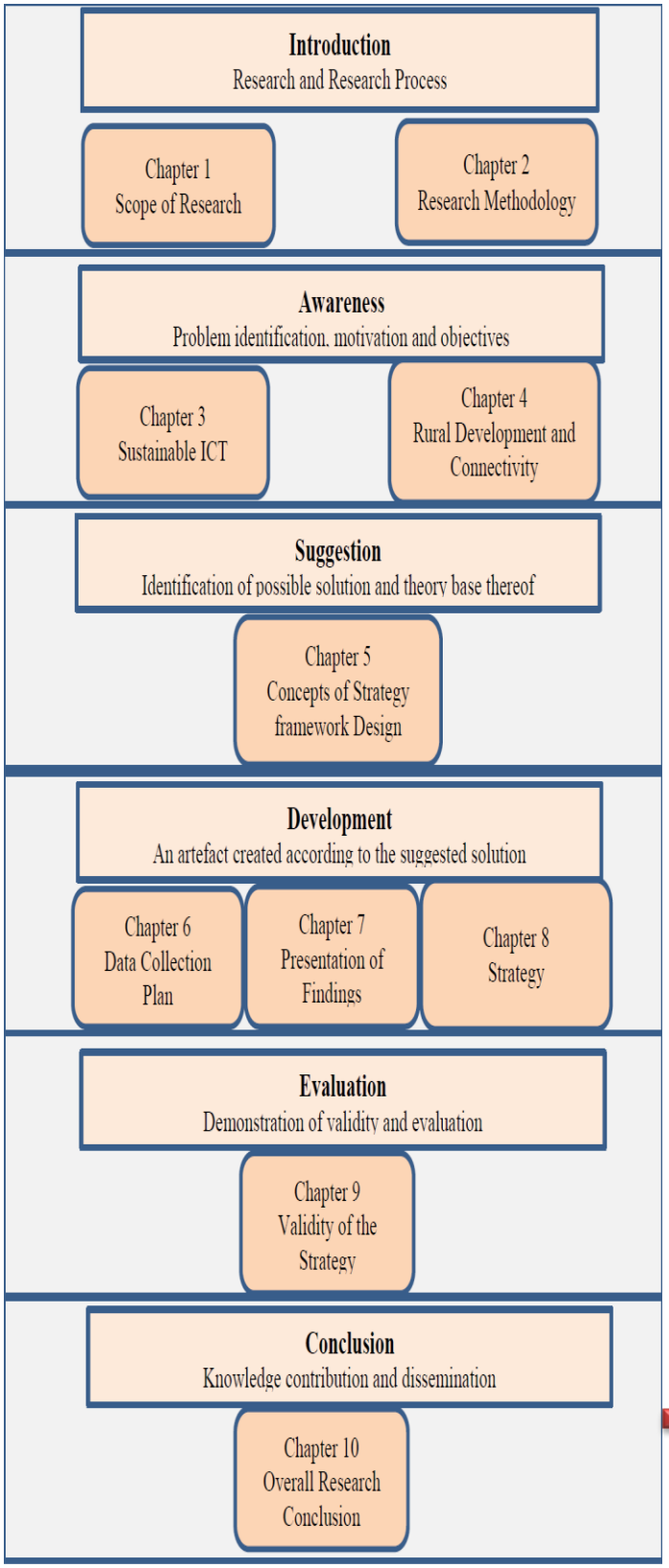
AmaJingqi and also presented a number of scenarios where it can be applied to benefit the affected communities.

The next chapter presents the conclusion of the thesis. It will revisit the study's main objectives and will give an overview of the study and the contributions. It also presents the limitations of the study and recommends future research.

CHAPTER 10: OVERALL RESEARCH CONCLUSION



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10.1 Introduction

Chapter 8 presented a strategy formulation model to address the problem at hand, namely, the lack of a clear strategy for sustainable ICT development in deep rural environments. This chapter offers a summative conclusion of this research. The research defined the problem to be addressed as the lack of any apparent strategy for sustainable ICT development in deep rural environments. Consequently, the main research objective was to devise and ensure a sustainable strategy for sustainable ICT development in deep rural environments and this was achieved.

With the above-mentioned in mind, this chapter is structured as follows, Section 10.1 presents a brief introduction. Section 10.2 restates the research sub-objectives and how they are achieved while Section 10.3 provides a summary of the research methodology used in conducting this research. This is followed by Section 10.4, which briefly evaluates the research. The significance and contributions of this research are discussed in Section 10.5 which deals with the research contribution. Section 10.6 deals with the research reflections under the headings: methodological reflection, practical reflection and theoretical reflection. Then Section 10.7 addresses the lessons learnt during the study. Section 10.8 then outlines the limitations of the study and suggestions for future research follows in Section 10.9. Finally a summary of the research is presented in Section 10.10.

10.2 Achievements of the Research Objectives

The main research objective is to develop a strategy that will ensure deployment of sustainable ICT development in deep rural environments.

The following sub-objectives are addressed to achieve the main research objective:

- To define a strategy that will ensure an implementation of sustainable ICT development in deep rural environments;
- To clearly define the ICT sustainability;
- To profile different users and outline the definition of deep rural environments; and
- To describe the complete composition of the sustainable ICT Intervention.

This subsection discusses each of above sub-objectives, and how they are achieved, in more detail below:

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10.2.1 Sub-Objective 1

To define a Strategy that will ensure an implementation of Sustainable ICT Development in Deep Rural Environments.

This sub-objective was achieved by synthesising and interpreting the findings of the case study that is presented in Chapter 8. The factors identified in Chapter 8 are synthesised and categorised into three categories: (i) Digital Inclusion, (ii) Rural Development, (iii) Government Leadership, (iv) Adoption of ICT, (v) Technology Infrastructure and (vi) Funding Model factors. The next stage is to identify distinct themes using multiple iterations to make sure that the identified themes are accurate and complete. The kernel of a strategy, as proposed by Rumelt (2011), is used to diagnose the actual problems within the rural community. Diagnosis is the core component of the strategy that is used to define the type of the challenge, highlighting the critical aspects of the environments directly from the environmental assessment and the hindrances which have to be overcome. In the diagnosis, an attempt is made to identify the fundamental problem and put it into context by thoroughly comprehending the situation. At the very least, the diagnosis classified the situation, linking facts to patterns, and suggesting issues which needed to be addressed. The diagnosis helps to simplify an overwhelming, complex and ambiguous situation so as to make sense of the situation.

10.2.2 Sub-Objective 2

To clearly define the ICT Sustainability.

Chapter 3 of the study has dealt extensively with various elements of the ICT sustainability. The elements of sustainable ICT are dealt with and cover areas such the demand and supply sides and the need to make sure that a solution for the community is provided in the context of the local needs. The chapter also outlined various elements such the need for sustainable policy intervention on spectrum and the need for an effective funding mechanism for the rural ICT projects.

10.2.3 Sub-Objective 3

To profile different Users and outline the definition of deep rural environments.

The first part of the sub-objective of profiling different users is achieved through an extensive, comprehensive case study carried out in the rural area of the Eastern Cape outside of Willowvale and

involving the use of semi-structured interviews and questionnaires, as reported in Chapter 6. The case study involved ordinary members who included professionals such as the educators and health care workers in the rural area and was undertaken over a period of two months. Its intention was to explore the experiences of the community on how they use ICT and the challenges they are faced with. The aim of carrying out the case study was to get first-hand information to fully understand the current position and utilisation of ICT services in the community.

There was also a one on one engagement with the Chief and an Elder within the Kulo-Jingqi rural community outside Willowvale which was used as a case study. The Kulo-Jingqi is an Amalgamation of 22 villages in the southern part of Willowvale within the rural municipal area of Mbashe in the Eastern Cape. Their community has a total population of about 11 000 with an unemployment rate of 87% and a 100% primary source of income being the government social grants. This is a clear indication that the majority of the rural communities are very poor with a lack of access to financial means and this will have been classified as not being able to afford services.

10.2.4 Sub-Objective 4

To describe the complete composition of the sustainable ICT Intervention.

This sub-objective was achieved by identifying appropriate guiding policies, as per Rumelt (2011), for each of the challenges diagnosed earlier. A guiding policy specifies the overall approach to dealing with the obstacles identified during the diagnosis. Hence, for each guiding policy there is a need to identify a set of coherent actions. The set of coherent actions is defined in the form of steps, policies, resource commitments and actions designed to activate the guiding policy. The next stage is to establish the order in which the coherent set of actions is to be implemented, resulting in the eventual strategy which thus formed the main research contribution.

The proposed strategy was also subjected to expert reviews in the form of an evaluation tool which was conducted with subject domain experts to evaluate the usefulness and applicability of the proposed strategy. Five participants were selected to evaluate the proposed strategy model. The overall response was that the factors of the proposed strategy are very important and relevant and minor additions to the strategy were recommended and the strategy updated accordingly in Chapter 8. These sub-objectives helped to address the purpose of this research.

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10.3 Research Methodology

The overarching methodology for this research was a case study approach. The case study methodology, as expounded by Yin (2014), is used to build a single extensive embedded case study, which consisted of designing the case, conducting the case and analysing the case evidence.

This research adopted a single embedded dimension as the unit of analysis. A single embedded case study was selected because this method enables an in-depth study to be carried out. In this case, the real-life phenomenon to be studied is the way in which strategy for sustainable ICT development in deep rural environments.

An interpretivist paradigm was applied to the research mainly because it allowed for the exploration and in-depth understanding of the context and the environments in the rural community of the AmaJingqi where the study was conducted. A mixed methods approach is used for this research to gather rounded and reliable data. A mixed methods approach is highly appropriate for this research because rural areas are quite diverse environments and therefore no single method would have adequately addressed the complexities of the sector.

10.4 Research Evaluation

Case studies are often classified as failing to sufficiently develop operational measures and of relying on "subjective" assessments. However, it is important to note that case studies are generalisable to theoretical propositions, and not populations (Neuman, 1997; Yin, 2014). Theories developed within the research need to be based on empirical data and not linked to a specific context. To combat the criticism of the case research methodology, Yin (2014) suggested few techniques for ensuring reliability and validity in exploratory research as in this particular study. These are the constructs of validity, internal validity (for explanatory or causal studies), external validity and reliability.

To substantiate that the research had been done appropriately and suitably according to qualitative research there is a need for an evaluation (Meadows and Vollman, 2016). Bryman (2015) also stated that qualitative research must be evaluated to guarantee rigour, credibility and integrity. Therefore, research evaluation is an important part of qualitative research. The subsection below discusses the evaluation of this under the headings of validity, reliability and generalisability.

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10.4.1 Validity

Validity is a term used to indicate whether the methods and other steps taken during the conduct of research are appropriate for the research that has been undertaken. In this research two theoretical frameworks are identified to achieve external validity. During data collection, triangulation of data sources and viewpoints from various role-players in the ICT sector are undertaken with the aim to increase construct validity.

10.4.2 Reliability

According to Easterby-Smith et al., 2008, reliability refers to the extent to which the data collection techniques or analysis procedures will yield consistent findings. To ensure reliability in research, a case protocol can be used which outlines all the steps taken in the research. This protocol allows other researchers to come up with almost similar results. In addition, all the participants are made aware of the purpose of the research and are given the opportunity to ask questions before the commencement of the interviews or the completion of the questionnaires. This ensures that the respondents answered the questions with the full knowledge of the purpose of the research and without any reservations. The respondents are assured that their participation is confidential and hence they will need to answer questions as honestly as possible. Finally, the data is compiled and analysed using the research methods outlined in Chapter 2 to ensure accuracy and reliability.

10.4.3 Generalisability

The correct undertaking of the case study should not only fit the specific group of people or event studied but should generally provide an understanding about individuals and groups with similar attributes (Berg, 2007). The research was conducted in a rural community in the Eastern Cape which has similar challenges to all the rest of the rural areas; it is for this reason that the outcomes might be limited due to the contextual and technological variations. However, the outcomes might have to be all-encompassing to all the South African rural communities, which generally experience the same contextual and technological situation as the community of the AmaJingqi.

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10.5 Contribution

This research contributed knowledge at the methodical, practical and theoretical levels. It contributed to an increased understanding of sustainable ICT development in deep rural environments specifically within the community of AmaJingqi. The research also contributed to the body of knowledge on the use of ICT in the rural community for development. The rural communities of South Africa have unique dynamic needs and requirements which may be met by use of sustainable ICT. The major contribution of this research is the strategy for sustainable ICT development in deep rural environments. This research broadens knowledge of the need for the adoption of a strategy for sustainable ICT development in deep rural environments.

This study identified and recommended ways to address the lack of strategy for sustainable ICT development in deep rural environments; and its proposed strategy can be used to guarantee sustainable ICT. Therefore, it should be noted that this study contributes way beyond the proposed strategy.

Strategy for sustainable ICT: Essentially the strategy identified several factors to ensure a strategy for sustainable ICT development in deep rural environments. The strategy included digital inclusion, government leadership, technology infrastructure, ICT adoption and a funding model as some of the most important factors for a strategy for sustainable ICT. The strategy focused primarily in deep rural environments of the AmaJingqi community.

There are additional factors recommended by the subject domain experts to be added to strategy and these range from behavioural economics, local indigenous languages, partnerships, incentives, education exposure, community ownership, dynamic spectrum sharing technologies, training locals for basic maintenance, external power generation, and project timeframes.

The study is conducted for the rural community of the AmaJingqi but will be applicable to all the rural communities of South Africa as they all have similar challenges. The National Planning Commission (2012) emphasised that South Africa's rural communities should have greater opportunities to participate fully in the economic, social and political life of the country, supported by good-quality education, healthcare, transport and other basic services. Successful land reform, job creation and rising agricultural production will contribute to the development of an inclusive rural economy. Thus the strategy for sustainable ICT development in deep rural environments will make sure that the aspirations of the NDP are fully realised.

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Evaluation tools: The proposed strategy framework was evaluated by five experts. The google online evaluation tool was developed for the experts and this is attached in Appendix B. Minor recommendations are noted and the comments and suggestions are used to modify the strategy.

There are five parts of this tool (Part A - E). PART A which included the main aim of the tool, instructions on how to use it and a brief description of the elements of the proposed strategy. Part B asked for biographical information and PART C presents the factors identified as influencing the successful implementation of strategy for sustainable ICT development in deep rural environments with a view to obtaining comments about them. PART D briefly described and defined components on the formulation of strategy for sustainable ICT and PART E sought to validate the proposed strategy as a whole.

Parts (Part A - E):

- Part A-is the introduction;
- Part B-collects the biographical information;
- Part C-presents the factors identified, as influencing the successful implementation of the strategy; and
- Part E-seeks to validate the proposed strategy model as a whole.

The strategy evaluation tool forms a template that can be customised and used for the assessment of another strategy model.

10.6 Reflections

This section presented reflections from three perspectives: methodological; practical and theoretical. The methodological reflection described the stance taken to conduct research; the practical reflection described how the research contributed to the existing literature and the theoretical reflection described how the research contributed to the theoretical knowledge of the research community.

10.6.1 Methodological Reflection

An interpretive case study methodology is followed as it is suitable to respond to the aims and research questions of the study. Thus, this research provided a methodological contribution by allowing an

extended engagement (Nandhakumar and Jones, 1997) with the research participants to investigate particular issues within the rural communities and formulate a strategy for sustainable ICT.

The study contributed to the need to ensure a strategy for sustainable ICT services for deep rural areas and also covered the importance of ensuring that ICT is used as an enabler for the development in deep rural environments. The study puts an emphasis, amongst others, on a need for effective policies to ensure the availability and adoption of ICT services, which will, in turn, ensure sustainability.

This study investigated factors that might influence the formulation of the strategy for sustainable ICT. The two paradigms that underpinned this study are the pragmatic paradigm and the design-science paradigm. Neither the pragmatic nor the design science paradigm is committed to any one system of philosophy and reality. Both paradigms had a philosophical underpinning for mixed-methods studies, where the researcher emphasises the research problem and utilises the diverse approaches accessible to understand the problem.

Hence, this study is a mixed-methods study. Both qualitative and quantitative data is collected from the observations, the questionnaire and the expert reviews. Descriptive and content-analytical methods are used to interpret and analyse the data; so that conclusions can be derived from the results.

10.6.2 Practical Reflection

This research contributed to the existing literature as there is currently a dearth of academic research on the strategy for sustainable ICT development in deep rural environments within the context of South Africa and the Eastern Cape Province. The major contribution is the diagnosis of the problems that are experienced around the use of sustainable ICT for the development in deep rural environments. The diagnostics are:

- the gender digital divide,
- the importance of youth development,
- unemployment,
- literacy,
- ICT infrastructure,
- market competition,
- affordability,

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- Other media platforms,
- Internet access,
- policy and regulatory framework,
- economic development,
- passive infrastructure,
- digital literacy, and
- infrastructure support and maintenance.

In addition, the research contributed to the guiding policies required for each of diagnostic. The guiding policies that resulted are:

- digital inclusion;
- rural development;
- government leadership;
- adoption of ICT;
- technology infrastructure; and
- funding model.

Subsequently, the research contributed a coherent set of actions for each of the guiding policies.

The study conducted an evaluation of the strategy by a means of structured feedback from the subject experts and a number of factors to enhance the effectiveness of the strategy were added and these are:

- behavioural economics;
- local indigenous knowledge;
- incentives to offer services in remote areas;
- importance of education exposure;
- community ownership of the local networks;
- interoperability of networks;
- dynamic spectrum sharing technologies;
- training of locals for basic maintenance;
- external power generation; and
- project timeframe.

The main obstacles and correct interventions needed from each stakeholder are identified. The research, to the best of the researcher‘s knowledge, is the first and outlined a strategy for sustainable ICT for the rural community of AmaJingqi in the Eastern Cape.

Therefore, this research has provided the foundation for appropriate interventions from government and other role-players within a rural community. Policymakers in South Africa and other similar countries can use this research to develop more focused policies in this important sector. However, the major contribution of this research is a strategy for sustainable ICT development in deep rural environments.

10.6.3 Theoretical Reflection

The research developed a strategy formulation process model, as shown in Figure 10.1. This model is utilised to develop the eventual strategy as the research output of this research and is a contribution to the body of knowledge, especially in the study of the rural areas in the Eastern Cape. The model can be used by other researchers who may be interested in conducting research in the field’s strategy for sustainable ICT development in deep rural environments as well as other related studies.

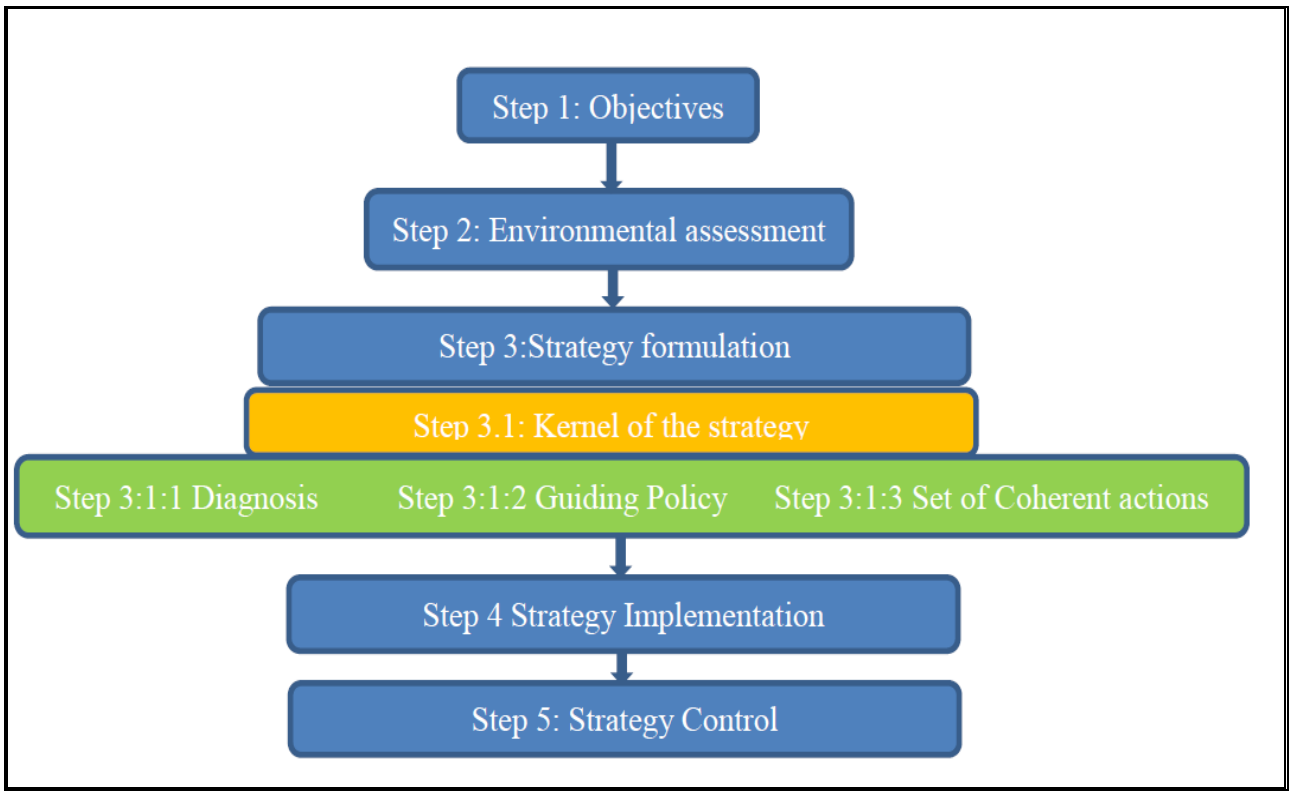

Figure 10..1: Strategic formulation processes model (Researcher’s Design)

Thus, the research also succeeded in providing a theoretical model for strategy formulation. In addition to the model, the research offered a deep understanding of the strategy factors for sustainable ICT and set out coherent actions which needed to be taken in deep rural environments.

10.7 Lessons Learnt

The topic areas of the study were fairly extensive, emergent fields in their right. A narrower study scope may have resulted in more manageable datasets. As it is, the data collected is fairly extensive, and only the most pertinent data sets are used. The application of additional statistical methods may have provided more extensive results. A wider and more representative sample population is also likely to yield more results. Despite conducting one set of extensive questionnaires, problems still emerged, and a more extended pilot study is recommended.

The majority of data collectors had Grade 10 as the highest form of qualification, and this had many challenges and limitations when it came to understanding ICT and being able to ask follow up questions where clarity might have been needed. There was, however, extensive training to make sure that the data collectors had a basic understanding of ICT data collection and basic interpretation.

10.8 Research Limitations

Some ICT policies have been developed by the government to address the issue of the lack of ICT services in rural areas. The study did not endeavour to investigate the impact and how far the policies have been implemented and if there have been any benefits for the recipients.

The scope of the study used a small population outside Willowvale to check on what is needed to make sure that a strategy for sustainable ICT gets developed, and there are evident benefits and development in deep rural environments from the available ICT services. As a result of the sampling method used and the small size of the research sample, there are limitations to the data. Given the nature of the sparsely populated rural community involved, the study cannot be spread beyond the Traditional Council of the Amajinqi. There are, thus, limitations concerning the overall conclusion that the situation might be as dire across all the rural communities in the Eastern Cape Province. Along with the small sample size, this limited the generalisability of the findings.

The study acknowledges the fact that there are some extensive interventions that the government still needs to undertake. These include the reallocation of the digital dividend spectrum which has much

bearing on the achievement of the universal services and access. The cost and the extent of the delay of the redistribution of the spectrum are very large. However, the study did not have the capacity to research the quantification of such cost.

10.9 Suggestions for Future Research

There is a need to determine the most appropriate technology that will suit the affordability and the absolute need for the rural communities. There had been a major discussion and tests conducted on the possibility of using the Television White Space as one of the technologies. However, this is yet to be fully implemented and tested over time on whether it is the appropriate technology to meet the needs of the rural communities. The cost-effective and sustainable funding model is yet to be fully researched as well and will have to cover the simplified funding model.

10.10 Conclusion

The purpose of this research was to develop a strategy for the sustainable ICT development in deep rural environments in the rural community of AmaJingqi. The research was motivated by the apparent lack of ICT utilisation for the development of the rural communities of the AmaJingqi. The strategy was therefore developed as a solution to this identified gap. The problem statement formulated resulted in the design of the research objectives carried out in Chapter 1.

It can be concluded that the purpose of the research is satisfied through the development of the ICT strategy, and its implementation plan as well as it evaluation plan. The strategy for sustainable ICT advocated seamless and improved access to information and this in turn will ensure effective information flow within communities. The roll-out of robust ICT services will make sure that effective exchange of information is promoted, and the lives of the people will be improved in the process. The accessibility to ICT infrastructure has to be one of the major considerations in ensuring universal ICT services and access. Thus cost-effective, power-efficient technology will be critical to ensure a strategy for sustainable ICT. The technology must have the capabilities of bandwidth on demand and be dynamic enough to make sure that the bandwidth gets allocated where it is needed in the moment. A people-focused solution where users will derive the benefit will have to be designed and implemented. The solution will have to be user-centric and be able to address the needs of the rural communities. It is critical that the service and technology neutral licensing regime is also encouraged to ensure economies of scale and maximum return on investment.

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The aspect of social development and the dividend is also an agenda which is promoted by the government. The use of ICT has been proven to be an enabler and a tool which, if used, will improve the livelihood of the deep rural development. The strategy for sustainable ICT will ensure improved knowledge and access to social programmes of the government (e-government), which will ensure regular interaction between the people and the state, and this will ensure improved service delivery with the improvement of people's lives.

ICT had been identified by the government to be one of the major drivers of the development of the SMMEs in areas of information provision, access to national and international markets, and other areas of business development and support. ICT enables entrepreneurs to manage their businesses efficiently, thus enhancing their competitiveness in the global market. They can increase their geographic reach, improve efficiency in procurement and production and improve customer communications and management. For these reasons, the need to encourage and accelerate the uptake and optimal application of ICT by SMMEs in different sectors of the economy cannot be overemphasised. It has to be emphasised though that there is a clear lack of ICT infrastructure to enable the small businesses in the community to order supplies online and get them delivered to the business premises.

There is also a need to encourage the use of ICT for business incubations. Business incubations will be able to provide seamless access to the much-needed resources; this will also offer support and offer the services which the SMMEs and new entrants into the market need to be established successfully. There are number of SMMEs which need help in establishing their business strategies and then creating their core business management skills. ICT will then serve as an enabler for efficiency within the operations and administration of their rural small businesses. Business incubations will focus on the deployment of ICT to support the business processes, before progressing to e-business applications. The latter will be of greater importance in the beginning for the export-oriented businesses. This will have to be the adopted approach to introducing ICT to the small businesses within the rural communities.

One of the most critical areas to ensure sustainability was to ensure a sustainable business model. The dynamics are so diverse within the rural communities, and it will require a tailor-made business model to ensure sustainability. The hybrid model of PPP and Government-funded initiatives are recommended. The success of the business model will depend on the development of capable entrepreneurs. Effective operational plans will have to be developed and implemented. The plans must have clear and measurable milestones and timelines. The appropriately structured projects which made a case for the investment will be pivotal in ensuring success and strategy for sustainable ICT.

Cross-sectoral coordination to ensure minimal duplication of resources and quicker turnaround time on the main projects implementation is critical to ensure successful strategy. These coordinated initiatives will ensure full leverage on the collaborative networks and will ensure an integrated vision and realisation of full benefits derived from the ICT services. Multi-layer government planning is therefore encouraged to ensure effective implementation of the main ICT projects.

The government must facilitate and ensure competition and private investment. To ensure investor confidence, the Government must act as a risk-taker. The Government must make sure matrices are put in place for regular measurement of ICT impact, and this will be effective once there is a clear, robust monitoring and evaluation framework.

To promote the uptake and usage of the ICT services, the community will have to be involved in the design process with a clear understanding of the local context and ensure a successful implementation of the solution. To ensure a positive attitude to information technology and its products, the government will need to come up with effective change management processes that will make sure that behaviours that are supportive of the sustained adoption of technology are developed.

Finally, the policy directive within the ICT sector is also one of the pivotal drivers to make sure that strategy for sustainable ICT is realised. There are a number of interventions which are needed to make sure that the issues of demand stimulation get addressed together with infrastructure sharing as prescribed in the discussion of the Rapid Deployment draft policy paper. To ensure maximum benefits, the ICT policies will have to be integrated into the national economic growth and development strategies. There is a need to develop a specialised institutional capacity that is required for policy responsiveness.

10.11 Summary

The research followed a case study approach whilst using an interpretivist philosophical stance. The research methodology and design section of the study is presented in Chapter 2. Chapters 3 and 4 are chapters in which the literature was reviewed to understand the nexus of strategy and sustainable ICT. Chapter 3 gave an outline of what is meant by sustainable ICT and Chapter 4 defined what is meant by rural development and connectivity. Chapter 5 defined the strategy framework and various components which constitute a strategy. Chapter 6 presented the data collection process, presented the results of the case studies, and triangulated the results with those from the ethnography and the document and data analysis. The data analysis and findings were then outlined in Chapter 7. The strategy was then defined

and outlined in Chapter 8. Chapter 9 presented validation of the strategy and, finally, Chapter 10 presents the overall research conclusion.

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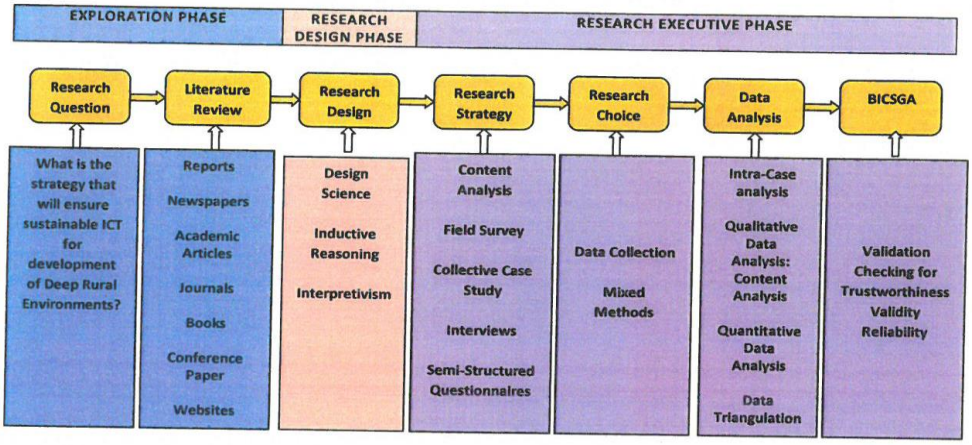
Appendix A: The Questionnaire

The methodology summary is given in the figure below.



PROJECT PhD: QUESTIONNAIRE
FOR ICT USERS AND HOUSE OF TRADITIONAL COUNCIL

The Objectives of the Questionnaires:

1) *To understand the ease of access to ICT services and which type of services is the community able to reach.*
2) *To assess income profile and affordability of different household.*
3) *To assess the level of ICT skills and computer literacy among the various communities*
4) *To assess the readiness of the various users to adopt new technologies*
5) *To understand the buying patterns of local businesses and access to online banking.*
6) *To assess level of understanding of the community on the benefit of ICT*
7) *To assess the level of sustainability of any ICT initiatives within the communities.*
8) *To assess the ability to innovate and culture of creative thinking*

SECTION A: ADMINISTRATIVE SECTION (TO BE COMPLETED BY THE INTERVIEWER)

1

Name of interviewer:	

Interview Date:			2015

SECTION B: BACKGROUND INFORMATION:

Name of participant		**Gender**	☐ Male	☐ Female

Age	☐ 16 – 21	☐ 22 – 30	☐ 31 - 40	☐ 41 – 50	☐ 50+

Category of participant	Youth	Employed	Self Employed	Unemployed

Home language	1) Xhosa 2) Zulu 3) Setswana 4) South Sotho 5) North Sotho 6) Venda 7) English 8) Afrikaans 9) Other	**Is participant literate (read and write)?**	Yes	No

Education	**Primary school**	**High School**	**College**	**University**
	Grade 7 or less	Grade 8 (Std 6) Grade 10 (Std 8) Matric	Diploma/Certificate	Degree/Postgraduate degrees

SECTION C: EMPLOYMENT INFORMATION

Who do you work for?

☐ Yourself	☐ Family	☐ Private/Public Sector	☐ Unemployed

If employed, do you work full-time or part-time?

☐ Full-time	☐ Part-time	☐ Fixed-Term Contract	☐ Piece-Work

For how long have you worked here?

☐ Less than one Year	☐ 1-5 Years	☐ 5-10 Years	☐ 10+ Years

SECTION D: COMMUNICATION:

Telecommunication:

Do you have access to a Fixed Line phone?	Yes	No	Where is your nearest access point?	1) Office Computer 2) Home Computer 3) Internet Café 4) Cell Phone	How far do you have to travel?	1) < 5km 2) 5km – 10km 3) 10km – 20km 4) > 20km
How long does it take you to travel the distance?	1) < 1 hr 2) 1 – 2 hrs 3) 2 – 3 hrs 4) > 3 hrs		How often do you need to make the trip?	1) Daily 2) Once a week 3) Twice a week	To whom do you make the most calls?	1) Business calls 2) Relative 3) Friends 4) Other

Do you have access to a fax?	Yes	No	Where is your nearest access point?	1) Office 2) Home 3) Internet Café 4) Cell Phone	How far do you have to travel?	1) < 5km 2) 5km – 10 km 3) 10km – 20 km 4) > 20km
How long does it take you to travel the distance?	1) < 1 hr 2) 1 -2 hrs 3) 2 – 3 hrs 4) > 3 hrs		How often do you need to make the trip?	1) Daly 2) Once a Week 3) Twice a Weak	To whom do you send/ receive the most faxes?	1) Business related 2) Relative 3) Friends 4) Other

Do you own a cell phone?	Yes	No	Make and Model.	1) Samsung 2) Iphone 3) Nokia 4) Blackberry 5) Huawei 6) Other	Type of Contract?	1) Prepaid 2) Postpaid	
If no, do you have alternative access to a cell phone?	Yes	No	Where do you get access?	1) Business 2) Family 3) Friends 4) Other	Do you have a sim card but no cell phone?	Yes	No

Which Cell phone service provider do you use?

☐ MTN	☐ Vodacom	☐ Cell C	☐ Virgin Mobile	☐ Telkom Mobile

What do you use your cell phone for? *(Mark all that apply)*

Making calls	☐ Always	☐ Sometimes	☐ Not at all	☐ Don't know
Receiving calls	☐ Always	☐ Sometimes	☐ Not at all	☐ Don't know
Sending SMS	☐ Always	☐ Sometimes	☐ Not at all	☐ Don't know
Receiving SMS	☐ Always	☐ Sometimes	☐ Not at all	☐ Don't know
Internet browsing	☐ Always	☐ Sometimes	☐ Not at all	☐ Don't know
Internet Banking	☐ Always	☐ Sometimes	☐ Not at all	☐ Don't know
Other (Please specify)	☐ Always	☐ Sometimes	☐ Not at all	☐ Don't know

How much do you spend on airtime in a month?

☐ 0-R50	☐ R50-R100	☐ R100-R200	☐ R200 – R400	☐ > R400

Do you buy SMS bundles?

☐ Yes (Please indicate the cost per month)_____	☐ No

Who writes the SMSes?

☐ Yourself	☐ Somebody else *(Why?)*_____

Is the cell phone reception adequate in your area?

☐ Yes	☐ No	☐ Intermittent	☐ Don't Know

Do you own a television set?	Yes	No	Which are you favorite programs?	1) News 2) Sports 3) Documentary 4) Movies 5) Debates
Do listen to the radio?	Yes	No	Which are your favorite radio stations?	1) Umhlobo wenene 2) Lesedifm 3) Motswedingfm 4) Metrofm 5) R2000 6) SAFM 7) RSG 8) Ukhozifm 9) Other
Do you read the newspapers?	Yes	No	What are your fields of interest?	1) News 2) Sport 3) Finance Column 4) Entertainment Column 5) Others
Do you have a postal address?	Yes	No	Where do you collect your post from?	1) Local Supermarket 2) Post Office 3) Postnet 4) Delivered at home 5) Other

Do you have internet access?	Yes	No	What means of access do you use? (i.e. Community Centre, 3G USB modem, other	1) Community Centre 2) Cellphone 3) ADSL 4) Other	Do you have an e-mail address?	Yes	No

Computing:

Have you ever used a computer? ☐ Yes ☐ No

If Yes, where?

Internet Café	Home	School	Work	Library	Any other place

Purpose of computer use:

☐ Internet ☐ Typing and printing ☐ Pictures and presentations ☐ Calculations

4

How many years of computer experience do you have?

☐ Less than one Year	☐ 1-2 Years	☐ 3-5 Years	☐ 6+ Years	☐ None

If you have computer experience, which of the applications below do you use?

☐ MS Word	☐ MS Excel	☐ MS PowerPoint	☐ Internet Explorer	☐ MS Paint	☐ Calculator

SECTION E: ECONOMY

On average how much do you spend on food (groceries) every month?

☐ Less than R500	☐ R1000-R3000	☐ R4000-R6000	☐ R6000 +

On average how often do you buy food (groceries)?	1) Every Day 2) Once a Week 3) Twice a Week 4) Three times a Week 5) Once a Month 6) Twice a Month 7) As in when I need it

☐ Every day	☐ Once	☐ 2 Times	☐ 3 Times	☐ Other _____
☐ Every week	☐ Once	☐ 2 Times	☐ 3 Times	☐ Other _____
☐ Every month	☐ Once	☐ 2 Times	☐ 3 Times	☐ Other _____

Do you buy some things more often than others?

SECTION F: STRATEGY FOR SUSTAINABLE ICT

Is there any strategy for sustainable ICT for development of Deep Rural Environment in existence?

☐ Yes	☐ No	☐ Not Sure

If the answer is yes, what impact had the strategy had on deep Rural Development?

☐ High Impact	☐ Moderate Impact	☐ Less Impact

In your thinking, are there progressive ICT Policies?

☐ Yes	☐ No

If the answer is YES, How effective are these policies?

☐ Highly effective	☐ Moderately effective	☐ Less effective

Are there any initiatives in place to ensure content creation is encouraged within the communities?

☐ Yes	☐ No

SECTION G: TECHNICAL SUPPORT

Do you know who to contact whenever you have ICT related problems?

☐ Yes	☐ No

What are typical problems that you experience with your ICT networks?

☐ Device	☐ Network Coverage	☐ Connection problems	☐ Others

What is the means of communication to report an ICT related problems?

☐ Fixed Telephone	☐ Cell phone	☐ Fax	☐ Walk-in Centre	☐ Email

What are the challenges encountered when reporting ICT related problems?

☐ Lack of access to communication means	☐ Holding for an Operator	☐ Lack of knowledge who to contact.	☐ Limited Technical Knowledge

Which of these factors would be important if you needed technical support?

	Not important 1	2	3	4	5 *Extremely important*
Receiving support immediately (within 2hrs)	☐	☐	☐	☐	☐
High technical skills from support staff	☐	☐	☐	☐	☐
A well known company or consultant	☐	☐	☐	☐	☐
Support provider is part of my community	☐	☐	☐	☐	☐
Regular maintenance	☐	☐	☐	☐	☐

SECTION H: PAYMENTS

Do you have a personal bank account?

☐ Yes	☐ No

If yes, do have access and use online banking?

☐ Yes	☐ No

If no, who goes to the bank on your behalf?	1) Supervisor 2) Employee 3) Family member 4) Cash intransit services 5) Other

How do you pay for your accounts?

☐ Cash	☐ Check	☐ Credit card	☐ Debit card	☐ EFT

SECTION I: MODE OF BUYING AND TRANSPORT

How do you buy supplies?

☐ Physically go and buy supplies?
☐ Order groceries and collect from the supplier?
☐ Order groceries and have it delivered by supplier?

In case of order and collect or have it delivered by supplier, what is the means of communication to place an order?

☐ Fixed Line	☐ Cell Phone	☐ Fax	☐ Email	☐ Other_____

How effective is the means of communication?

☐ Less effective	☐ Moderately effective	☐ Highly effective

SECTION J:PHYSICALLY GO AND BUY SUPPLIES

What kind of transport do you use?

☐ Own vehicle	☐ Hired vehicle	☐ Taxi/Bus	☐ Other_____

On average, how much does the transport cost you to go and buy supplies?

SECTION K:INFRASTRUCTURE

Categories	Details		X	Description			X
Electricity	Eskom – Power Grid	Yes	No	Stable		Unstable	
	Alternative Energy			Solar Panels			

		Other				
	Account Payments	Prepaid System				
		Monthly Account				
ICT Infrastructure	Do you have access to Internet	Yes		No		
	If yes, what is the means of access?	Cell Phone or Data (ADSL, 3G or 4G) Connection				
		Community or Telecentre				
		Other, specify_____				
	If access is by means of Community or Telecentre, how far do you have to travel to reach the place?	100-300m	300-500m	500m-1km	1-2km	2km+

SECTION L: ICT SKILLS DEVELOPMENT

Rate your skills on the following technological devices.

Cellphone	1) Never used 2) Still learning 3) Skilled 4) Expert	PC	1) Never used 2) Still learning 3) Skilled 4) Expert	Smartphone	1) Never used 2) Skill learning 3) Skilled 4) Expert	Tablet	1) Never used 2) Still learning 3) Skilled 4) Expert

Do you have any Qualifications in ICT?

☐ Yes ☐ No

Are you interested in obtaining and ICT qualification?

☐ Yes ☐ No

If Yes , what career choice will you follow thereafter?

☐ Full time Employment ☐ Own a business within my community ☐ Not Sure

Can you afford to attend a basic ICT Training?

☐ Yes ☐ No

Do you an access to Online ICT Training?

☐ Yes ☐ No

SECTION M: GENERAL

What challenges do you experience in ICT Access on a daily basis?

How do you think these challenges can be resolved?

General remarks:

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Appendix B: Strategy Evaluation Tool

Strategy evaluation tool

This tool has been designed for the experts to validate the proposed strategy for sustainable ICT development in deep rural environments. The main purpose of this evaluation tool is to assess the proposed strategic framework. Additionally, it aims to gather factors that might influence the successful strategy for rural community in the deep rural Eastern Cape. The case study chosen is the rural community of the Amajingqi just outside of Willowvale.

The evaluation will take approximately 40 minutes to complete. Participation is voluntary, you may decide at any time to discontinue. Furthermore, you may withdraw from evaluation at any stage. However, participants who agree to evaluate the strategy are encouraged to answer all questions. Participation is completely anonymous. Thank you so much for taking the time to participate and your cooperation is highly appreciated. If there are any further questions and clarity needed, please contact the candidate by email at jakestsika@gmail.com.

Instructions

There are five parts to this tool (Part A - E). You are currently in PART A which includes the main aim of this tool, instructions on how to use this tool and brief description of the elements of the proposed strategy. Part B asks for biographical information and PART C presents the factors identified as influencing the successful implementation of strategy for sustainable ICT development in deep rural environments with view to obtaining your comments about them. PART D briefly describes and defines components on the formulation of strategy for sustainable ICT and PART E seek to validate the proposed strategy as a whole.

The Proposed Strategy Model

The most effective route to achieving substantial benefit with ICTs in development programmes is to concentrate on re-thinking development activities by analysing current problems and associated contextual conditions, and considering ICT as one ingredients of the solution. The literature study states that ICT projects aimed at reducing poverty often used examples based on providing access to new technology, new skills and better ICT infrastructure with the expectation that ICT will primarily stimulate economic development and output efficiency. Thus, ICTs can assist in improving efficiency and effectiveness of public sector institutions by creating the enabling environments for the community

to increase her competitiveness. Improved systems and networks of information and communication have a dual function, to supply the information required by the poor to pursue sustainable livelihood strategies, and to provide information required by institutions responsible for making decisions that affect those strategic livelihood options.

The Figure 1 below describes some of the elements understood to be key on the formulation of the strategy for sustainable ICT for development of deep rural areas. The following components are outlined:

a) Digital Inclusion

While ICT access is a necessary condition for social and economic inclusion it is not a sufficient condition. As services and devices become more sophisticated and knowledge more pervasively available, the affordability of access and the ability to optimally use them are likely to marginalise more users. Closing the access gap and promoting digital inclusion requires more than simply ensuring that services are available and affordable. It also requires that these services be relevant and accessible for disadvantaged groups and this includes women and the young generation. The strategy for sustainable ICT seeks to address this issue to close the access gap.

b) Rural Development

The National Planning Commission (2012) expressed that by 2030, South Africa's rural communities must have better opportunities to participate fully in the economic, social and political life of the country. People should be able to access high-quality basic services that enable them to be well nourished, healthy and increasingly skilled. ICTs should not only be seen as a means of understanding the complexities of rural livelihood strategies better through improved data collection but also as a means of facilitating increasingly differentiated approaches to achieving rural development goals. The fact that ICTs are so flexible, and as convergence between them continues they become more so, could be used to benefit future rural development strategies if decentralisation of control over the ICTs and autonomy of the information system permeate down to the local level of the rural community.

c) Government Leadership

Government leadership in implementing effective policies and building partnerships within the ICT sector is one of the key components for strategy on sustainable ICT. Clear and unequivocal leadership in support of stated national policy objectives is critical in ensuring that projects move from theory to

practice. Decisions, both those made or not made in 2016, on spectrum, the publishing of a policy on rapid deployment and resulting implementation, more realistic targets and the urgent creation of a compact between the private sector and government on funding and implementation of the policy, is needed to ensure a positive impact on South Africa for years to come. Strong, consistent and decisive leadership is urgently required to deal with the thorny issues involved, thereby crafting a better future for all South Africans.

d) Adoption of ICT

It also needs to be noted that one of an inhibiting factor for the adoption of ICT is the cost to communication and the affordability of Internet services for the mass market within the rural environments. The 'calling party pays' model and highly innovative pricing plans were essential for the spread of mobile to users who have limited ability to pay. A similarly radical and innovative model has not yet emerged in data markets, both fixed and mobile. Further innovation in data pricing is needed to enable viable delivery of access and services to low- income users. This is a complex area in any competitive market and the risk for policymakers is that policy action, or inaction, may confine access to data services to the more privileged.

e) Technology Infrastructure

One of the biggest challenges in rolling out affordable ICT solutions within these communities is the lack of cost-effective wireless solution due to the sparsely populated target communities. A number of literature studies have indicated that the most viable last mile for the roll-out ICT services within the Low-Income Communities is the wireless solution. One of the proven benefits of the TVWS spectrum band is that it can cover larger distances due to the favourable propagation characteristics of the lower frequency blocks within the frequency band.

The government ICT strategy is mainly anchored around capital investment for ICT infrastructure in rural and semi-rural areas, ensuring access to ICT services and the development of Digital Hubs. One of the biggest inhibitors is the cost to roll-out infrastructure to rural areas and is can be reduced by infrastructure sharing.

f) Funding Model

Since the Government is constrained by the twin challenges of reducing the deficit and meeting some competing demands placed on the public purse, the PPP will provide effective solution to this dilemma.

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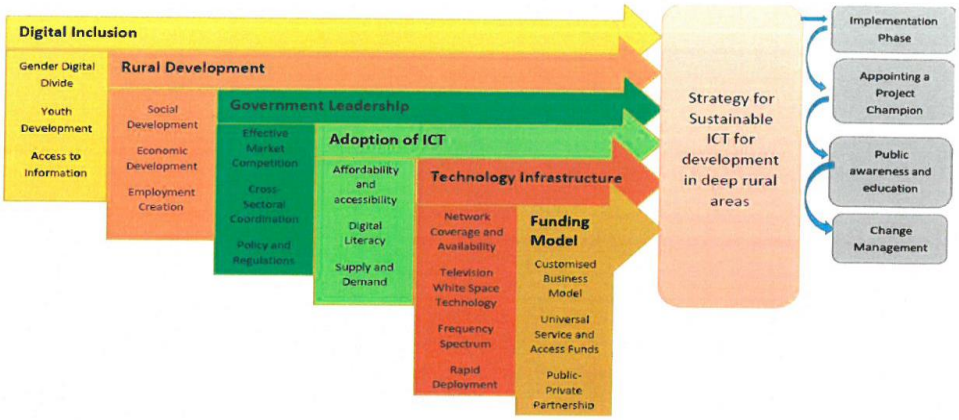
The funding model will make sure that the private sector complement the government's investment with comparable resources of their own. The Private Sector is a significant contributor to research, technology, skills, investment and new business models necessary to scale innovative solutions. The PPP arrangement will make it possible to implement the rural project with appropriate scope and accelerated timescales, ensuring public funds are used in the most effective and efficient manner while encouraging as much private sector involvement and especially risk sharing as possible.

It is also important to keep in mind that the often remote and difficult to serve areas requiring support from USAFs are also lacking in other basic necessities; not just adequate communications.

Strategy Framework Model



Background Information

This section of the evaluation refers to background and biographical information. Where applicable, please select the appropriate option

1. **Gender** *
   Mark only one oval.
   - ◯ Male
   - ◯ Female

2. **Age Group** *
   Mark only one oval.
   - ◯ 20 - 30
   - ◯ 31 - 40
   - ◯ 41 - 50
   - ◯ > 50

3. **Designation** *
   Tick all that apply.
   - ☐ ICT Sector Champion
   - ☐ Academic Sector
   - ☐ Government Legislator
   - ☐ Government Policy Maker

4. **Years of Service** *
   Mark only one oval.
   - ◯ 5 - 10
   - ◯ 11 - 20
   - ◯ 21 - 30
   - ◯ > 30

Digital Inclusion

For the strategy to be successful in deep rural environment, which factors do you think are Very IMPORTANT and which factors are LEAST IMPORTANT in to ensure digital Inclusion inclusing rural communities

5. **Gender Digital Divide** *
Tick all that apply.

- [ ] Very Important
- [ ] Important
- [ ] Not Important
- [ ] Least Important

6. **Youth Development** *
Tick all that apply.

- [ ] Very Important
- [ ] Important
- [ ] Not Important
- [ ] Least Important

7. **Seamless Access to Information** *
Tick all that apply.

- [ ] Very Important
- [ ] Important
- [ ] Not Important
- [ ] Least Important

Rural Development

For the strategy to be successful in deep rural environment, which factors do you think are Very IMPORTANT and which factors are LEAST IMPORTANT in to ensure digital Inclusion for rural communities

8. **Social Development** *
Tick all that apply.

- [ ] Very Important
- [ ] Important
- [ ] Not Important
- [ ] Least Important

9. **Economic Development** *
Tick all that apply.

- [ ] Very Important
- [ ] Important
- [ ] Not Important
- [ ] Least Important

10. **Employment Creation** *
Tick all that apply.

- [ ] Very Important
- [ ] Important
- [ ] Not Important
- [ ] Least Important

Government Leadership

For the strategy to be successful in deep rural environment, which factors do you think are Very IMPORTANT and which factors are LEAST IMPORTANT in far as the role of the government is concerned.

11. **Effective Market Competion** *
Tick all that apply.

- [ ] Very Important
- [ ] Important
- [ ] Not Important
- [ ] Least Important

12. **Cross-Sectoral Coordination** *
Tick all that apply.

- [ ] Very Important
- [ ] Important
- [ ] Not Important
- [ ] Least Important

13. **Policy and Regulation** *
Tick all that apply.

- [ ] Very Important
- [ ] Important
- [ ] Not Important
- [ ] Least Important

Adoption of ICT

For the strategy to be successful in deep rural environment, which factors do you think are Very IMPORTANT and which factors are LEAST IMPORTANT in far as the ease of adoption of the ICT services.

14. **Affordability and Accessibility** *
Tick all that apply.

- [ ] Very Important
- [ ] Important
- [ ] Not Important
- [ ] Least Important

15. **Digitall Literacy** *
Tick all that apply.

- [ ] Very Important
- [ ] Important
- [ ] Not Important
- [ ] Least Important

16. **Supply and Demand** *
Tick all that apply.

- [ ] Very Important
- [ ] Important
- [ ] Not Important
- [ ] Least Important

Technology Infrastructure

For the strategy to be successful in deep rural environment, which factors do you think are Very IMPORTANT and which factors are LEAST IMPORTANT in far as the technology for the rural areas is concerned

17. **Coverage and Availability** *
Tick all that apply.

- [ ] Very Important
- [ ] Important
- [ ] Not Important
- [ ] Least Important

18. **Television White Space** *
Tick all that apply.

- [ ] Very Important
- [ ] Important
- [ ] Not Important
- [ ] Least Important

19. **Frequency Spectrum** *
Tick all that apply.

- [ ] Very Important
- [ ] Important
- [ ] Not Important
- [ ] Least Important

20. **Rapid Deployment** *
Tick all that apply.

- [ ] Very Important
- [ ] Important
- [ ] Not Important
- [ ] Least Important

Funding Model

For the strategy to be successful in deep rural environment, which factors do you think are Very IMPORTANT and which factors are LEAST IMPORTANT in far as the Funding Model for the rural areas is concerned

21. **Customised business model** *
Tick all that apply.

- [ ] Very Important
- [ ] Important
- [ ] Not Important
- [ ] Least Important

22. **Universal Service and Access fund** *
Tick all that apply.

- [ ] Very Important
- [ ] Important
- [ ] Not Important
- [ ] Least Important

23. **Public-Private Partnership** *
Tick all that apply.

- [ ] Very Important
- [ ] Important
- [ ] Not Important
- [ ] Least Important

Digital Inclusion

For the strategy to be successful in deep rural environment, which factors do you think are Very Relevant and which factors are LEAST Relevant in far as the Digital Inclusion for the rural areas is concerned

24. **Gender Digital Divide** *
Tick all that apply.

- [ ] Very Relevant
- [ ] Relevant
- [ ] Not Relevant
- [ ] Least Relevant

25. **Youth Development** *
Tick all that apply.

- [ ] Very Relevant
- [ ] Relevant
- [ ] Not Relevant
- [ ] Least Relevant

26. **Seamless Access to Information** *
Tick all that apply.

- [ ] Very Relevant
- [ ] Relevant
- [ ] Not Relevant
- [ ] Least Relevant

Rural Development

For the strategy to be successful in deep rural environment, which factors do you think are Very Relevant and which factors are LEAST Relevant in far as the Rural Development for the rural areas is concerned

27. **Social Development** *
Tick all that apply.

- [ ] Very Relevant
- [ ] Relevant
- [ ] Not Relevant
- [ ] Least Relevant

28. **Economic Development** *
Tick all that apply.

- [ ] Very Relevant
- [ ] Relevant
- [ ] Not Relevant
- [ ] Least Relevant

29. **Employment Creation** *
Tick all that apply.

- [ ] Very Relevant
- [ ] Relevant
- [ ] Not Relevant
- [ ] Least Relevant

Government Leadership

For the strategy to be successful in deep rural environment, which factors do you think are Very Relevant and which factors are LEAST Relevant in far as the Government Leadership for the rural areas is concerned.

30. **Effective Market Competition** *
Tick all that apply.

- [ ] Very Relevant
- [ ] Relevant
- [ ] Not Relevant
- [ ] Least Relevant

31. **Cross-Sectoral Coordination** *
Tick all that apply.

- [ ] Very Relevant
- [ ] Relevant
- [ ] Not Relevant
- [ ] Least Relevant

32. **Policy and Regulations** *
Tick all that apply.

- [ ] Very Relevant
- [ ] Relevant
- [ ] Not Relevant
- [ ] Least Relevant

Adoption of ICT

For the strategy to be successful in deep rural environment, which factors do you think are Very Relevant and which factors are LEAST Relevant in far as the Adoption of ICT for the rural areas is concerned.

33. **Affordability and accessible** *
Tick all that apply.

- [ ] Very Relevant
- [ ] Relevant
- [ ] Not Relevant
- [ ] Least Relevant

34. **Digital Literacy** *
Tick all that apply.

- [ ] Very Relevant
- [ ] Relevant
- [ ] Not Relevant
- [ ] Least Relevant

35. **Supply and Demand** *
Tick all that apply.

- [ ] Very Relevant
- [ ] Relevant
- [ ] Not Relevant
- [ ] Least Relevant

Technology Infrastructure

For the strategy to be successful in deep rural environment, which factors do you think are Very Relevant and which factors are LEAST Relevant in far as the relevant technology infrastructure for the rural areas is concerned.

36. **Network coverage and availability** *
Tick all that apply.

- [ ] Very Relevant
- [ ] Relevant
- [ ] Not Relevant
- [ ] Least Relevant

37. **Television White Space** *
Tick all that apply.

- [ ] Very Relevant
- [ ] Relevant
- [ ] Not Relevant
- [ ] Least Relevant

38. **Frequecy Spectrum** *
Tick all that apply.

- [ ] Very Relevant
- [ ] Relevant
- [ ] Not Relevant
- [ ] Least Relevant

39. **Rapid Deployment** *
Tick all that apply.

- [ ] Very Relevant
- [ ] Relevant
- [ ] Not Relevant
- [ ] Least Relevant

Funding Model

For the strategy to be successful in deep rural environment, which factors do you think are Very Relevant and which factors are LEAST Relevant in far as the relevant funding model for the rural areas is concerned.

40. **Customised business model** *
Tick all that apply.

- [ ] Very Relevant
- [ ] Relevant
- [ ] Not Relevant
- [ ] Least Relevant

41. **Universal Service and Access funds** *
Tick all that apply.

- [ ] Very Important
- [ ] Relevant
- [ ] Not Relevant
- [ ] Least Relevant

42. **Public-Private Partnership** *
Tick all that apply.

- [ ] Very Relevant
- [ ] Relevant
- [ ] Not Relevant
- [ ] Least Relevant

Digital Inclusion

From the proposed factors, which factors would you recommend to be removed (not important at all)

43. **Which factors would you suggest to be removed?** *
Tick all that apply.

- [ ] Gender Digital Divide
- [ ] Youth Development
- [ ] Seamless Access to Information
- [ ] None

44. **Which factor/s would you add and why?**

Rural Development

From the proposed factors, which factors would you recommend to be removed (not important at all)

45. **Which factors would you suggest to be removed?** *
Tick all that apply.

- [ ] Social Development
- [ ] Economic Development
- [ ] Employment Creation
- [ ] None

46. **Which factor/s would you add and why?**

Government Leadership

From the proposed factors, which factors would you recommend to be removed (not important at all)

47. **Which factors would you suggest to be removed?** *
Tick all that apply.

- [ ] Effective Market Competition
- [ ] Cross-Sectoral Coordination
- [ ] Policy and Regulation
- [ ] None

48. **Which factor/s would you add and why?**

Adoption of ICT

From the proposed factors, which factors would you recommend to be removed (not important at all)

49. **Which factors would you suggest to be removed?** *
Tick all that apply.

- [ ] Affordability and Accessibility
- [ ] Digital Literacy
- [ ] Supply and Demand
- [ ] None

50. **Which factor/s would you add and why?**

Technology Infrastructure

From the proposed factors, which factors would you recommend to be removed (not important at all)

51. **Which factors would you suggest to be removed?** *

Tick all that apply.

- [ ] Network coverage and Availability
- [ ] Television White Space
- [ ] Frequency Spectrum
- [ ] Rapid Deployment
- [ ] None

52. **Which factor/s would you add and why?**

Funding Model

From the proposed factors, which factors would you recommend to be removed (not important at all)

53. **Which factors would you suggest to be removed?** *

Tick all that apply.

- [ ] Customised business model
- [ ] Universal Service and Access Funds
- [ ] Public-Private Partnerships
- [ ] None

54. **Which factor/s would you add and why?**

The strategy formulation strategy

The are number of fundamental components of any strategy formulation process and some of them are defined on the table below. The strategy formulation components are made of:

Components of strategy formulation

Ingredients	Description
Objectives	The fundamental ingredient of any strategy formulation process is to set objectives which guide the direction and path to be taken. A strategy serves as a medium for the realisation of objectives. The objectives and strategy are closely linked in the sense that the former stresses the state of being there, whereas the latter stresses the route to reaching there.
Environmental assessment	The environmental assessment describes the current status, with a critical view and comparative analysis. The needs and challenges also get identified. It also involves analysing both the internal and external environments in order to understand the factors that affect the strategy for sustainable ICT for development in deep rural environment. It requires the involvement of all stakeholders. The e-readiness also get tested during the assessment.
Strategy formulation	Accordingly, Rumelt (2011), proposes a three-stage approach to formulating the kernel of a strategy. The kernel of a strategy provides the logical structure, which acts as a guide in reasoning and ensuring that a quality strategy is developed. The kernel of the strategy comprises three distinct but related elements, namely: diagnosis, guiding policy and a set of coherent actions. These elements and their roles are discussed in detail below.
Strategy Implementation	Strategy implementation implies the execution of a set of coherent actions. It involves following guiding policy and executing the set of coherent actions identified in the strategy formulation process. The implementation process will be holistic and involve different role-players as well as the deployment of the devised strategy in the rural area. The implementation gives guidance on the order in which the actions are to be implemented, as well as the role of different stakeholders. It involves the re-alignment and redesign of how ICT services are offered in the deep rural areas.
Strategy control and monitoring	Strategic control links elements of the strategy formulation process together, and helps to assess their effectiveness as well as supporting the continual revision of strategy. The control process continually assesses the relevance, progress and feedback in the guiding policy and set of coherent actions. It also evaluates how well the set of coherent actions satisfies the devised strategy and enables the taking of remedial actions to address gaps in the needs of all the different role-players. The severity of the gaps in the needs of the various role-players must be judiciously documented for future evaluation.

Rate the importance of the strategy formulation components

Components of the Strategy

55. **Objectives** *
Tick all that apply.

- [ ] Very Important
- [ ] Important
- [ ] Not Important
- [ ] Least Important

56. **Environmental Assessment** *
Tick all that apply.

- [ ] Very Important
- [ ] Important
- [ ] Not Important
- [ ] Least Important

57. **Strategy formulation** *
Tick all that apply.

- [ ] Very Important
- [ ] Important
- [ ] Not Important
- [ ] Least Imporant

58. **Strategy Implementation** *
Tick all that apply.

- [ ] Very Important
- [ ] Important
- [ ] Not Important
- [ ] Least Important

59. **Control and Monitoring** *
Tick all that apply.

- [ ] Very Important
- [ ] Important
- [ ] Not Important
- [ ] a

Rate the relevance of the strategy formulation components

Components of the Strategy

Appendix C: Conference Paper

ICT Strategy for an effective Socio-economic development within the South African rural communities

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Abstract: *The predominant goal of the ICT infrastructure implementation is to contribute to socio-economic development through maximum integration of ICTs in all sectors and the provision of ICT services to rural areas. Economic growth and development will achieve less potential if the rural communities are not able to exploit new technologies and reaping their benefits [ITU, 2015].*

The ICT innovation has been an important component in socio-economic development. ICT entrepreneurship has also captured the imagination of the most marginalised from the rural communities and particularly the youth. The low cost of bootstrapping a business coupled with the creative nature of the ICT is able to encourage millions within the rural communities to launch their own small businesses. The common impact of the ICT for entrepreneurs is the creation of a whole new segment of online business opportunities. It is thus very critical that employment be raised through faster economic growth, improving the quality of education, skills development, and innovation and building the capability of the state to play a developmental and transformative role.

This had compelled the governments to create a number of programs and interventions, to enhance the economic measures for the implementation of infrastructure, and many kinds of literature have established that most of the implemented ICT Initiatives are not sustainable due to the lack of ICT Strategy. The paper seeks to develop an ICT strategy for socio-economic development within the South African rural communities.

Keywords: ICT, Rural communities, Strategy, National Development Plan, Design Science,

1. Purpose of the study

Labelle (2005) advocates that the most prominent route to attaining greater benefits using the ICT in the developmental programs is to focus on the rethinking of the developmental activities by analysing current challenges and the related contextual conditions, taking into account the ICT as just one part of the solution. He asserts that one of those things, is the importance of upholding a human development aspect and concentrating on the achievement of benefits for people through the correct use of ICTs. This therefore calls for an effective ICT strategy for economic development for rural communities.

The major purpose of the study is the formulation of an ICT strategy for socio-economic development earmarked for the most rural areas where the most affected and disenfranchised individuals are located.

The ICT strategy will:

- Identify and highlight the development priorities and challenges facing the rural communities;
- Profile the income of the rural community members to assess the level of affordability;
- Look at the gender balance and distribution of skills to ensure that the strategy is effective;
- Prioritise youth development for the streamlining of much needed capacity for economic development;
- Ensure that the market assessment and environmental scanning is undertaken to understand the circumstances of the affected communities; and
- Address the lack of technical and managerial skills to use and apply ICT services.

The main question to be addressed is:

What is the ICT strategy that will ensure socio-economic development within the South African rural communities?

2. Introduction

It is important to note that if the availability of the ICT infrastructure is accompanied by innovative technology ideas on the largest possible scale in all socio-economic developments, there will be a remarkable thing in the growth of economy and social development will ensure progress in the well-being of the rural community. It is thus important to highlight that the ICT production and usage can significantly contribute to economic growth basically through gains in total factor productivity and increased flows of information and knowledge which are translated in reducing uncertainty and transaction costs [Mandour, 2009].

The South African National Development Plan, NDP (2012), which is encapsulate vision 2030, is a framework which has been recently adopted by the government as a guideline for economic and infrastructural development in South Africa. The NDP promotes the advocates for the following amongst others:

- Connected vibrant information society;
- Underpin nation-building; and
- Strengthened social cohesion.

The vision 2030 in the NDP (2012) promises a seamless ICT infrastructure by 2030 that will underpin a dynamic and connected, vibrant information society and a knowledge economy that is more inclusive, equitable and prosperous with a particular focus on rural communities.

The NDP (2012) has further highlighted that a single cohesive strategy is essential to ensure the diffusion of ICTs in all areas of society and the economy. Like energy and transport, ICT remains an enabler which can speed up delivery, support analysis, build intelligence and create new ways to share, learn and engage.

3. Literature review

ICT activities are a major component of any rural socio-economic developmental strategy. Though education and personal development creates subjective abilities, it is information that offered substance to learning. The significance of information for advancement and socio-economic emacipation is undoubted, however, imperative issues encompass whose reality the information reflects, and who can make utilisation of that information for the benefit of the rural poor. There is a new emphasis in the acquisition of information and enabling the rural poor to request information specific to their particular livelihood needs [Chapman and Slaymaker, 2002].

The Policy Paper Series (2011) highlights that an efficient information infrastructure that promotes economic growth and greater inclusion requires a stronger ICT network at affordable prices. The NDP (2012) also notes that the cost of services and infrastructure remains a critical barrier to the effective use of mobile phones and fixed lines, with minimal network competition further increasing costs.

This has resulted in exacerbating one of the biggest problems which is the continued investment in the ICT infrastructure in urban areas. The NDP (2012) further emphasises the need of redirecting investments away from same urban infrastructure to underserved areas through incentives and subsidies, together with open access wholesale regulation to enable service-based competition; this appears to be a way of enabling affordable access to ICT services for all including the deep rural environment.

One of the major contributors to the lack of accessible ICT services within the rural communities is affordability. It is thus important to note that there are several critical factors which will drive affordability in emerging markets. The first is an innovation by service providers and content generators regarding their pricing and business models. Regulators are therefore encouraged to enable this innovation to flourish and not inhibit it by preconceived notions of the right model or pricing. [The Policy Paper Series, 2011]. The second problem is the power of relevant content within the communities. The extended availability of the relevant content and services which are highly considered by the rural communities and can be watched from the smart devices using the local languages, can be a catalyst to greater demand for access to ICT services with a serious boost to the socio-economic development. The third factor which inhibits an ICT platform which will ensure the socio-economic benefits is the cost to communicate of the ICT services to the rural market. One of the models called the "calling party pays" with other highly innovative pricing structures are necessary for the widespread of the ICT infrastructure and end-user devices.

4. Research Methodology

The overarching methodology for this research is a case study approach. The case study methodology, as expounded by Yin (2014), is used to build a single extensive embedded case study, which consisted of designing the case, conducting the case and analysing the case evidence.

This research adopts a single embedded dimension as the units of analysis. A single embedded case study is selected because this method enables an in-depth study to be carried out. In this case, the real-life phenomenon to be studied is the formulation of the ICT strategy for socio-economic development for the South African Rural communities.

Design Science has been chosen as the research paradigm for the research work. Design Science addresses research through the development and evaluation of innovative artifacts intended to meet an identified business need or to solve a relevant problem [Hevner et al., 2004]. It also presents some criteria and guidelines for critically appraising Design Science research, which governs the research project. Hevner et al. (2004) further indicates that the design science paradigm had its roots in engineering and the sciences of the artificial. It is fundamentally a problem-solving paradigm. It seeks to create innovation that defines the ideas, practices, technical capabilities, and products through which the analysis, design, implementation, and use of information systems can be efficiently accomplished.

March and Smith (1995) identify two design processes and four design artifacts produced by design science research in. The dual processes are *evaluate and build*. The artifacts are *constructs, models, methods and instantiations*. Purposeful artifacts are built to address heretofore unsolved problems.

5. Research Findings

The research methodology used to gather and interpreting information regarding ICT strategy for socio-economic development is the design science using the case study approach. This chapter summarises the results of questionnaires and interviews conducted during the study. There are 200 questionnaires which are distributed across four rural communities within the AmaJingqi traditional councils with 120 selected for analysis. The results reveal that most respondents are positively inclined towards the ICT services and expected to see their livelihood improved with the appropriate ICT infrastructures. There is also a huge level of unemployment, and the cost of living is very high, and basic ICT services are beyond their reach.

Since one of the main interests of this research is to categorise individual's perception about the utilisation of the Internet across general categories, factor analysis is applied to a survey data that measured perception for the strategy for sustainable ICT for each of the following six items:

- Gender distribution (Q1)
- Employment Categories of participants (Q2)
- Highest Qualifications (Q3)
- Employment rate (Q4)
- How much monthly spent on airtime and data bundle (Q5)
- Do you have an internet access (Q6)

5.1 Gender Distribution

The findings highlight that the respondents are constituted mainly by females. There are (53%) of women who responded as compared to (47%) of Males. One of the main reasons is likely to be that the tradition in the rural areas still dictates that women are expected to stay home and look after the children while men are in the cities to find employment to take care of the families. The importance of equipping rural women with ICT skills is to ensure retention of those skills within the served communities and economic development of the rural people.

5.2 Employment Categories of participants

The findings highlight that the highest number of participants are unemployed (46%), with a smallest number of participants being self-employed (8%). It is equally important to note that the youth constituted (10%) of the participants and the majority of those are high school going pupils. The current figure of the South African unemployment is (25%), and it is critical to note that youth constituted about (46.9%) of the total unemployed individuals according to the 2011 South African Census. Thus, the (46%) of the unemployed respondents mainly constitutes the youth, and this raised some serious concern for a developing country such as South Africa. There will have to be serious youth empowerment for them to be actively involved in the main streams of the economy in the rural communities.

5.3 Highest Qualifications

The findings illustrate that the majority (58%) of the participants has grade eight (8) as the highest qualifications with the second group (18%) having achieved a diploma or certificate. The trend indicates that the majority of the people are yet to see the door of institutions of higher learning.

5.4 Employment rate

The findings highlight a high level of unemployment (56%) amongst the respondents. What is important to note is that the affected age group is within the supposedly economically active individuals. There is a clear indication that the level of unemployment is high within this community. The findings highlights that there are a small number (8%) of respondents who are self-employed, and this is an indication that

there are not many entrepreneurial activities within the communities. Studies have shown that there is a direct link between the roll out of ICT infrastructure and job creation to the small businesses.

5.5 How much monthly spent on airtime and data bundle

The findings highlight that the majority of the respondents (43%) spent between R50 and R100 to buy airtime every month. There is just a mere (3%) who can afford to spend more than R400 on airtime every month. The community has proven to be very poor and the Government will need to come up innovative pricing models which will enable the community to have affordable access to ICT services. There is a clear indication that most of the community members are unable to afford the Internet services.

5.6 Do you have an internet access

The findings highlight, that the majority of the respondents (63%) indicate that they have access to the internet but has to be pointed out that most of the internet access being referred to, to be likely be the social media. It is important to remember that the web access is mainly through the respondents (92%) cell phones. There is a reasonable number but not enough number of community members with access to the internet through the ADSL (4%) and Community Centres (1%). This is a very clear indication that there is a huge lack of affordable ICT infrastructure within this community.

6. Main Findings

There is an unyielding imbalance regarding the reach of the respondents (53%) where women are in the majority. This trend had in the process, marginalised the rural women when it comes to the exposure to ICT due to lack of an environment that will expose them to the use and understanding of the ICT technologies.

There is a high rate of unemployment among the respondents (46%). This is a course for concern as affordability is one of the aspects which will ensure seamless adoption and uptake of ICT services. The census of 2011 has indicated that the national unemployment rate is (35%), and the youths are the most affected and constitute about (46%) of the total unemployment. There is a clear indication that the majority of the unemployed are the young people who ordinarily are supposed to be economically active.

The majority (58%) of the participants has grade eight (8) and more as the highest qualifications with the second group (18%) having achieved a diploma or certificate. The trend indicates that the majority of the people are yet to see the door of institutions of higher learning.

South Africa is faced with a huge rate of unemployment, and the most affected age group is the young people. The study has confirmed that unemployment within the community is still very prevalent as the majority of the respondents (56%) are unemployed. It has to be noted that one benefits of the roll out of the ICT Infrastructure is the direct link to sustainable job and employment creation.

There is a good penetration of mobile phones. The huge number of respondents (96%) has access to mobile phones and only (4%) are without mobile phones. The only setback is that the majority of the respondents (96%) have prepaid contracts which under normal circumstances are very expensive compared to postpaid.

The amount of money spent on mobile phone looks very small when looking at the trend of the respondents (43%) who have indicated that they only spent between fifty Rand (R50) and hundred Rand (R100) every month for airtime. There is also a small number of respondents (3%) who can afford to buy airtime for up to four hundred Rand (R400). Only (32%) of the interviewees indicates that they buy the SMS bundle. There is a strong indication that the affordability of airtime is also a huge inhibitor to exploiting the benefits of ICT fully.

It is equally important to note that there is a combination of the interviewees (50%) who believed that the mobile phone reception is not adequate, and the current coverage is not always available and intermittent. There is also a significant number (9%) of the respondents who did not have an idea of what is the adequate network reception. One of the suggested solution is the open-access network where sharing of infrastructure is encouraged as it allows cost-effective infrastructure rollout.

7. ICT Strategy for economic development

The figure 1 below highlight some of the areas of importance to formulate an effective strategy to address the gaps identified during the data collection and analysis. There are number of important areas which will need to be addressed in order to come up with an effective strategy which will ensure sustainable ICT. In order to respond and solve the six problem areas which are identified below, guiding policies needs to be identified for each of the six diagnostics. These will be discussed in detail below.

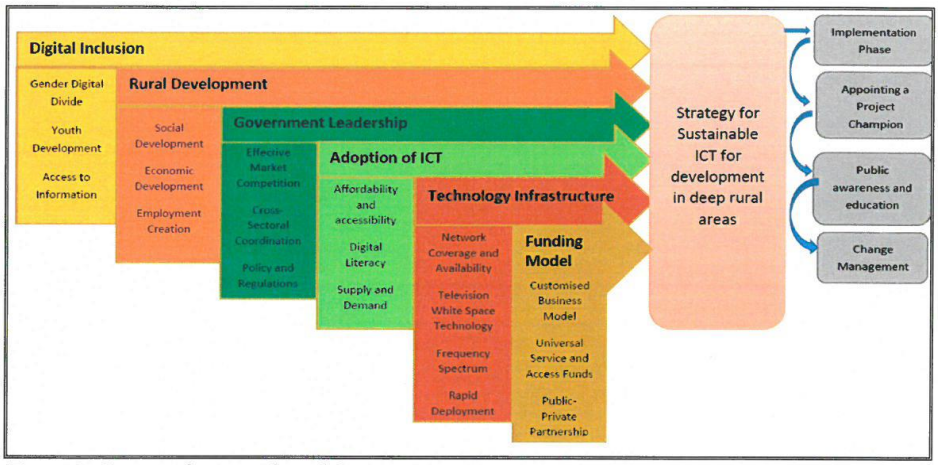

Figure 1: Strategy framework model

7.1 Guiding Policy 1: Digital Inclusion (GP1)

In order to enhance digital inclusion, there are various factors which will need to be addressed and this included seamless access to information, youth development and bridging the gender divide. The digital inclusion is very important for the socio-economic development to be enhanced.

i. Bridging the gender divide

The NDP (2010) articulates that women constitute a large number of the poor, particularly in the deep rural areas. The plan took gender along with race and geographic location into account, proposing a range of measures to advance women's equality.

ii. Youth Development

The younger generation is the cornerstone and the core of any developing economy. It is, therefore, important that policies which focus on youth development be promulgated and speedily implemented.

iii. Seamless access to information

Digital technologies play a key role in promoting access to information, both by improving records management and by providing open access to key public information and this calls for open access and data policies.

7.2 Guiding Policy 2: Rural Development (GP2)

In order to enhance rural development, there are various factors which will need to be addressed and these included social development, economic development and employment creation. This is one of

agendas which will make sure that there are meticulous plans in place to explore the full potential of socio-economic development of the rural communities.

i. Social development

ICTs and specifically broadband are general purpose technologies that can be applied to a wide range of economic and social activities. Their positive effects on development have been well documented.

ii. Economic development

ICT has a multiplier effect on economic growth at a number of levels. First, the introduction of ICT across different business environments improves efficiency by facilitating the adoption of more effective business processes. Second, extensive rollout of ICTs accelerated innovation and creativity by introducing new consumer applications and content. Third, ICT lead to a more efficient functioning implementation of enterprises by maximising their reach to a pool of resources, access to raw materials, and end-users.

iii. Employment creation

Adopting ICT to increase job creation opportunities for the rural poor and empowerment with information and learning also requires strategic objectives, substantial experimentation, local resources participation, social learning and plans for increasing sustainability. The application of ICTs across all economic sectors is putting new demands on the users and worker's skills.

7.3 Guiding Policy 3: Government Leadership (GP3)

In order to enhance rural development, there are various factors which will need to be addressed and these include effective market competition, cross-sectoral coordination and policy and regulations.

i. Effective market competition

One of the interventions which the government will have to undertake is to make sure that the playing field is levelled and that the market competition is fully regulated. Before making public investments in implementing out ICT infrastructure, the Government must first look at regulatory frameworks that might be able to improve entry and competition, and hence maximise what the market can deliver.

ii. Cross-sectoral coordination

The cross-sectoral coordination to ensure minimal duplication of resources and quicker turnaround time on the main project implementation is critical to ensure successful strategy. These coordinated initiatives will ensure full leverage on the collaborative networks and will ensure an integrated vision and realisation of full benefits is derived from the ICT services. The multi-layer government planning is therefore encouraged to ensure effective implementation of the main ICT projects.

iii. Policy and Regulations

The key regulatory barriers are (1) a lack of solid leadership and policies on the development and the implementation of the ICT agenda; (2) lack of awareness and education of how best to use ICT strategies to promote government programs, and assisting provinces in promoting their programs similarly; (3) silos in which the various entities operate within the sector; and (4) lack of funding for ICT initiatives. The government had put in place legislation to address and promotes universal access to telecommunications, access to information and services.

7.4 Guiding Policy 4: Adoption of ICT (GP4)

In order to enhance rural development and the development of socio-economic, there are various factors which will need to be addressed and these include affordability and accessibility, supply and demand.

i. Affordability and Accessibility

It also needs to be noted that one of an inhibiting factor for the adoption of ICT is the cost to communication and the affordability of ICT services for the greater population within the rural environments.

ii. ***Supply and Demand***

One of the highlighted problems which inhibit the uptake and use of ICT services are a lack of access to advanced end-user devices. Thus, the demand-side must be stimulated by ensuring affordability and access to devices. On the supply side, Infrastructure rollout constitutes a major portion of the capital expenditure, and this is also one of the inhibitors of the accessibility of the ICT services.

7.5 Guiding Policy 5: Technology Infrastructure (GP5)

In order to enhance socio-economic rural development, there are various factors which will need to be addressed and these include network coverage and availability and Television White space technology.

i. ***Network Coverage and Availability***

There is a need for the market review, and some of the fundamental policies which will assist in providing affordable and reachable services are the open access, infrastructure sharing, technology and service neutrality, and the reallocation of the digital dividend spectrum. The policy makers will have to promote the open access policy which will ensure that the sharing of infrastructure are encouraged and enforced, and the Operators can compete on services offered.

ii. ***Television White Space Technology (TVWS)***

Numbers of literature studies have indicated that the most viable last mile for the roll out ICT services within the Low-Income Communities is the wireless solution. One of the biggest challenges in rolling out affordable ICT solutions within these communities is the lack of cost-effective wireless solution due to the sparsely populated target communities. One of the proven benefits of the TVWS spectrum band is that it can cover larger distances due to the favourable propagation characteristics of the lower frequency blocks.

iii. ***Frequency Spectrum***

The National Government must implement initiatives to encourage more efficient use of frequency spectrum and this will free up spectrum for reassignment. Network Operators today have limited incentives to use frequency spectrum more efficiently and this has resulted in lack of deployment of ICT services to rural areas due to nonviable business models and this has resulted in a lack of economic upliftment for the rural communities.

iv. ***Rapid Deployment***

The government notes the difficulty of drawing ICT carriers in the most areas due to a lack of both market competition and resources to underwrite incentives. Better use of right of way can lower these hurdles, but some service providers, including the state owned entities are currently unable to take advantage of this approach. The government will have to mandate all service providers to install their underground conduits in the same trench, at the same time on a shared-cost basis.

7.6 Guiding Policy 6: Funding Strategies (GP6)

In order to enhance rural development for socio-economic promotions, there are various factors which will need to be addressed and these includes Customised business model, Universal Service and Access Funds and Public-Private Partnership. These will address the must needed funding mechanisms in the rural communities.

i. ***Customised business model***

One of the biggest impediments in rolling out infrastructure in the most rural environment is the lack of viable business models and incentives. Business will have to be certain of the rate of returns before investing business resources in the implementation of affordable ICT infrastructure.

ii. ***Universal Service and Access Funds (USAF)***

One of the inventions on funding mechanisms is the USAF which will need to be accompanied by a clear definition of the overall USAF strategy and objectives for the funds to be put to the use for which they are intended. The funds have had several challenges such as the lack competent management personnel who lacked the appropriate skills and background required for the effective use of the funds and administration thereof.

iii. Public-Private Partnerships (PPPs)

The NDP (2012) highlighted the role of the State and Institutional Capability to encourage trust between the public and private sectors. The government should encourage collaborations between the public and the private sector which should be treated as partners in policy design and implementation and the private will then have to respond to the realization of the national agenda.

8. Evaluation and Revised Strategy

The proposed strategy was evaluated by five professionals with diverse expertise and experiences which the NGO, Academic, Research Institution (CSIR), Government Legislator and Government Policy Maker. The researcher developed an evaluation tool to assess the strategy. The online evaluation tool is developed by using Google forms. The results reveal that most of the reviewers agreed that the factors proposed, as influencing strategy, are very important and relevant.

One of the Experts suggests that the **Gender Digital Divide** be removed as in the age of mobile telephony and mobile broadband, gender digital divide no longer exist as in many communities rural and urban both girls and boys have the same exposure to mobile phones. It is therefore not relevant to consider this as a metric for assessing digital inclusion. However, majority of the Experts agreed that Gender Digital Divide is important and hence this will be considered to be important and will remain as part of the study. The expert also suggests that other **power generation sources** outside of the power grid must be added. They say that none of the strategy elements can be applied unless strategies are in place for rural communities to have reliable access to electricity or the means to generate their own, such as solar/biogas/generators. Aspect like **behavioural economics** and the impact of group dynamics on behavior and believes patterns of individual within communities are also suggested to be added. Finally, the **local indigenous knowledge** is also suggested as the additional strategy element.

The Experts further recommends that **education and support** be added as one of the elements of the strategy to ensure qualified teachers to impart literacy, life skills and digital literacy for all age/gender groups can swiftly become competent and to encourage developmental innovation. One of the experts also suggests that **partnerships** will be very important to ensure a successful strategy for sustainable ICT. Partnerships have been dealt with extensively as part of the discussion during the strategy formulation process.

One of the Experts recommends the replacement of the **TVWS** by the **Dynamic Spectrum Sharing Technologies**. The other Expert recommends that the locals be trained on **support and maintenance of the infrastructure**. The **Affordability** of the ICT services is also recommended. However, affordability is discussed extensively as part of the initial strategy formulation.

It is important to note that majority of the Experts highlighted the importance of **PPPs** as one of the funding strategies. One of the Experts recommended that **Incentives** be added as one of the strategic factors. The strategy will include the suggested recommendations by the subject domain experts and a number of the strategic factors added as part of the final strategy.

9. Conclusion

The purpose of this research is to develop an ICT strategy for socio-economic development for the rural South Africa. The research is motivated by the apparent lack of ICT utilisation for the development rural communities of the AmaJingqi. The ICT strategy is therefore developed as a solution to this identified gap. The research follows a case study approach whilst using an interpretivist philosophical stance. It can be concluded that the purpose of the research is satisfied through the development of the ICT strategy. The ICT strategy for socio-economic development advocates a seamless and improved access to information and this in return will ensure effective information flow within communities. The rollout of robust ICT services ensures that effective exchange of information is promoted, and the lives of the people will be improved in the process. The accessibility to ICT infrastructure has to be one of the major considerations in ensuring universal ICT services and access. This will ultimately ensure ICT strategy which will ensure economic benefit to the rural communities of South Africa.

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