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A resource management framework for sustainability of rural ICT4D projects in Zimbabwe

by

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A resource management framework for sustainability of rural ICT4D projects in Zimbabwe

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Abstract

Developing countries are embracing Information Communication Technologies (ICTs) as a tool for alleviating poverty. There are, however, still challenges that developing countries face in trying to establish Information Communication Technology for Development (ICT4D). Among the major challenges is the lack of proper resource management which results in poor sustainability of ICT4D initiatives. If these ICT4D initiatives are to be sustainable for the benefit of current and future generations, proper resource management methods are to be developed and applied. This study proposes a resource management framework that can be applied to the management of ICT4D resources with the aim of achieving sustainability. The framework is informed by theory, and validated through enquiry in the field. Qualitative research methodology was used as a research approach for this study where three rural ICT4D initiatives were used as case studies. The case studies were conducted in rural Zimbabwe to investigate how proper resource management can influence the sustainability of ICT4D initiatives. It was identified from the study that the lack of proper resource management methods adversely affects the initiatives' sustainability. The proposed resource management framework will guide ICT4D resource management to enhance the initiatives' sustainability.

Declaration

I Hope Mugoni, hereby declare that:

- The work in this dissertation is my own work.
- All sources used or referred to have been documented and recognized.
- This dissertation has not previously been submitted in full or partial fulfilment of the requirements for an equivalent or higher qualification at any other recognized educational institution.

HOPE MUGONI

Declaration on Plagiarism

I Hope Mugoni student number 201113812 hereby declare that I am fully aware of the University of Fort Hare's policy on plagiarism and I have taken every precaution to comply with the regulations.

HOPE MUGONI

Dedication

To my husband Stanley and my son Eric, thank you for your unwavering support and prayers. This study was a success because of you.

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List of Abbreviations and Acronyms

ADSL - Asymmetric Digital Subscriber Line

AGRITEX - The Department of Agricultural, Technical and Extension Services

AI - Acquire and Implement

AMS - Automatic Milking Systems

CA - Capability Approach

CFF - Critical failure factors

CSF - Critical success factors

GIS - Geographic Information Systems

GMRDC - Govan Mbeki Research Development Centre

GPS - Global Positioning Systems

ICDL - International Computer Driving License

ICT - Information Communication Technology

ICT4D - Information Communication Technology for Development

ICTD - ICT and Development

ICTG - ICT for Government

IS - Information systems

ISACA - Information Systems Audit and Control Association

ISP - Internet Service Providers

ITGI - IT Governance Institute

IVR - Interactive Voice Response

LGDA - Lower Guruve Development Association

LGDC - Lower Guruve District Centre

MDG - Millennium Development Goals

MOESEC - Ministry of Education Sport and Culture

NGO - Non-governmental organizations

PDA - Personal Digital Assistants

RBV - Resource Based View of the firm (Resource Based Theory)

RDC - Rural district council

SARI - Sustainable Access in Rural India

SDA - School development associations

TB - Tuberculosis

VoIP - Voice over Internet protocol

VR - Virtual Reality

WCED - World Commission on Environment and Development

WLL - Wireless-in-Local Loop

WLZ - World Links Zimbabwe

WorLD - World Links for Development

ZESA - Zimbabwe Electricity Supply Authority

ZHMIS - Zambia Health Management Information System

ZIMS - Zambia Immigration Management System

Chapter 1

Introduction

1.1 Background

Developing countries are prioritizing the implementation of Information Communication Technologies (ICTs) as a driving tool for socio-economic development, in pursuit of achieving the United Nations' Millennium Development Goals (Heeks, 2008). The concept of ICT for Development (ICT4D) became more common in the late 1990s when ideas started surfacing that ICTs could transform people's socio-economic livelihoods (Esterhuysen, 2009). Since then ICT4D has gained popularity and is being implemented in many developing countries worldwide. According to Heeks (2009), ICT4D has evolved in three phases: ICT4D 0.0, ICT4D 1.0 and ICT4D 2.0. ICT4D 0.0 was the period when the first digital computer to be placed in a developing country was introduced in Kolkata, India in the year 1956. After this, the rise of the Internet and the Millennium Development Goals brought ICT4D 1.0 in the 1990's. Then the emergence of mobile devices and communication technologies then marked ICT4D 2.0.

In spite of the above recounted progress in ICT4D there are, however, still challenges that developing countries face in trying to establish ICT4D projects. The improper management of resources is repeatedly emphasized to be a main cause of ICT4D projects failure (Chan C. M., Hackney, Pan, & Chou, 2011). This concurs with Rangaswamy (2007) who explains that ICT4D resource management challenges emanate from skills shortages, personel incomptetence, limited finances to repair and maintain infrastructure and socio-political constrains. Poor resource management is one of the major contributors to the sustainability failure of ICT4D projects in developing countries (Macapagal M. , 2010). The author further stresses that resources need to be properly managed in order for ICT4D projects to succeed. This necessitates for the development of ICT4D resource management frameworks.

Heeks and Alemayehu (2009) classify failure of ICT4D projects in three categories, namely total failure, largely unsuccessful failure and partial failure. Considering the huge financial and resource investments made in the setting up of ICT4D projects, it is imperative that failure must be avoided. Jonathan and Kentaro (2009) emphasise that limited skills affect how organisations manage ICT4D projects and that there is need to do more to guide ICT4D resource management. Having pointed out the above problems, it is apt to mention that there is need to create resource management solutions that are appropriate for developing environments to avoid ICT4D project failures and to make the projects sustainable.

Sustainability has always been essential in the life cycle of development projects (Harris, 2004). The term sustainability literally means the ability to preserve something in a particular state (Oxford University Press, 2011). Harris (2004) refers to sustainability as the capacity of a project to remain functional after its implementer has departed. Kumar (2004) argues that sustainability of development projects is the ability to manage them in the long run. This study adopts the definition that ICT4D sustainability refers to the capability of initiatives to develop into models that are suitable for a particular environment and can be maintained by local resources (Howard, 2008). There is an ongoing debate over the reality of sustainability given that most projects are donor funded and there is difficulty for intended users of the systems to maintain them due to practical challenges (Ali & Bailur, 2007). Sustainability is yet to be achieved by many ICT4D players and it necessitates for the development of sustainability frameworks (Kumar, 2004). It is on this notion that this research will be based.

Zimbabwe is one of the countries in Sub-Saharan Africa which has embraced ICT4D. As a nation it faces the same challenges that most developing countries face in ICT4D, as well as additional challenges unique to the country (Ndlovu, 2009). Among these challenges is ICT4D projects' sustainability failure which emanates from lack of skilled staff and poorly designed and techno-centred rather than people centred systems (Madzima & Nhamu, 2010). In addition to this there is also vandalism of ICT4D resources and lack of proper resource management techniques (Tsokota, Chipfumbu, Mativenga, & Mawango, 2013). There is therefore need to focus on resource management of ICT4D projects in Zimbabwe to isolate the core problems affecting their sustainability.

This research seeks to develop a resource management framework for ICT4D projects in rural areas of developing countries. Resource management is concerned with the proper investment and management of critical IT resources (IT Governance Institute (ITGI), 2007). This research will analyse existing theories on ICT resource management and sustainability and evaluate how they can be incorporated into ICT4D with the aim of tackling the research

problem. The study will also apply a field study to examine the resource management and sustainability circumstances prevailing in rural ICT4D projects operating in Zimbabwe.

The following sections of this proposal will unfold respectively: the statement of the problem, main and secondary research questions, objectives and significance of the study, literature review, research methodology and delimitation of the study.

1.2 Statement of the Problem

The lack of proper resource management methods results in sustainability failure of ICT4D projects in rural Zimbabwe.

1.3 Objective of the Study

The objective of this study is to develop a resource management framework for ICT4D projects in rural Zimbabwe.

1.4 Main Research Question

How can proper resource management be applied in ICT4D projects in rural Zimbabwe to improve sustainability?

1.4.1 Secondary Research Questions

1. How are the rural ICT4D projects in rural areas of Zimbabwe currently managed?

2. What are the factors influencing sustainability of rural ICT4D projects in Zimbabwe?

3. What can be done to ensure sustainability of rural ICT4D projects in Zimbabwe?

1.5 Significance of the Study

ICT4D interventions have been regarded as a major driver for alleviating poverty in developing countries in order to achieve the Millennium Development Goals of the United Nations (Heeks, 2009). Nevertheless there are still challenges that deter the sustainability of the ICT4D initiatives. These sustainability challenges can be addressed by capturing and dealing with the principal problem sources (Kumar & Best, 2006). A report by Macapagal and Macasio (2009) indicates that ICT4D players in developing countries currently face major challenges in the proper management of project resources. In view of that, resource management is one of the major problems that contribute to the sustainability failure of rural ICT4D initiatives, hence the need to address it. Based on this premise, the proper management of ICT4D resources can be considered as a key driver for ICT4D sustainability, leading to the development of rural livelihoods. Properly managed projects result in improved

social and economic welfare of rural communities (Mutula, 2010). In this regard a resource management framework will enhance the execution of sustainable ICT4D projects.

1.6 Literature Review

The literature review builds the theory base for this research. Theory will be used to inform the construction of the framework as well as assist in the analysis of the findings. This study applies the Resource Based Theory, also named the Resource Based View of the firm (RBV), Sen's Capability Approach (CA) and the Control Objectives for Information and related Technology (COBIT) Framework as its underlying theories. The following sub-sections discuss the literature review.

1.6.1 Information Communication and Technology for Development (ICT4D)

Information Communication and Technology for Development (ICT4D) is the application of ICTs within the fields of socio-economic development, international development and human rights to solve problems of the developing world (Gurstein, 2007). ICT4D seeks to improve human standards of living through the use of ICTs (Day, 2005). As remarked by Ali and Bailur (2007), ICTs have moved from traditional stand alone systems to modern information systems where data is shared and stored digitally. They comprise of all technologies involved in the storage, processing and retrieval of information in digital form; examples are mobile phones, personal desktop computers, televisions and radios (Cecchini & Scott, 2003). More so, the Internet has become a major backbone for the advancement of ICTs (Anderson, 2010). Even so, Africa lags behind in per-capita income and thus remains the region that has the greatest developmental challenges (Esterhuysen, 2009). This observation aligns with the gap that still exists between the need for development through ICTs and the hindrances that prevail. This socio-economic disadvantage explains why most rural areas in Sub-Saharan Africa are still less privileged in terms of access to ICTs.

1.6.2 ICT4D in Zimbabwe

Developing regions including Zimbabwe are implementing ICT4D yet they are faced by problems that encompass technical, financial, social, environmental and political challenges (Ndlovu, 2009). Embedded within these afore mentioned major challenges are equipment and power failures, software infections and reinstallations, remote management and transportation problems (Zano, Munyoka, Gombiro, Chengetanai, Hove, & Mauchi, 2008). Additionally these factors together with resource management and structural factors result in sustainability failure of most ICT4D projects (Kumar & Best, 2006). Identifying the core issues surrounding ICT4D crisis in Zimbabwe can assist in the isolation of and concentration upon the problem factors with the aim of designing suitable management approaches.

Since the year 2000, Zimbabwe has been through its own economic hardship (Sachikonye, 2002). According to the Networked Readiness Index in the Global Information Technology Report of 2010-2011, this has resulted in the country being one of the last countries to embrace ICTs (Dutta & Mia, 2011). Power shortages, poor infrastructure, low bandwidth, brain drain and expensive telecommunications costs are some of the problems that Zimbabwe is currently facing (Ndlovu, 2009). In addition to these problems ICT4D in Zimbabwe is hindered by resource management challenges that include lack of training, poor management skills, limited infrastructure and incompetency (Kundishora, 2008). Considering these limitations, it is crucial to develop managerial procedures that promote the success of ICT4D projects in Zimbabwe to produce long-term sustainability of the projects.

1.6.3 Factors Influencing Sustainability

Sustainability became a priority after 1972's Roman 'Limits to Growth' report. The UN also enforced it in 1980 by making sustainability an international action benchmark in environmental development. After 1987 the term 'sustainable development' gained fame when an environmental report (also called the Brutland Report) gave the now commonly used definition for sustainability which was meeting present needs without hindering future generations of the capacity to meet their own needs (Jenkins, 2009). From this derives sustainability which in the realm of ICT4D implies initiatives adaptable to models that are suitable for a particular environment (Howard, 2008). It can thus be inferred that the concept of sustainability is not new, but its meaning and implications evolve with time and use.

In the effort to outline factors which influence sustainability, Kumar and Best (2006) classified its failure in five dimensions. The dimensions are financial, cultural-social, technological, political/institutional and environmental sustainability failure. Each of the dimensions pertains to factors that can contribute to failure or success of ICT4D projects. Literature conveys little about the link between sustainability of ICT4D projects and their proper resource management; this is a gap that this research seeks to bridge.

As previously mentioned, this research will make reference to three theories: the Control Objectives for Information and related Technology (COBIT) framework, Sen's Capability Approach (CA) and the Resource Based Theory.

1.6.4 COBIT Framework

The COBIT framework, designed by the IT Governance Institute (ITGI), explains the control processes which organizations can apply to get good returns from IT investment (ITGI, 2007). IT Governance comprises of the management and organizational structures and

processes that guide the enterprise's IT to sustain and extend the organization's strategies and objectives (ITGI, 2007). 70% of IT projects fail due to lack of proper management (Heeks, 2002). In light of this, the COBIT framework can be used to direct the proper management of the IT resources that ICT4D projects utilize. Though most ICT4D organizations' goal is not profitability, the COBIT framework can guide them to improve their strategies and achieve their objectives.

The COBIT framework component that will be emphasized is the Resource Management focus area. Resource management is about the best investment in and the proper management of critical IT resources (ITGI, 2007). Project managers must ensure that appropriate methods and skills exist to manage IT projects, and benefits are real and achievable (Hardy, 2006). The COBIT framework explains how resource management can be handled and the ICT4D resource management framework will adopt these methods. COBIT 4.1 and COBIT 5 will be referred to in building the theory base for this study.

1.6.5 Sen's Capability Approach

Sen's Capability Approach views human rights as freedoms which allow people to fully live the lives that they value (Sen, 2005). Examples of such freedoms include access to health facilities, education and business success. Capability implies positive freedom, whereas being unable to do some things is termed capability failure (Qizilbash & Clark, 2005). Sen (1999) suggests that in order for communities to develop there is a need to counter against challenges, like sustainability failure. The same writer also calls such development problems 'unfreedoms'. ICTs can be used to increase people's access to basic needs. Based upon this, the proposed ICT4D resource management framework is expected to help increase capabilities and freedoms to development.

According to Kleine (2009), ICTs have been viewed as an enabler for socio-economic development. Kleine (2009) also mentions that ICTs enable communication and sharing of information, thereby increasing people's opportunities. It can be concluded that ICTs, when properly implemented in developing regions, can increase people's freedoms and capabilities. In the context of this research, Sen's Capability Approach will be used to analyse how development can be achieved through proper resource management for ICT4D sustainability.

1.6.6 Resource Based Theory

The Resource Based Theory, also called the Resource Based View of the firm (RBV) was designed to comprehend how firms can accomplish sustainable competitive advantages. According to Liang and You (2009), the RBV is a theory that can be used to assess the

impact of IT on business performance. Using this theory, an ICT4D project is viewed as a firm with physical and social resources. (Caldeira & Ward, 2001). The theory is functional to examine resources and operations of organizations; in this case ICT4D projects (Bailey, 2009). It is the RBV's properties of integrating IT resource management and organizational sustainability that make it relevant for this study.

When using the RBV to assess the impact of IT on organizations, IT is regarded as a resource that can increase organizational capabilities and in the long run lead to better performance (Liang & You, 2009). It can therefore be viewed that the RBV is principally oriented on resources and capabilities. The RBV will be used to examine how resources in ICT4D projects can be properly managed for effective performance. Focus will not be put on uniqueness of resources, but more on management methods that result in sustainability. The following section explains the research methodology applied for this study.

1.7 Research Methodology

Research methodology explains the scientific techniques used to solve a research problem (Kothari, 2008). This research will employ an interpretive paradigm, qualitative approach, case study method and semi-structured interviews, observations and documentary analysis. Details of the research process are explained in Chapter 4.

1.8 Research Paradigm

This research will adopt an interpretive paradigm. Interpretivist information systems (IS) researchers investigate IS development and implementation processes by analysing the experiences of the actors involved (Cecez-Manovic, 2005). Organizational situations are complex and unique and they result from particular circumstances and individuals (Saunders, Lewis, & Thornhill, 2009). This study investigates management processes that are influenced by environmental factors and circumstances of the people involved in the ICT4D projects, thus this study necessitates the use of an Interpretivist approach. More so, to obtain results that portray reality of sustainability and its influencing factors in a developing country, an interpretive paradigm is most suitable.

1.9 Research Approach

According to Creswell (2003), the three approaches to research are qualitative, quantitative and mixed methods. The qualitative approach focuses on collecting and analysing non-numeric phenomena, whereas the quantitative approach focuses on numeric data. Mixed methods involve the use of both qualitative and quantitative approaches (Thomas, 2003). Collis and Hussey (2003) state that interpretive researchers lean more towards qualitative

research approaches and positivist researchers lean towards quantitative approaches. This research will use qualitative techniques to collect and analyse data. The qualitative approach has been chosen because the nature of phenomena to be analysed is subjective and inseparable from its context.

1.10 Research Method

The research will employ the case study research method. Research methods are the techniques and procedures used to obtain and analyse data (Saunders, Lewis, & Thornhill, 2009). This concurs with Hofstee (2009) who explains that 'method' refers to the general technique/s used to examine a thesis. The purpose for which information is being collected affects the method to be used (Kumar, 2005). Collis and Hussey (2003) define a case study as a thorough analysis of a single phenomenon of interest. The case study method is appropriate for use when the phenomenon being studied is not separable from its context, for example a project or a program under study (Yin, 2003). The phenomena in this research are best studied in their context, thus it is essential to use a case study.

The next section outlines the data collection methods that will be used to answer the research questions.

1.11 Data Collection Methods

Case studies can use data generation methods like interviews, observations, document analysis and/or questionnaires (Oates, 2006). The approaches to be used in this research are semi-structured interviews, observations and documentary analysis. This use of two or more methods of data collection and analysis is referred to as triangulation (Cohen, Manion, & Morrison, 2007). The aim of triangulation is to compensate for any one-sidedness or distortion that may result from using only one method (Flick, von Kardorff, & Steinke, 2004).

Semi-structured interviews will be used to collect data from the key stakeholders of the project. With semi-structured interviews the researcher lists topics or questions before the interview. The researcher can adjust the order or wording of the questions depending on any unexpected issues that may arise during the interview. (Lodico, Spaulding, & Voegtle, 2010). This will assist the researcher to gain more insight into some issues that might not have been predicted which will help reach better conclusions and results in the data analysis.

Document analysis will be employed to gather data on the flow of information on resource management within the project. Oates (2006) suggests that documents can be used as objects or entities in their own right to examine the production and distribution of information in an organization.

Observations will be applied to generate data on the current state of resource management within the projects and to observe if what is reported on documents is being implemented exactly. This method of data collection is suitable when the researcher seeks to know how people do things (Saunders, Lewis, & Thornhill, 2009). Observations are a relevant data collection method as they will assist the researcher to find out how ICT4D projects are run in reality.

1.12 Sample and Population

The projects to be used for this research are the Plumtree Rural ICT Project, Mutoko World Links ICT Centre and Practical Action's Podcasting Project. These three ICT4D initiatives are being implemented in three different rural districts of Zimbabwe. The research objectives and characteristics of the study population determine which and how many people to select (Creswell, 2003). Non-probabilistic and purposive sampling will be used to select the sample for the data collection. The population to be used for data collection constitutes all the stakeholders of the three projects. From the population, samples will be taken from project managers, communal users and project staff members. This sampling method has been deliberately chosen due to the differences in populations per project and the detailed information required from the interviews and observations. From the population of documents available per project, a sample constituting only relevant documents will be assessed.

1.13 Data Analysis Methods

This study will take the inductive approach. The inductive approach is theory generating (Creswell, 2003). The aim is to establish a relationship between the research objectives and the findings derived from the raw data (Thomas, 2003). The findings gathered from the data will be used to create the framework.

1.13.1 Case Study Analysis

Tesch (1990) states that procedures in qualitative data analysis are diverse and that there is no standard way of doing it. Miles and Huberman (1994) also agree with Tesch and maintain that qualitative research does not adhere to any strict rules of analysis, but is rather crafted to fit the scenario under study. The procedures to be used for analysing data from the case study are adopted from Marshall and Rossman (2006). The authors divided the process of data analysis into seven (7) procedures. The procedures have been chosen due to their inductive theory generating nature. The procedures are shown in Table 1.1 below. Details about how these procedures are carried out will be outlined in Chapter 4.

Table 1.1: Data analysis procedures

STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5	STAGE 6	STAGE 7
Organizing data	**Immersion in The Data**	**Generating Categories, Themes & Patterns**	**Coding the Data**	**Interpretation Through Analytic Memos**	**Searching Alternative Explanations**	**Writing the Report**

1.13.2 Framework Validation

The resource management framework to be designed will need to be validated. Validation is the process of proving that the framework is an acceptable illustration of the actual system (Hillston, 2003). One of the methods for framework validation, which will be used for the purpose of this research, is Expert Review. Hillston (2003) refers to this same method as Expert Intuition and explains that with Expert Review the framework is examined by experts in the field to inspect its output and behaviour. The proposed resource management framework will be sent to experts in the field of ICT4D for review.

1.14 Delimitation of the Study

Sustainability challenges are faced by many countries in Sub–Saharan Africa. This study's data collection will only focus on the rural areas of Zimbabwe. ICT4D is a very broad concept and this study will only focus on resource management and the sustainability of ICT4D projects. Other aspects of ICT4D like adoption and impact assessment will not be covered by this study.

1.15 Ethical Considerations

The research design must not cause the research population embarrassment or physical and emotional disadvantage and the people who are being researched must have consented (Saunders, Lewis, & Thornhill, 2009). In order to benefit the society, the researcher must carry out their research responsibly and adhere to the moral and legal order of the society the research is being carried out in (Social Research Association, 2003).

This research will adhere to these ethical principles so as to ensure that the research benefits the society without causing any negative implications. The interviews, document analysis and observations will be done upon the consent of the populations to be researched. Names of individuals and any confidential details will not be given for the sake of privacy of individuals.

1.16 Outline of Proposed Chapters

The table below shows the proposed chapters of the research respectively.

Table 1.2: Outline of proposed chapters

CHAPTER 1	CHAPTER 2	CHAPTER 3	CHAPTER 4	CHAPTER 5	CHAPTER 6	CHAPTER 7
Introduction	**Management of ICT4D projects**	**Sustainability of ICT4D projects**	**Research Methodology**	**Findings and Data Analysis**	**Building of the resource management framework**	**Conclusion**

Chapter 1 is the introductory chapter comprising of the problem statement, research objectives and methodology. Chapters 2 and 3 will consist of the literature study covering management of ICT4D projects and the factors influencing sustainability of rural ICT4D projects. Chapter 4 covers the research methodology and the case study. This will outline how the data collection and analysis for this research will be conducted. Chapter 5 gives the findings from the data analysis and proposed recommendations. Chapter 6 will explain the design of the resource management framework and the framework validation. Chapter 7 will conclude the research report as well as highlight propositions for further study.

Chapter 2

Managing ICT4D Projects in rural areas of developing countries

2.1 Introduction

In the previous chapter the research area for this study was introduced and the research objectives were stated. This chapter will focus on the management of Information Communication Technologies for Development (ICT4D) projects in developing countries, with emphasis on resource management. Initially ICT4D will be defined and explained, followed by a discussion on debates against ICT4D. The importance, benefits and applications of ICT4D will then be covered. Subsequently, the challenges with implementing ICT4D will be explored, followed by a section on the application of the Control Objectives for Information and related Technology (COBIT) in ICT4D management. Next will be a section on examples of ICT4D projects management in developing countries. Then the chapter will conclude with current state of affairs in the management of ICT4D in developing regions.

The prioritization of Information Communication Technologies (ICTs) to meet the Millennium Development Goals (MDGs) of the United Nations popularized the concept ICT for Development (ICT4D) (Heeks, 2008). As mentioned by Rao (2008), it has been discovered through research and implementation that ICTs can improve the livelihoods of the poor. Poverty can be reduced through the use of ICTs to enable global interactions and thereby bridge the knowledge gap (Harris, 2004). ICTs encompass everything that uses technology for communication, for example televisions, Internet, radios and mobile phones (Coward, 2010). This recitation of works that discuss the use of ICTs to enhance development in rural areas indicates the necessity of studying how these ICTs can be effectively used for sustainable rural development in Zimbabwe.

International donors and non-governmental organizations (NGO) became the major drivers of ICT4D from the year 2000 after the MDGs were officialised (Heeks, 2008). By the early 2000's most international NGOs and donors started getting involved in ICT4D projects in developing countries (Harris, 2004; Heeks, 2009). As ICT4D projects are implemented in different countries, various challenges are faced. Among them is the challenge of sustainability. The lack of proper resource management techniques has been one of the causes for most ICT4D projects' un-sustainability (Young & Hampshire 2000; Marais 2011). Identifying the causes of sustainability failure, one of which is the lack of proper resource management, will help in addressing the problem to bring a solution, which is the sustainability of ICT4D projects.

The majority of the world's poor live in rural areas of developing countries, hence most ICT4D projects are run in these regions (Cecchini & Scott, 2003). This explains the high rate of sustainability failure in the same regions. As identified by Marais (2011), limited education and skills in marginalized communities contribute to lack of the essential proper management of ICT4D projects. There is therefore need to invest in rural education and to increase training in the field of ICT4D projects management. When flexible management protocols are put in place, projects will run effectively for the intended period and for as long as their benefits are still needed (Macapagal, 2010). This supports the former reference to the need for capacity building in ICT4D project management. Moreover, huge investments are made in implementing ICT4D projects and for good return on these investments, good management principles must be established, as pointed by Kimaro (2006). It is expedient that ICT4D projects in rural areas focus more on the aspect of proper resource management for them to achieve development benefits from their investment in ICTs.

This chapter presents arguments on ICT4D projects management. By reviewing the literature, trends in research on management of ICT4D projects will be identified so as to show how this research fits into previous studies and to identify any gaps that exist.

2.2 ICTs Defined

Some authors have attempted to explicitly define ICTs, whilst others simply explain ICTs by what they do or by giving examples (Harris, 2004; Kuriyan, Ray, & Toyama, 2008). Heeks (1999) defines ICT as the electronic way of capturing, processing, storing and distributing information. Osterwalder (2002) is in agreement with this by defining ICTs as technologies that facilitate communication and processing information electronically. Chetley (2006) similarly defines ICTs as tools that aid the communication, processing and transmission of information by electronic means. From the various given definitions of ICTs it can be

concluded that ICTs are all infrastructures, technologies and systems that enable the input, processing, storage and output of digital information.

Figure 2.1 below shows some of the applications and technologies that ICTs encompass.

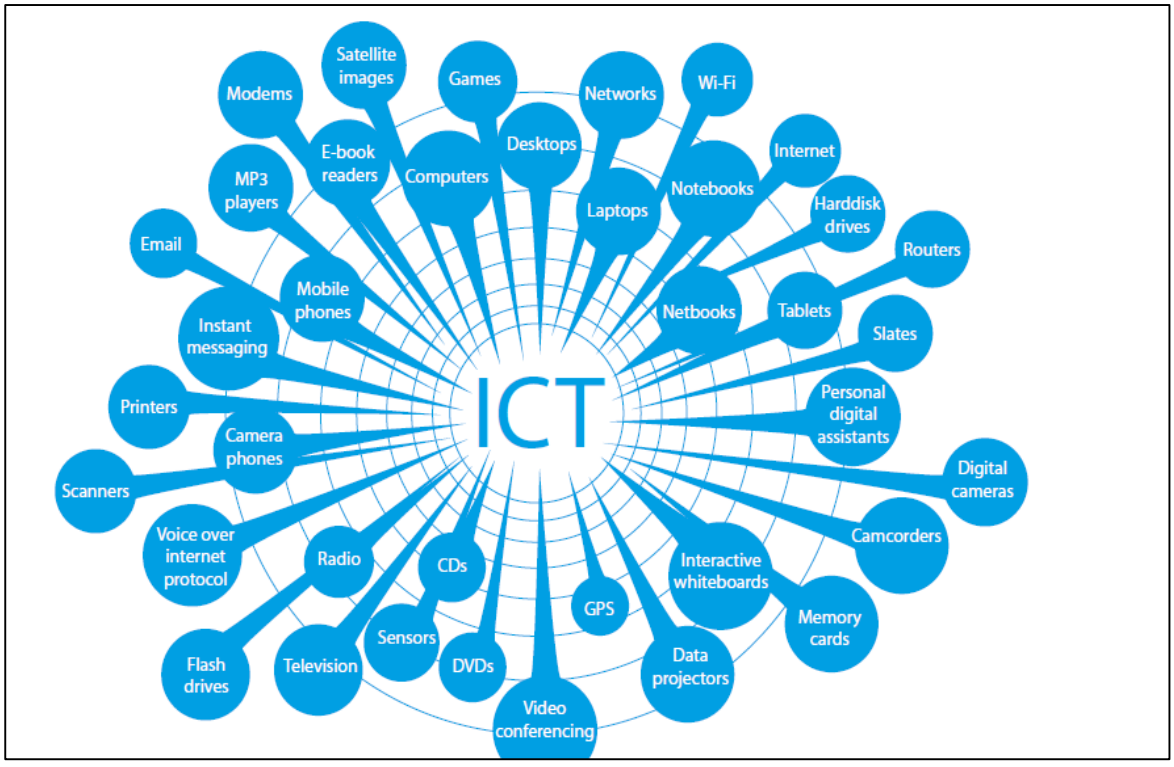


Figure 2.1: ICT Technologies (Anderson, 2010)

It can be viewed from Figure 2.1 that there are ICTs that have been in common use for a long time, like radios and televisions, which Greenberg (2005) calls 'old' ICTs. The figure also shows Wi-Fi, Voice over Internet protocol (VoIP) and satellites as examples of new ICTs. According to Greenberg (2005), new ICTs are those which have recently been in common use. The illustration shows that ICTs encompass anything that uses technology for communication. Having defined ICTs, the first part of the term ICT4D, development is explained in the following section.

2.3 Defining Development

In his theory called the Capability Approach (CA), Sen (1999) defines development as the means of increasing people's abilities and choices. In another article, Sen proceeds to say that human freedoms are a person's capabilities to have access to welfare and that the term 'functionings' is also used to refer to capabilities (Sen, 2005). Sen (2005) further clarifies that functionings represent what must be done to achieve well being. This shows that development is the capability of communities to achieve well being and the degree to which people can be in charge of their lives. Sen's Capability Approach, which states that development, gives people freedom to choose, is useful to identify how ICTs can contribute

to development by enabling communication and interaction, thereby giving them empowerment (Kleine, 2009). Furthermore Kleine (2009) explains that ICTs can enhance market growth, access to health, education and employment facilities, resulting in socio-economic empowerment. It can thus be said that ICTs are a functioning that can enable humans to develop by giving them access to basic rights.

80% of the world's population live in rural areas (ITU, 2010). Among the many challenges facing Sub-Saharan Africa's rural communities are poverty, low bandwidth, electricity shortages, inadequate access to education, poor Internet penetration rates and resource shortages (Pade-Khene, Palmer, & Kavhai, 2010). The authors state that in order to achieve development it is crucial to be responsive to the needs of the rural environments targeted by the ICT4D projects. From this it can be viewed that most of the world's population is in great need for poverty alleviation tools which include ICTs to enhance development.

Heeks (2007) points out that insufficient work has been done to link concepts in development studies to ICT4D research. This reveals that it is important to focus on the development aspect in order to develop projects that will be sustainable enough to meet stakeholder needs. The fundamental dimensions of development in which ICT impact is measured include health, education, income, and empowerment (Hamel, 2010). Hamel (2010) goes on to say that dimensions of development signify people's important goals and that ICTs can have a positive impact on human development. One can therefore conclude that ICTs can enhance the ability for people to meet their goals of development if they are effectively implemented as tools and not an end in itself. Likewise, in order to efficiently exploit ICTs, management methods that are directed towards sustainability are fundamental.

2.4 Defining ICT for Development (ICT4D)

The term ICT4D incorporates two terms which are 'ICT' and 'Development'. Both terms have been defined in the previous section to express the significance of the ICT4D subject. There is a considerable volume of published studies describing ICT4D as the use of ICTs to enhance socio- economic development in marginalized communities (Premkumar & Roberts, 1999; Heeks, 1999; Cecchini & Scott, 2003; Heeks, 2009). The rise of the Internet promoted an increased use of computing and communication technologies worldwide. Among the countries which also embraced the use of ICTs for socio-economic development purposes are countries in the developing regions (Heeks, 2009). A major contributing factor to this embracement of ICTs for poverty alleviation was the MDGs. The MDGs were introduced in the year 2000 and they gave ICTs high priority as they were assumed to be a major tool for development (Opoku-Mensah, 2004). The notion was that if global communication is

enhanced, marketing and business in developing areas will improve through faster transmission of information by means of telecommunications infrastructure and the knowledge gap will be bridged (Heeks, 2009). It can be thus be concluded that ICT4D is the use of ICTs increase people's capabilities and freedoms in order to alleviate poverty in marginalised regions and to enhance development.

Heeks (2008) identifies ICT4D in three stages which he names ICT4D 0.0, ICT4D 1.0 and ICT4D 2.0. Heeks (2009) states that ICT4D 0.0 was the period when there was no ICT4D, but there was ICTG which meant ICTs for government and later for growth. This was the period when computers were stand alone and there were no networks; the period between 1956 and the 1990s. According to Heeks (2009), ICT4D 1.0 is when the Internet was introduced and computers began to be networked and the MDGs were stated in the year 2000. He proceeds to say that ICT4D 2.0 is the stage of the use of mobile networks and technologies. This same author emphasizes that ICT4D 2.0 focuses more on in depth study of beneficiary environments for the delivery of affordable and context sensitive ICT systems to the poor. ICTs therefore have evolved from stand alone systems for use in the office to tools which can be used to enhance development in the lives of the poor.

2.5 Critique of ICT4D

Though ICT4D has been widely accepted and embraced, there are studies, however which challenge the ICT4D notion. Sreekumar and Rivera-Sanchez (2008) argue that ICT and Development (ICTD) should replace ICT4D. According to Sreekumar and Rivera-Sanchez (2008), ICTD gives more attention to the demand of marginilised populations when adopting ICTs. The authors criticise that ICT4D claims that there is a unidirectional relationship between ICTs and development and yet there is little evidence to prove it. Sreekumar and Rivera-Sanchez (2008) agree with Pieterse (2005) who calls ICT4D a 'package deal' which is driven by market expansion, thereby promoting digital capitalism. Pieterse (2005) maintains that ICT4D has labelled socio-economic problems as digital problems with the aim of marketing Northen technologies to the global South. Therefore he suggests that more focus be put on telephones, radios and television rather than on the Internet.

It seems, however, that some writers use the terms ICT4D and ICTD interchangeably such as Austin (2010) who uses the term ICTD to mean the same as ICT for Development throughout his article. Another similar use of the terms is in Coward (2010) who explains that though there are differences in fine distinction, he uses the terms ICT4D and ICTD to mean the same thing. Heeks (2009) argues that ICTs simply help developing regions to access technological benefits that are available to developed regions. Apparently the previously

mentioned authors who critisize ICT4D for being digital capitalism were biased towards socio-political research, hence their studies might not have focused much on ICT practical implementation issues. Their ideas being thus centred, it can be also viewed that whether ICTD or ICT4D, ICT is the major driver and development is the common target.

2.6 Importance of ICT4D

The focus of ICT4D is for ICTs to be implemented not as an end itself but as a driver for development in regions that are disadvantaged socio-economically (Gichoya, 2005; Bass, 2010). As a result, some communities have introduced facilities like telecentres, living labs, public libraries and cyber cafes for public access to ICT. The goal for such investments is to enhance communication and automation for development (Heeks, 2009b).

Figure 2.2 below illustrates the focus areas of ICT4D.

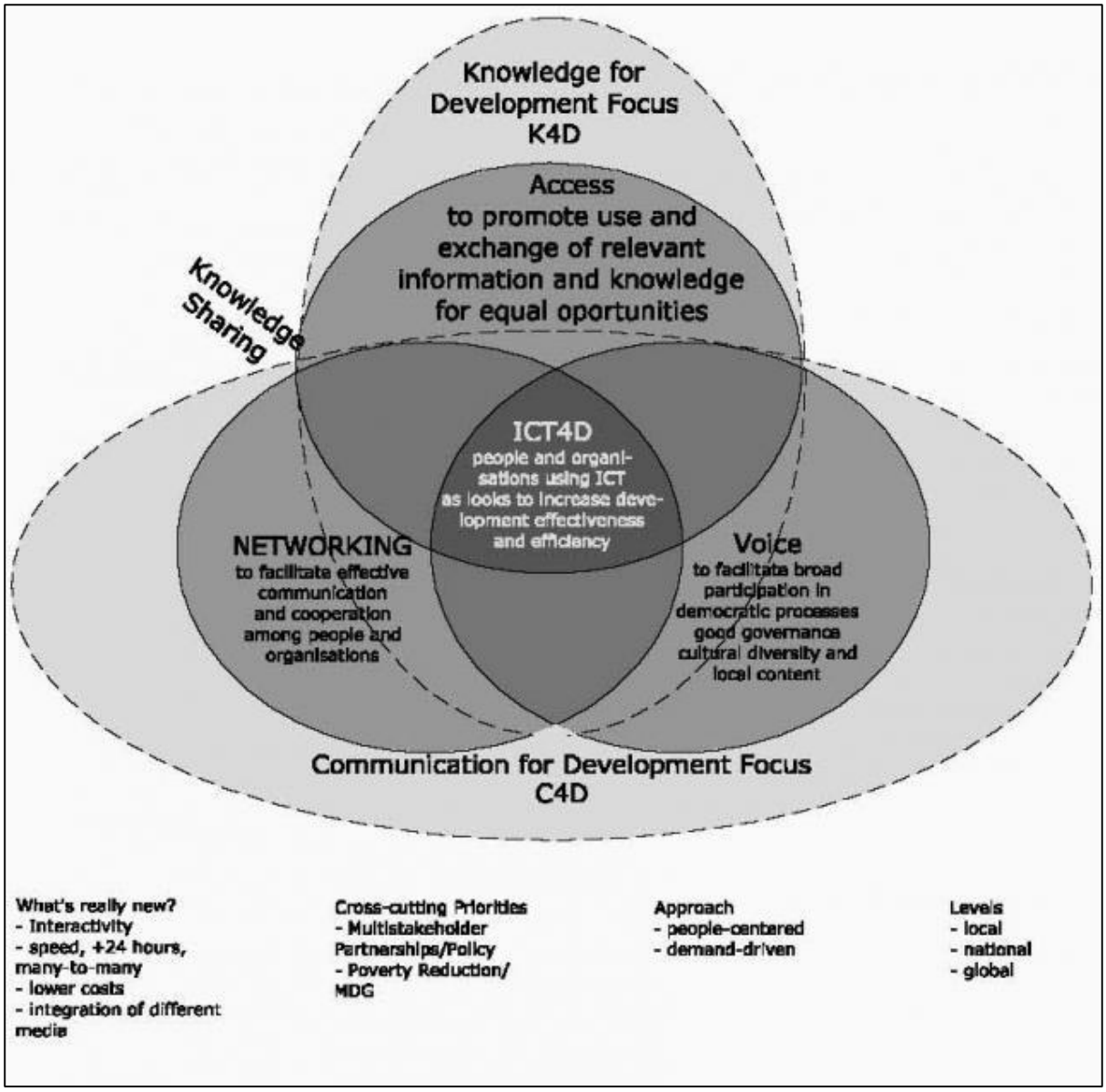


Figure 2.2: ICT4D Focus Areas (Weigel & Waldburger, 2004)

ICT4D is the core tool for networking, voice and access, as illustrated in Figure 2.2 above. The networking component in the figure shows that organizations and individuals are able to collaborate and share knowledge; voice represents empowerment that can be gained through initiatives like e-Governance, and access illustrates that information sharing offers equal opportunities. All these opportunities offered by ICTs are aimed at bringing development to the poor.

Some of the benefits that can be derived from ICT4D are listed and explained below:

2.6.1 Access to Markets and Global Issues

Communication technologies open up new markets that were not formerly reachable due to distance (Premkumar & Roberts, 1999). Rural businesses can access other rural or urban markets, thereby gaining information on better pricing, logistics and supply chain. This

enables them to make better business decisions (Pade-Khene, Palmer, & Kavhai, 2010). Cecchini and Scott (2003) also stress that ICTs can improve rural livelihoods by giving them access to global markets. Cecchini and Scott give a brief discussion on the computerized milk collection centres in India which help farmers to prepare and market their products with the help of computerized systems.

ICTs empower developing communities by enabling them to connect to global issues (Gomez & Baron-Porras, 2011). As mentioned by Dutta and Mia (2011), ICTs provide an infrastructure for global business dialogue with consumers and other stakeholders using various kinds of digital communications.

Sub-Saharan countries thrive on agriculture for livelihood. ICTs can enhance sustainable agriculture and food security through advanced processes for information sharing and access, this is called E-Agriculture (Mangstl, 2008). Radio, television, mobile phones and the Internet are some of the various channels used to disseminate agricultural information.

Mobile telephony has proven to be one most prevalent tools for knowledge access and exchange among players in the agricultural field (Mangstl, 2008; Gakuru, Winters, & Stepman, 2009).

In Kenya, between the years 2006 and 2008, a report by Muriithi, Bett, and Ogaleh (2009) shows that there was an average increase of 23 443 in mobile telephone monthly hits for agricultural information. During that same period, an increase of 54 hits was noted in Interactive Voice Response (IVR) through which farmers were requesting for information on seed varieties to plant. These statistics indicate that the use of ICTs is contributing to rural livelihoods' development.

Farmers in rural India are making use of ICTs to enhance agricultural products supply chains. In Gujarat they have developed a Dairy Information System Kiosk for computerized milk collection and selling. This system makes the business run faster and more effectively as the farmers are paid on time and milk is tested electronically for fat content (Cecchini & Scott, 2003). These systems offer positive health benefits for customers.

2.6.2 Access to Education

Rural schools often suffer from lack of adequate learning infrastructure and study materials. ICTs provide a platform for learning through the use of online educational resources and simulations for experiments. Interactive online learning materials, collaboration tools and CD

ROM based modules are examples of the facilities provided by ICT4D projects centred on ICT for education (IICD, 2007). The quality of education in developing countries can thus be improved through the use of ICTs.

As noted by Anderson (2010), the educational sector is critical for the development of marginalized communities. Limb (2005) suggests that e-education in Africa has the prospective to attain savings, amplify speed of delivery of information and allow African students to access up-to-date global information. Formation of the human capital and ICTs are now an integral part of the modern society. Similarly, Anderson (2010) argues that there is no way the society is ever going back to the old systems which survived without ICTs. Therefore ICTs are an important driver for educational development to under-privileged communities as they can now remotely access learning materials that were formerly not available to them due to distance and lack of resources.

E-Education is the use of ICTs for knowledge sharing and transmission (Mac-Ikemenjima, 2005). ICT can be used to enhance curriculum development and administrative processes in schools. It offers opportunities for students, especially those living in rural communities, to widen their prospects and advance their employment forecasts (Whelan, 2008). With the ICTs, educational resources and professionals in nearly every subject can now be accessed from anywhere and at any time to the benefit of learners in developing countries that have limited and obsolete library resources.

Figure 2.3 below shows the business model of the e-Education service as adopted from Drozdova and Dado (2007).

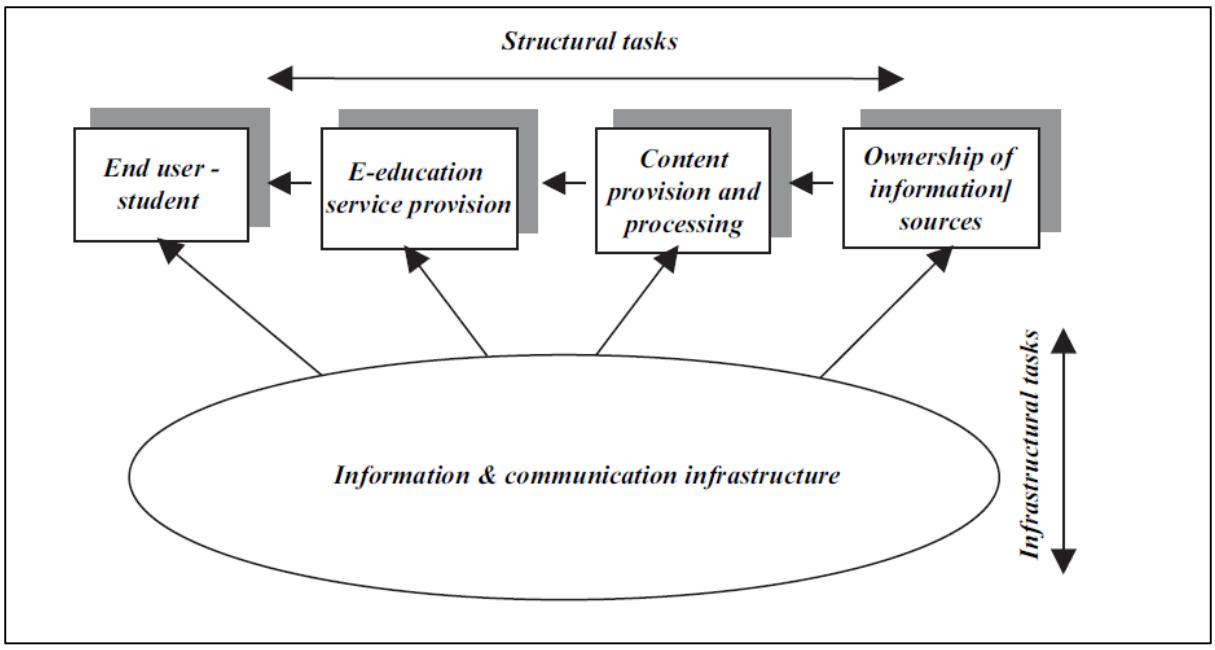


Figure 2.3: Business model of the e-education service (Drozdova & Dado, 2007)

From the above figure it can be observed that ICT infrastructure features, which are to capture, process, store, transmit and present information, are manipulated in order to boost e-education.

2.6.3 Economic and Political Empowerment

Economical capabilities can be realised by communities which implement ICT4D initiatives. A study by Harvey and Sturges (2010) showed that ICTs positively improved economic status for Gambian entrepreneurs by giving them flexibility and improved logistics through instant communication. According to Curwen and Whalley (2011), mobile technologies have double economic benefits in that the more tele-density increases, more wealth increases, and the more wealth increases, the more tele-density increases.

ICTs can empower people to access their rights and to communicate with the responsible actors (Beardon, 2008). Ogan et al. (2009) also argue that ICTs are a tool which can be used for the empowerment of women and for the adoption of more democratic policies. Citizens gain access to government facilities with more ease and speed through e-Governance systems. This gives them empowerment as they can also be involved in decision making and their view can be aired to the responsible governments (Kitaw, 2006).

E-Governance is the use of ICTs to facilitate access to government services and make governments more available to citizens (Kitaw, 2006). Saxena (2005) differentiates between e-Governance and e-Government, defining that e-Governance are the systems that cover all forms of digital communication between government and the citizen, thereby enabling

citizens to partake in the government's policy-making. E-Government involves all the ICT infrastructure used by government institutions for communication with their users and their internal functionings. This concurs with Backus's (2001) definition which states that e-Governance is the use of ICTs for internal processes and interaction between government and citizens. E-Governance systems allow citizens to access government services anywhere and anytime without having to queue at the offices.

Gyandoot is an initiative that has been designed for such purposes in Madhya Pradesh, India. The system allows citizens to access government forms and documents from tele-kiosks. This empowers citizens by making them gain the right to access information whenever needed (Cecchini & Scott, 2003).

A case study of the Akshaya Telecentre Project in Kerala, southern India conducted by Masiero (2011) reports that if e-Governance initiatives are built in consideration of cultural and political constructs of the environment, they will reap trust and positive response from the citizens. The Akshaya e-Governance telecentres enable citizens to pay government bills online and at their convenience. The other benefit that has been derived from this project is the bridging of the accountability gap between the government and its citizens. The Kerala citizens can now also be involved in the decision making process through this ICT driven channel.

In their argument against ICT4D, Sreekumar and Rivera-Sanchez (2008) also mention the Gyandoot e-Governance project as an ineffective example to give as one of the successful initiatives. They contend that e-Governance initiatives promote inequalities and rural power hierarchy. Their view could be justified where the e-Governance system approach is techno-centric rather than user-centric. Techno-centric approaches provide ICT access without regard to the actual needs of people, yet assuming that it will bring development, but user-centric approaches prioritize people's developmental needs (Marais, 2011). E-Governance systems with user centric approaches can empower communities and make governments accountable to their citizens.

2.6.4 Employment Creation

Among the wide range of opportunities that ICT offers is employment creation (Hamm, 2001; Rao, 2008; Gomez & Baron-Porras, 2011). A study of telecentre projects in Jamaica revealed that ICT training given to youths equips them with important skills for the job market (Bailey, 2009). Employment is also one of the freedoms mentioned by Sen (2005). Thus ICTs can aid as a function to enhance individuals' freedom to achieve their valued needs.

In their study of a mobile-only Internet use, Donner, Gitau, and Marsden (2011) identified that training in ICTs can assist people in getting jobs in South Africa. In the study, one of six women who were involved managed to assist a friend to get a job via a website which she accessed through a mobile phone. One can conclude thus that an increased use of ICTs can help reduce unemployment rates.

2.6.5 Access to Health

The application of ICTs in the medical field for the delivery of health services and information is known as e-Health (Eysenbach, 2001). Among the major benefits brought about by the use of ICTs in health are improved efficiency in administration, ability for remote consultations, collaboration among health workers and faster dissemination of information on health threats (Chetley, 2006). These benefits are most critical in developing countries where poverty is rife and life-threatening diseases like malaria and TB are common.

Chetley (2006) reports of one successful e-Health project which was developed in Rajashahi, Bangladesh to register, schedule and track children's immunization. Within three years this initiative saw a 40% increase in immunization rates. This was a result of improved record processing speeds brought about by the use of ICTs, giving the health workers more time to attend to patients.

Telemedicine, an element of e-Health, enables medical practitioners to research, diagnose and manage records and data using ICTs. In India a Health Care delivery project now enables midwives to collect and manage large amounts of data on rural immunizations and births using Personal Digital Assistants (PDAs). This gives them more time to give medical attention to the poor (Cecchini & Scott, 2003).

2.7 Challenges with Implementing ICT4D

The most common ICT4D challenges are lack of proper resource management, poor infrastructure, electricity shortage and poor education and skills (Best & Smyth, 2011; Gomez, Pather, & Dosono, 2012). These challenges affect sustainability and contribute to the failure of some ICT4D projects in Sub-Saharan Africa. Failure of ICT4D projects can be classified in three categories, that is: total failure, largely unsuccessful failure and partial failure (Heeks, 2002). In the same paper, Heeks (2002) draws attention to the gap that exists between the reality of the user's actual context and the designer's conception when designing an information systems (IS) for a developing region. He calls this kind of gap the design-reality gap. The design-reality gap can adversly affect the sustainability of ICT4D projects. This can be experienced when a project fails to meet stakeholder needs and gets abandoned. An example Heeks (2002) gives in the article is of South African touch screen

kiosks which were quickly abandoned when people failed to use them. This example shows that there is a need to create solutions that help reduce project failures to make the projects sustainable.

Kumar and Best (2006) identify five principal modes of sustainability failure, namely: financial/economic, cultural/social, technological, political/institutional and environmental sustainability failures. The authors mention that it is in these dimensions that sustainability problems lie. It can thus be implied that analysing factors in these dimensions can assist in identifying major causes for sustainability success or failure. Kumar and Best's sustainability failure model is derived from Heeks and Bhatnagar's (1999) critical failure factor model which outlines ten critical failure factors. The factors are delineated as: information, technical, people, management, process, culture, structure, strategy, politics, and environment.

The five sustainability failure modes are evidently the critical factors which pose sustainability challenges for ICT4D projects. Addressing these factors will help bring solutions to the sustainability problems in developing countries' ICT4D initiatives. The sub-sections below briefly explain the critical factors and their relative challenges in ICT4D sustainability.

2.7.1 Technological Challenges

As an example for technological failure factors, Kumar and Best (2006) cite failure of the field hardware and software to function properly as they are designed to do and eventually the system stops working. There is lack of competent local personnel to continuously manage and repair ICT4D resources in most developing countries (Howard, 2008). Moreover, remote management has proven to be difficult as the connectivity between the ICT4D system and their remote developers is often poor (Bailey, 2009). Howard (2008) maintains that this has a negative impact on the sustainability of ICT4D interventions as systems can be down for days and there will be no productivity.

Electricity shortages are a common characteristic in almost all developing countries and backup facilities are expensive or unsustainable due to long blackout hours, yet computer systems rely heavily on electric power (Best & Kumar, 2008). Incompatibilities in software and hardware among different field sites in an ICT4D system can result in the disruption of information inflow and result in failure (Heeks & Bhatnagar, 1999). Another cause for such incompatibilities is that some donated second-hand computers are offered free of charge but with some faulty components, posing extra costs for repairs, import duty and replacement costs (IICD, 2007). Most rural areas in underdeveloped nations suffer from lack of access to

international bandwidth, poor telecommunications infrastructure and limited number of Internet Service Providers (ISP) together with high Internet access costs as barriers to consistently deliver digital resources and services (Ashcroft & Watts, 2005; Limb, 2005; Chetley, 2006).

For developing nations to benefit from the global connectivity, operators must attain greater amounts of international Internet bandwidth, increase and advance central networks, and upgrade network infrastructure. Furthermore the cost of accessing digital resources must be made affordable (International Telecommunication Union (ITU), 2011).

2.7.2 Financial/Economic Challenges

Research done by Best and Kumar (2008) in 36 tele-kiosks of rural India identified that 85% of the kiosks were financially unsustainable and had to close down. The contributing issues to the sustainability failure were lack of continual support and lack of new and relevant content. The kiosks were providing Internet services at a charge and when there was no connectivity, there was no income. Concerns over the need for new content were expressed, but nothing was done and they ultimately lost clients. One can therefore conclude that various factors contribute to financial challenges in ICT4D initiatives which are expected to produce income.

Heeks (2002) explains that differences exist in the economic context of designers and users of ICT4D systems. The author states that these gaps stem from developing regions' strong belief in imported goods from the North. The result of this is an adoption of ICTs which will not fit in the economic context of the user and subsequently failure will occur.

All prospective expenditure and income generation must be integrated in the planning process from the start for projects to be financially sustainable (Macapagal & Macasio, 2009). Another aspect to consider is the local users' demand. If supply meets the local demand at low cost, local consumers will have the ability to pay and the projects will become financially sustainable (Cecchini & Scott, 2003; Marais, 2011).

2.7.3 Cultural/Social Challenges

Different regions present different cultural/social challenges. Examples of such are IT staff problems, tampering and theft, corruption, and illiteracy (Brewer et al., 2006).

Above literacy, a competent human capital is essential for the implementation ICT4D, moreover its shortage is a big obstacle in Africa. Voice based technologies, for instance

radio, TV and mobile phones are much more easily adoptable for communities with high illiteracy rates and where modes of communication are more oral than text based (Kitaw, 2006).

Capacity refers to inequality in the sharing of resources within societies. Differences in income among citizens of developing countries cause the poor and the rich to use different communications techniques, thus technical change in ICT has thus far been inclined towards the rich (Cecchini & Scott, 2003). This is a barrier to development since ICT4D is meant to improve the livelihoods of the poor. Such differences in communities need to be addressed when implementing ICT4D so that the voice of the poor is also heard and their needs are met. Women in undeserving communities are generally deprived fair access to the benefits of ICTs (Chetley, 2006).

2.7.4 Political /Institutional Challenges

Communities often lack local skilled and self driven champions that devote time and effort to keep ICT4D projects running (Heeks, 2002). To agree with this, Kumar and Best (2006) state that lack of efficient communal leadership and continual commitment is one of the main reasons for failure of ICT programs. Kumar and Best (2006) proceed to mention the case of the Sustainable Access in Rural India (SARI) project whose two leaders were transferred and the replacing officers failed to maintain the same commitment and drive that the previous ones had, causing eventual failure of the project. The authors suggest that projects need to be institutionalized rather than be dependent upon personal initiatives.

Walton and Heeks (2011) argue that user involvement is absent in most ICT4D projects; this increases design-reality gaps and results in systems that do not fit into the local context. They propose that beneficiary and users' ideas and needs be considered right from the start as this will give the locals a sense of ownership to the program and enhance its sustainability.

2.7.5 Environmental Challenges

Natural disasters being unpredictable and irregular are often ignored, yet they can affect field work at some point. Other less destructive local catastrophes include broken bridges, fires and heavy rains (Brewer et al., 2006). Another major environmental challenge that developing countries face is that of receiving obsolete dumped computers which they will not be able to use long enough. The result is failure because the systems will fail to match the needs of the intended users.

Environmental challenges usually derive from the absence of adequate environmental analysis (Heeks, 2002). The same author mentions a particular case of South Africa touch screen kiosks which only ran for a year and were abandoned because of lack of continual updates to fit the local context. This case reveals the need to familiarize with local context and values and to continually adapt to the ongoing environmental changes (Walton & Heeks, 2011).

The following section covers the management of ICT4D projects.

2.8 Management of ICT4D Projects

Given the above mentioned challenges to the sustainability of ICT projects, it can be concluded that there is a crucial need to properly administer ICT4D projects to achieve the goals of alleviating poverty in marginalized communities. Macapagal (2010) points out that one of the causes for failure is poor project management. Macapagal (2010) goes on to recommend that responsibly managing invested resources can help capitalize on sustainable benefits.

Sahay and Avgerou (2002) discovered that most organizations in developing regions fail to foster and maintain complex technology projects over the required long periods of time and resulting systems fail to have impact on the organizational problems they were intended to solve. A report by the UNDP (2001) highlights that Sub-Saharan ICT4D un-sustainability is caused by impractical timeframes, inadequate training, and failure to provide suitable technologies for local needs. The report gives reference to Zambian computing systems which were abandoned due to lack of user skills and another Sub-Saharan education computer system, which for the same reason, remained unused for three years. It shows that Sub-Saharan ICT4D management is still in need for robust and suitable techniques to ensure project success and sustainability.

Figure 2.4 below, from Macapagal and Macasio (2009), illustrates that one of the strategies to achieve the MDGs and poverty alleviation is to implement ICT4D projects with good project management methods, which will result in improvement in the livelihoods of the poor. ICTD is used to imply the same meaning as ICT4D in Macapagal and Macasio's report. One can thus observe that management is the key factor which influences either success or failure of ICT4D inititives.

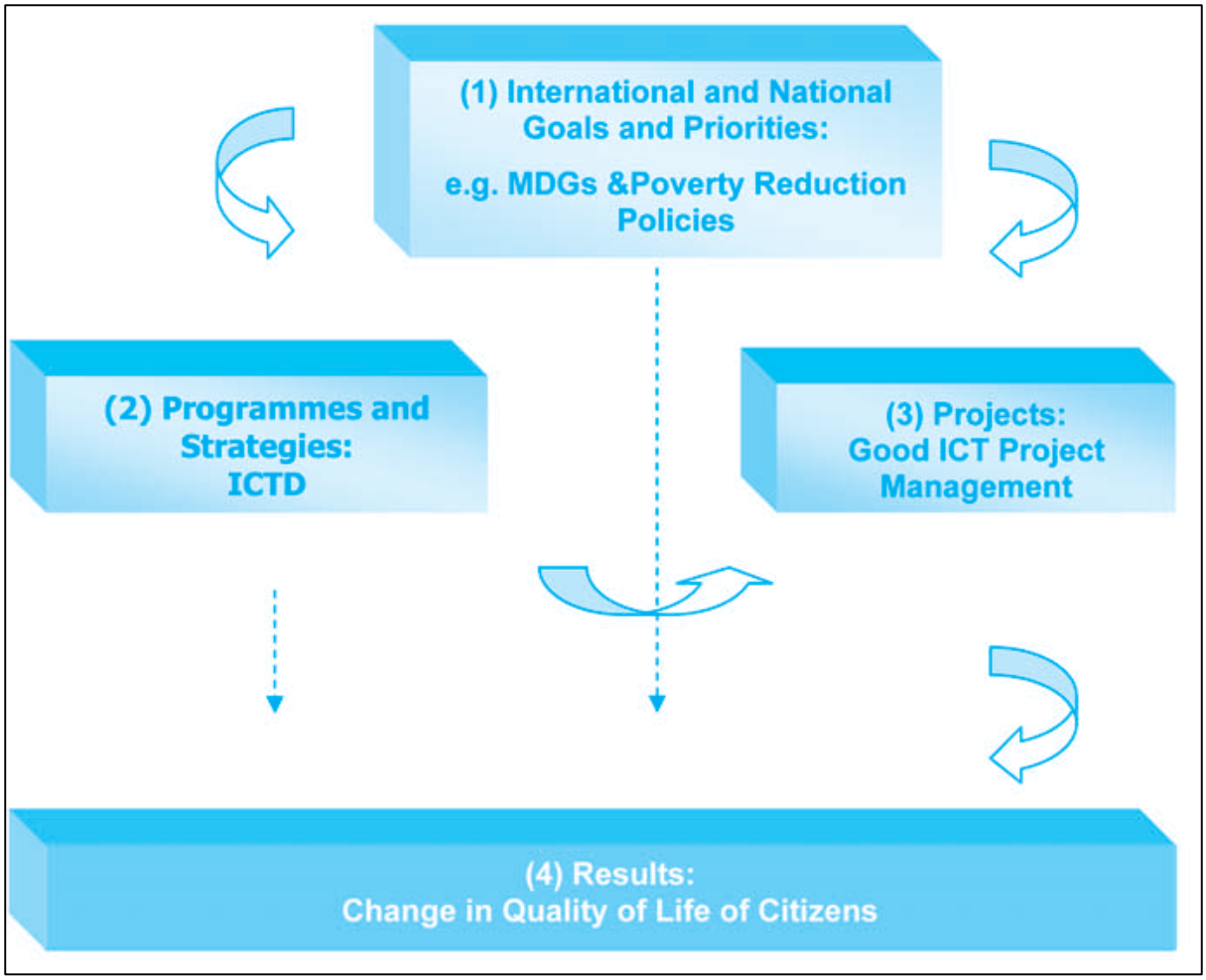


Figure 2.4: Poverty Reduction Strategy Programmes, ICTD and ICT projects. (Macapagal & Macasio, 2009)

Kumar and Best (2006) refer to management as one of the critical failure factors to ICT4D projects' sustainability. They argue that failure to make use of local capacities and to institutionalize the management structure can lead to sustainability failure. Management techniques adapted from industrial project management can be utilized in rural ICT4D projects with modification to suit the environment (Pade-Khene, Mallinson, & Sewry, 2011). The above mentioned authors also suggest that it is important for the project leaders to consider the limitations of the community in order to design models which will ensure projects' sustainability.

2.9 Current State of ICT4D Management

Nissilä (2010) explains that some ICT4D projects are first set up as pilot projects to build up the system and familiarize with its operation. The author further argues that most of the projects fail to scale up and become sustainable due to inadequate finances. According to Jensen and Esterhuysen (2001), the basic procedures for setting up a telecentre are the following:

1. Initially assign key people who will manage the on-going progress of the telecentre.

2. Hold a public meeting for the assessment of the community's needs to establish the services to be provided by the telecentre.
3. Acquire premises and design a business plan.
4. Establish funding for the telecentre.
5. Commence the telecentre operations.

Most cybercafés and telecentre managers lack technical capacity and financial literacy and this hinders their project's success (Pather & Gomez, 2010). According to Macedo, Garcia, and Felix (2007), poor management of ICT4D projects causes their failure. In light of the procedures suggested by Jensen and Esterhuysen (2001), the ICT4D project management staff must be competent and qualified for the job and there must be adequate finances for running the projects. Rural ICT4D projects often suffer from lack of qualified management due to the prevalent poverty and high illiteracy rates that characterize the regions. Ineffective leadership in ICT4D results in projects failure (Walton & Heeks, 2011).

Gutu Multipurpose Community Telecentre in Zimbabwe had lack of competent staff which resulted in regular breakdowns of equipment and poor service to the users (Abdulwahab & Dahalin, 2012). A study of the Masendu Rural Community ICT, Zimbabwe initiative revealed that the project was being run by selected teachers, village youths and a community leader (Madzima & Nhamu, 2010). One can conclude that Sub-Saharan ICT4D is lacking experienced managers and well-trained staff that are able to maintain the technical infrastructure and equipment.

Looking beyond Sub-Saharan Africa, ICT4D initiatives in other regions still currently face similar challenges in management, resource availability and access. Best and Kumar (2008) discuss the Sustainable Access in Rural India (SARI) project in Tamil Nadu, India which had several telecentres, some of which were owned by private entrepreneurs and some by a local NGO. The authors explain that of the private owned telecentres they studied, 32 out of 36 closed after three years. The reasons cited for the closures include erratic technical support, failure to upgrade content and lack of adequate training on telecentre management.

The table below shows some examples of services provided by ICT4D projects in rural areas and the technologies available.

Table 2.1: Examples ICT4D Projects services and resources

ICT4D Project	Services Provided	Technologies Available
Sustainable Access in Rural India (SARI) project in Tamil Nadu, India (Kumar & Best**,** 2006)	Basic computer education, e-mail, web-browsing, e-government, health, agricultural and veterinary services	Wireless-in-Local Loop (WLL) technology to provide Internet connectivity to rural villages, computers, printers
Nakaseke Multipurpose Telecentre, Uganda (Ojo, 2005)	Library services, IT skills training, typesetting, word processing, video services, telephone services, faxing, photocopying, telemedicine services and Internet access for e-mail and web browsing	Computers, printers, photocopiers, radios, television sets, projectors, inverters, facsimiles, UPS and speakers
Gutu Multipurpose Community Telecentre, Zimbabwe (Chikowore-Kabwato & Ajiferuke, 2002)	Internet, email, telephone and basic computing	Computers, telephones and network equipment for internet
Sekhukhune Living Lab, South Africa (Merz & van Rensburg, 2007)	Collaborative procurement and collaborative planning to support Small Medium and Micro Enterprises (SMMEs)	Wireless networks, fixed networks, GIS and collaboration tools, SMS based/browser based interaction, portal applications, Web2.0 tools
Siyakhula Living Lab, South Africa (Schaffers, Cordoba, Hongisto, Kallai, Siebörger & Terzoli, 2010)	Supporting e-commerce and e-marketing services of rural products, literacy training sessions	WiMAX, VSAT, Wi-Fi, GPRS, VoIP
Limpopo Living Lab (Merz & van Rensburg, 2007)	ICT business incubation, business process outsourcing and off-shoring, research and development, programme planning and execution	GIS and collaboration tools, SMS based/browser based interaction, portal applications, Web 2.0 tools

Abdulwahab and Dahalin (2012) mention that lack of publicity is one major hindrance to the full use of the ICT4D initiatives. The authors highlight that most rural people are not aware of the services provided by the ICT4D initiatives in their communities. This shows that there is need for awareness campaigns to be done as soon as an ICT4D project becomes functional. Abdulwahab and Dahalin (2012) further maintain that the more people are made aware of the ICT4D initiatives, the more their usage.

Resource inadequacy is a common challenge in rural ICT4D programmes (Grunfeld, 2007). Scarcity of computers and software, low bandwidth and obsolescence of equipment are some of the obstacles to the successful utilization of ICT4D facilities. Madzima and Nhamu (2010) state that the Masendu rural initiative suffered poor internet connectivity, power supply and had very few computers which were expected to serve a lot of people.

2.10 Examples of ICT4D projects management in developing countries

Gichoya (2005) identified several reasons for poor ICT4D project management in developing regions, among which are failure to address risk management, failure to fully justify business systems and lack of management participation. Gichoya (2005) insists that firm project management is vital to build up and implement successful ICT projects. Applying the COBIT to solve the above mentioned problems would entail enforcing the controls to help managers plan and organize ICT4D resources.

Africa lags behind in the investment in ICT infrastructure, yet this is a major driver for development in the information age (Kitaw, 2006). Kitaw (2006) suggests that African countries start to extensively invest in infrastructure to fully exploit the prospects offered by ICTs. The challenge of infrastructure is characterized by poor telecommunications infrastructure, limited number of Internet Service Providers (ISP) and lack of access to international bandwidth. The result is undependable connectivity and therefore unreliable transactions (Chetley, 2006). Reliability, according to COBIT, is a primary enabler for the achievement of ICT goals; it is imperative that ICT4D managers start to consider properly managing projects to achieve sustainability.

2.10.1 South Africa

A study by Pade-Khene, Mallinson, and Sewry (2011) of the Dwesa ICT project showed that there had not been any use of standard resource management, and decisions were made informally. The same authors argue that this kind of approach is risky and that there is need to develop proper management and implementation techniques for ICT projects in rural areas.

The Khanya Project of the Western Cape focuses on providing ICT to schools for curriculum development. As revealed in a research done by Chigona and Mooketsi (2011), most schools under the project lacked sufficient technical support. The result was that many computers remained inoperative for long periods and it increased burden to the available yet inadequate infrastructure. Macapagal and Macasio (2010) highlight that procurement of infrastructure that is used to meet project goals is a crucial management discipline. This relates to the ITGI (2007) which states that the acquisition, maintenance and protection of infrastructure should be strategically planned and should be auditable and measurable.

2.10.2 Zambia

Research on the use of ICTs in education in Zambia revealed that there were no ICT policies and master plans to steer investment such that there had been several acquisitions of the same product due to lack of organization (Gichoya, 2005). “Lack of adequate ICT infrastructure and, lack of proper change management procedures contribute much to the delay in appropriate e-government adoption in Zambia” (Bwalya, 2009, p.1). According to Bwalya (2009) one of Zambia’s e-Government initiatives the Zambia Health Management Information System (ZHMIS) faces is the challenge of poor infrastructure availability and management. The projects run in remote rural areas and often lack skilled human resources to support and maintain the system. Bwalya (2009) continues that these challenges cause the stakeholders not to adequately benefit from the initiatives.

Another Zambian ICT4D initiative mentioned by Bwalya (2009) is the Zambia Immigration Management System (ZIMS). The ZIMS is an automated visa and permit approval system which was designed to reduce service delivery time. The system, however, faces challenges similar to the above mentioned ZHMIS together with other challenges including: lack of trust resulting in unreliability, computer illiteracy among staff and unstable sustainability framework of the new system.

To solve the above mentioned challenges would be to apply the COBIT 4.1 principles according to the ITGI (2007), of setting an infrastructure management plan, training personnel and involving stakeholders to instil in them a sense of ownership.

2.11 COBIT and ICT4D Projects Management

According to Heeks (2002), 70% of IT projects fail due to lack of proper governance. This analysis proves the need for ICT4D projects governance structures that will help make projects succeed and become sustainable. ICT4D initiatives are IT enterprises and therefore considering frameworks in IT management can help to understand how ICT4D projects can be managed. The COBIT framework is one such relevant framework. The IT Governance Institute (ITGI) designed the COBIT framework to explain the control processes which organizations can apply to get good returns from IT investment (ITGI 2007). COBIT was created by the Information Systems Audit and Control Association (ISACA), and the ITGI in 1992. It was first published in 1996 (Abu-Musa, 2009). COBIT has evolved to COBIT 5 which is a framework that supports organizations in accomplishing their goals for IT governance and management (ISACA, 2012).

IT Governance is a set of management structures and processes that ensure that IT projects sustain and expand organizational goals (ISACA, 2012). This definition of IT Governance shows that there is a relationship between sustainability and governance of an IT entity. In the context of this research ICT4D projects are the IT entities that need proper governance.

Ridley, Young, and Carroll (2004) argue that COBIT is the most suitable control framework to help an institute guarantee alignment between use of IT and its business goals by abiding with the control objectives. The COBIT 5 framework comprises of five key principles and 17 generic goals and has been widely used globally in private and public firms and in academia (De Haes & Van Grembergen, 2012). Details of the domains and processes that are relevant to this study are given in the sections that follow. There is a limited amount of literature to show how COBIT has been applied in ICT4D compared to that of its application in the commercial sector. ICT4D projects are IT entities with development goals (whether profit or non-profit making) that need to be achieved (Gomez & Pather, 2012); hence in this research the COBIT framework has been chosen to aid in identifying how its controls can enhance ICT4D sustainability. Figure 2.5 from ISACA (2012) illustrates the basic COBIT 5 principles.

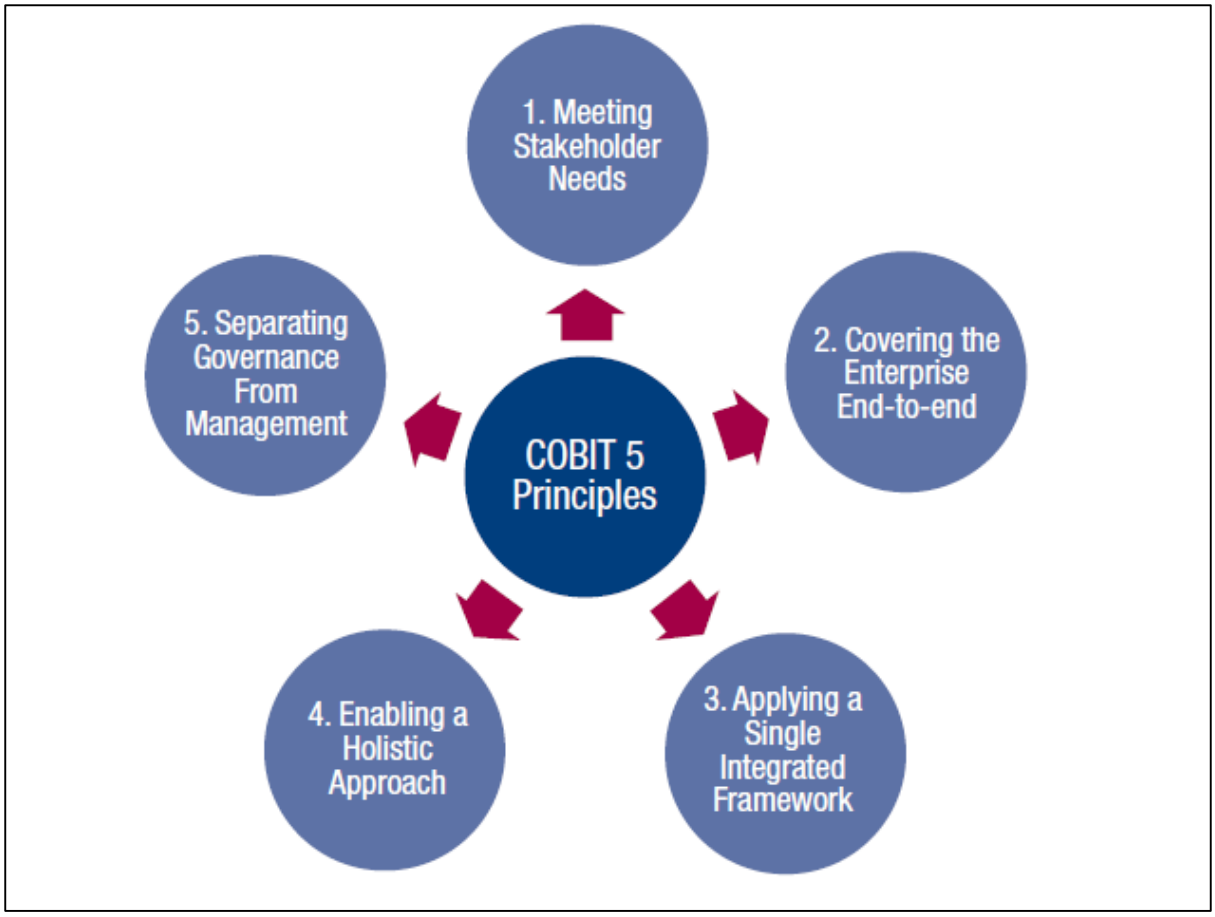


Figure 2.5: COBIT 5 Principles (ISACA, 2012)

The COBIT 5 framework is based on the principle that organizations run to meet their stakeholder needs through optimum use of resources (ISACA, 2012). The reason for choosing COBIT 5 is that its principles directly guide on how IT resources can be used to achieve organizational goals. COBIT 5 focuses on five key principles for governance and management of enterprise IT illustrated in Figure 2.5 above:

• **Principle 1: Meeting Stakeholder Needs**—Organizations are there to meet stakeholder needs through balancing between benefits realisation, risk optimization and resources use. To support this principle, COBIT 5 presents processes and other enablers to be applied by IT enterprises (ISACA, 2012). According to ISACA (2012), organizations can adapt COBIT 5 to match their own context.

• **Principle 2: Covering the Enterprise End-to-end**—COBIT 5 incorporates governance of organizational IT into organizational governance by considering ICTs as assets and regarding IT governance and management enablers to be comprehensive of everything and everyone that is involved in the ICT governance and management of enterprise information (ISACA, 2012).

• **Principle 3: Applying a Single, Integrated Framework**—COBIT 5 can be used as the main framework for governance and management of enterprise IT because it incorporates other major IT governance and management frameworks (ISACA, 2012).

• **Principle 4: Enabling a Holistic Approach**—COBIT 5 defines seven categories of enablers that can aid to accomplish organizational objectives:

– Principles, Policies and Frameworks

– Processes

– Organizational Structures

– Culture, Ethics and Behaviour

– Information

– Services, Infrastructure and Applications

– People, Skills and Competencies (ISACA, 2012).

• **Principle 5: Separating Governance from Management**—The COBIT 5 framework distinguishes between governance and management and defines that: **Governance** involves setting of strategic objectives, decision making, performance monitoring and compliance to objectives in order to meet stakeholder needs, whilst **Management** plans, builds, runs and monitors activities in alliance with the governance objectives (ISACA, 2012).

2.11.1 Applying COBIT to ICT4D

Literature pertaining to the management of ICT4D projects emphasises that the critical drivers that establish project success are people, process and technology (Macapagal M. , 2010; Walton & Heeks, 2011; Chan C. M., Hackney, Pan, & Chou, 2011). In light of this, focus of this research will be on two principles out of the five COBIT 5 principles. The COBIT 5 principles which will be emphasised in this study are the following.

- Principle 1: Meeting Stakeholder Needs
- Principle 4: Enabling a Holistic Approach

Explanation of each principle to justify its relevance to this study is given in the following sub sections.

2.11.1.1 Meeting Stakeholder Needs

Organizations need to optimize resource cost to achieve the major goal of realising benefits to create value for stakeholders (ISACA, 2012). ISACA (2012) defines a stakeholder as anybody who is responsible for or has any interest in the organization. In the ICT4D context, stakeholders can be project funders, government, project staff, users and the community. The figure below illustrates value creation as a governance objective.

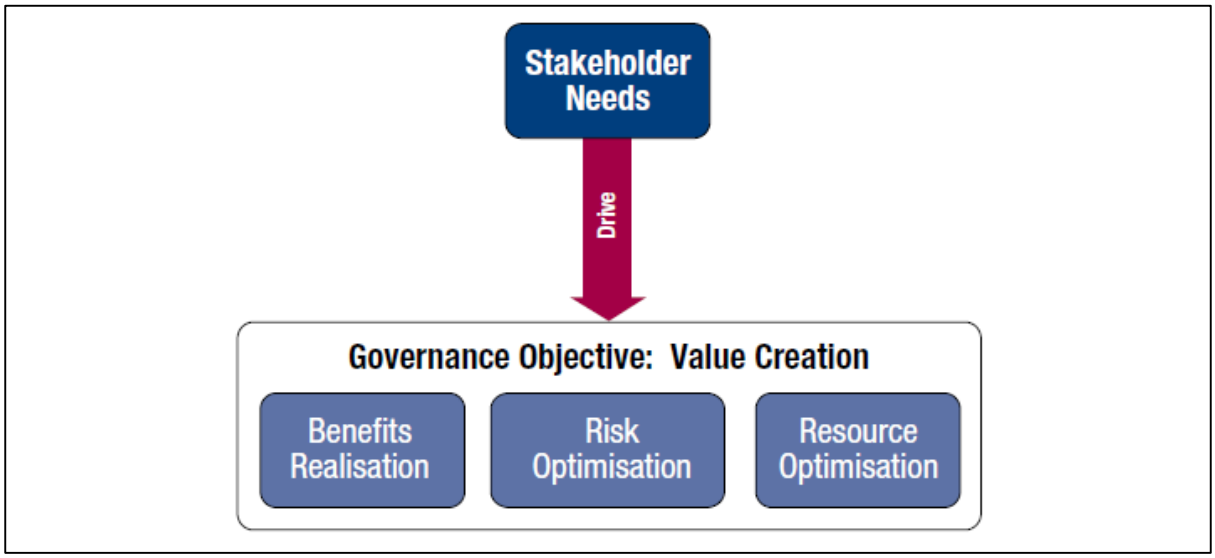


Figure 2.6: The Governance Objective: Value Creation (ISACA, 2012)

Figure 2.6 above shows that the governance objective of value creation is driven by the goal of meeting stakeholder needs. COBIT 5 exemplifies that sustainability can be achieved by meeting stakeholder needs through responsiveness to the dynamic business environment, skilled workforce and continuous innovation. In order to create value for stakeholders, one of the requirements is to optimize resources. For ICT4D initiatives to be ongoing and sustainable, stakeholder needs must be met hence optimization of resources is important.

2.11.1.2 Enabling a holistic approach

Principle 4 of COBIT 5 outlines seven enablers which influence whether IT enterprise governance and management will work. Of importance to this study are the following enablers which fall under resources:

- Information
- Services, Infrastructure and Applications
- People, Skills and Competencies

Figure 2.7 in the following section highlights the resource enablers which are critical to the governance and management of IT enterprises.

2.11.2 ICT4D Resource Management

ISACA (2012) defines resource optimization as the effectual, proper and accountable use of all resources. This relates to ITGI (2007) which explains that resource management is about the best management and investment in critical IT resources. It also corresponds with the World Commission on Environment and Development (WCED) (1987) definition of sustainability which states that present goals must be met without compromising future goals. Macapagal and Macasio (2009) express that ICT4D initiatives use resources and incur costs to produce deliverables. According to Geldof, Grimshaw, Kleine, and Unwin (2011), there should be sufficient resources to meet project needs. This implies that there should be proper resource management to ensure projects sustainability. As defined by ISACA (2012), enablers are the factors which determine how IT governance and management works. The seven categories of enablers are shown in the figure below.

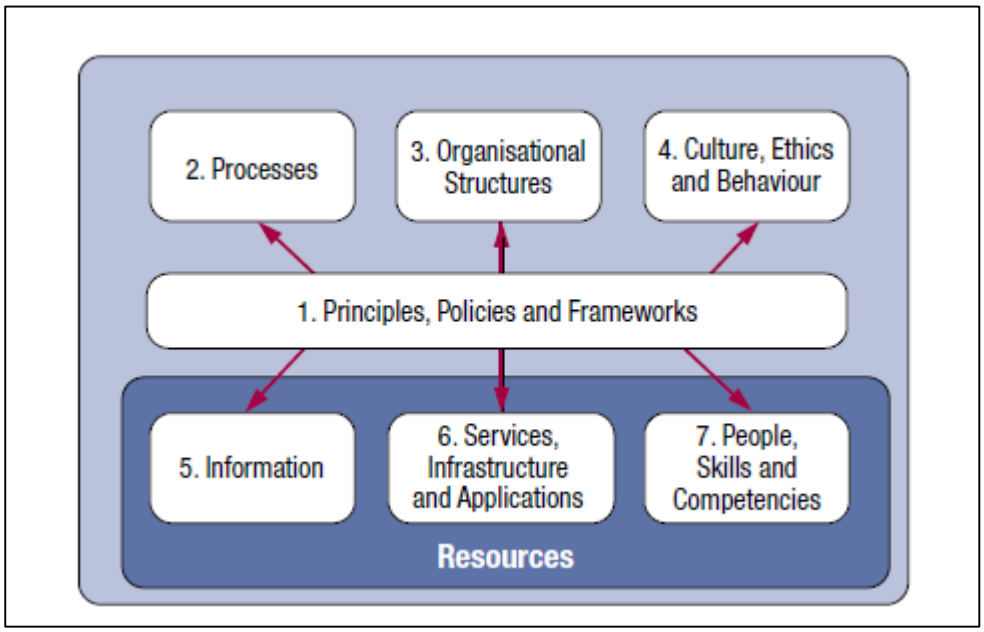


Figure 2.7: COBIT 5 Enterprise Enablers (ISACA, 2012)

The focus of this study is on resources enablers, which are labelled as category 5, 6 and 7 in Figure 2.7 above. Though the resources are grouped, they will each be explained in detail, with consideration to the relationships among them. ITGI's (2007) COBIT 4.1 outlines the critical IT resources to be applications, information, infrastructure and people. COBIT 5 builds upon that and introduces more resources which are services, skills and competences (ISACA, 2012).

It can be observed that the critical IT resources in COBIT 4.1 and COBIT 5 coincide with Kumar and Best's (2006) critical failure factors which are financial/economic, cultural/social,

technological, political/institutional and environmental factors. Below is a table showing where ITG's critical resources match with Kumar and Best's (2006) critical failure factors.

Table 2.2: Critical resources and failure factors

IT Critical Resource	**Kumar and Best's (2006) Critical Failure Factors**
Applications	Technological
Information	Technological
Infrastructure	Technological, Political/Institutional, Environmental
People	Cultural/Social, Political/Institutional, Environmental
Services	Technological, Financial
Skills and Competences	Cultural/Social, Political/Institutional, Environmental

The ITGI (2007) and ISACA (2012) define the critical IT resources as follows:

- **Applications** are the computerized and manual systems and routines that process the information (ITGI, 2007).
- **Information** is the data that is input, processed and output by the information systems. It consists of all information created and used by the organization, but at the operational level, information is usually the key product of the organization (ITGI, 2007).
- **Infrastructure** is the technology and systems that facilitate the processing of the applications (ITGI, 2007).
- **People** are the human resources necessary to plan, organize, obtain, execute, distribute, sustain, monitor and evaluate the information (ITGI, 2007).
- **Services** comprise the infrastructure, technology and applications that give information technology processing and services (ISACA, 2012).
- **Skills and Competences** are related to people and are necessary for achievement of all activities and for good decision making and taking remedial action (ISACA, 2012).

It can be implied from the above definitions that managing the critical IT resources properly can result in success of ICT4D projects. The next sections will examine how the critical IT resources can be managed using COBIT 4.1 and COBIT 5. COBIT 5 was built from COBIT 4.1 and other frameworks (ISACA, 2012). For the purpose of this study, several elements from COBIT 4.1 were found to be significant and directly relevant to explain how ICT4D resources can be properly managed, hence the considerable reference to it. In COBIT 5, as shown Figure 2.7, the critical resources are grouped as enablers (ISACA, 2012). Enabler 5 is Information resource, Enabler 6 consists of three related resources which are Services, Infrastructure and Applications, and Enabler 7 also comprises related resources - People,

Skills and Competencies. The following section will explain the management of IT resources, grouping them as they are categorised under COBIT 5 Enablers.

2.11.2.1 Managing Information

According to ISACA (2012), the information resource covers both manual and automated data that is generated and processed from IT and organizational processes. Figure 2.8 below illustrates that this data is transformed to information, information transforms to knowledge and the knowledge creates value to drive business and IT processes in a virtuous cycle.

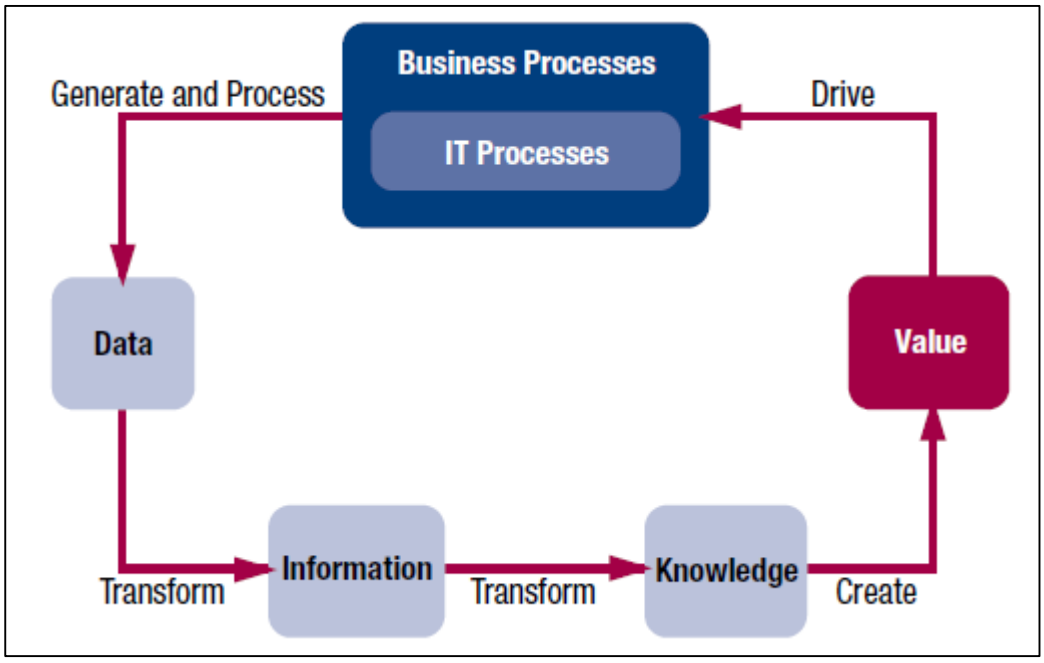


Figure 2.8: Information Cycle (ISACA, 2012)

COBIT 5 explains that the process of managing the information resource is performed as follows:

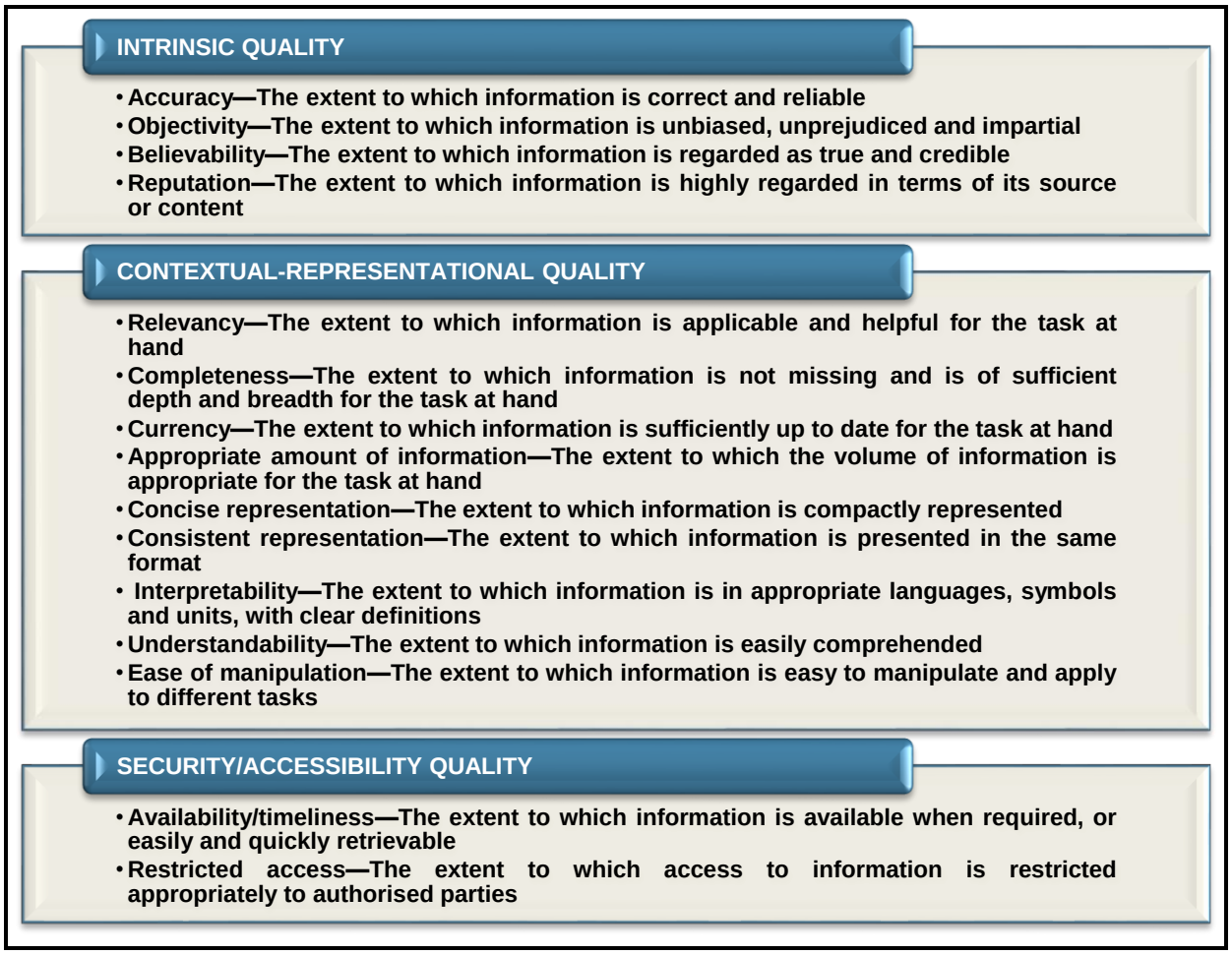
2.11.2.1.1 Addressing stakeholder needs

This can be achieved by identifying the stakeholders and their stake in the information. The information stakeholders can be categorised as Information producers, Information custodians and Information consumers, depending on their activities in the information life cycle.

2.11.2.1.2 Achieving the information goals

For an IT enterprise to achieve goals of the information, COBIT 5 emphasizes three dimensions of quality to be attained (ISACA, 2012). The dimensions are *intrinsic* quality, *contextual-representational* quality and *security/accessibility* quality. Table 2.2 below shows details of the information quality goals to be achieved.

Table 2.3: Information Quality Goals (adapted from ISACA, 2012)

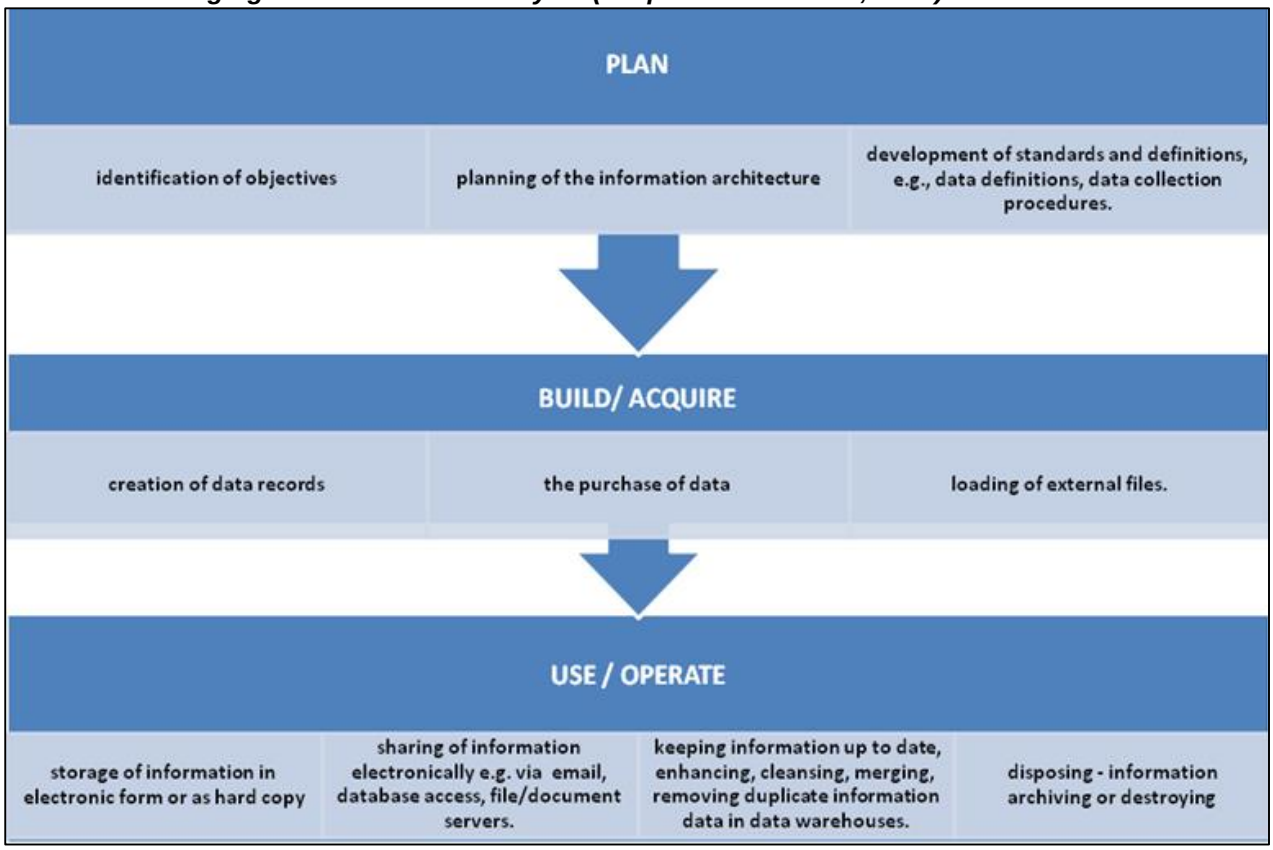


ICT4D projects need to focus on the above mentioned information management dimensions. This will enhance security and quality of the information that flows within the projects. The next section explains the management of the information cycle.

2.11.2.2 Managing the information life cycle

The information resource life cycle needs to be managed by way of identifying the right approaches to use for a particular phase of the cycle. The phases according to COBIT 5 are illustrated in Table 2.3 below.

Table 2.4: Managing the information life cycle (adapted from ISACA, 2012)



2.11.2.3 Applying good practices

Good information management practices can be achieved by implementing processes that are defined by information attributes. ISACA (2012) outlines these attributes as *physical world layer, empiric layer, syntactic layer, semantic layer, pragmatic layer* and *the social world layer.* Identifying these attributes can assist to define processes for the applications that will handle the information (ISACA, 2012). Below is the description of how the six information attributes are defined according to ISACA (2012):

• **Physical layer** — defines where the information will be stored.

• **Empirical layer** — defines how the information can be accessed.

• **Syntactical layer** — defines how the information will be structured and coded.

• **Semantic layer** — defines the type and level of the information.

• **Pragmatic layer** — defines the retention requirements and other information required for the information to be useful and usable.

• **Social world layer** — defines how the information is valued and used.

It can thus be comprehended that in order to properly manage the information resource, it is essential to apply good practices in accordance to the defined information attributes. As an example in an ICT4D project, storing information in both hard and soft copies and making regular backup falls under the physical layer, defining access levels that ensure that only authorized people can access information applies to the empirical layer.

Incorporating the above information management methods into the internal ICT4D structures ensures data integrity and reliability within the project's system; this supports consistency in the running of projects and subsequently success. Information management is critical in ICT4D, for example in initiatives like e-Health where trust, reliability, security and privacy are a priority when handling patients data which is sensitive and confidential (Chetley, 2006). Another example of applications which demand high levels of information security are e-Governance applications in which threats like cybercrime should be guarded against to protect government institutes and citizens (Kitaw, 2006).

2.11.3 Managing Services, Infrastructure and Applications

This sub section describes how services, infrastructure and applications must be managed in an ICT4D organization.

2.11.3.1 Services

COBIT 5 combines services, infrastructure and applications and refers to them as service capabilities. Service capabilities are resources that influence the delivery of IT services, i.e. infrastructure and applications. These services can be delivered and used by internal or external parties, hence the interests of all stakeholders must be known to ensure that adequate services are delivered or received. The services resources encompass infrastructure and applications. Based on this, the management of infrastructure and applications is explained in the next sections.

2.11.3.2 Infrastructure

Infrastructure is the machinery and amenities that facilitate the processing of the applications (ITGI, 2007). The ITGI's main guidelines for managing infrastructure in COBIT 4.1 fall under the domain Acquire and Implement (AI) and under processes AI3 and AI4 which are Acquire and Maintain Technology Infrastructure and Enable Operation and Use respectively.

The ITGI (2007) states in the AI3 process of the COBIT 4.1 that in order to maintain ongoing technological support there is need to strategically plan the acquisition, maintenance and protection of infrastructure. According to the ITGI (2007), this can be achieved by creating a technology acquisition and maintenance plan and applying internal control, security and

auditability measures. Applying this to ICT4D implies that all the infrastructure resources must be acquired and maintained in a documented and planned manner. The ITGI (2007) mention that this can be measured by percentage of infrastructure that are not meeting the defined IT architecture and technology standards, the rate of crucial processes using outdated infrastructure, and the rate of infrastructure units that are no longer manageable.

Process AI4 of the COBIT 4.1 necessitates the creation of documentation and manuals for users and IT, and the provision of training to ensure the proper use and operation of applications and infrastructure (ITGI, 2007). The ITGI (2007) further explains that this will enhance successful operation and use of the system. ICT4D projects are implemented in environments where there is lack of skills; user training is crucial and beneficial for the sustainability of the projects (Bailey, 2009). According to the ITGI (2007), users, managers, support and operational staff must be trained and training documentation must be produced for knowledge transfer. To measure this, the ITGI recommends the design of a plan for documentation of all operational aspects and to transfer knowledge to managers, end users and operational and support staff.

2.11.3.3 Applications

According to ITGI (2007), applications are the computerized operations and manual functions that process information. Oz (2009) defines applications as the programs designed to meet users'specific needs. Combining the above two definitions implies that applications are the computerized systems, software and manual procedures that process information to meet the user's needs. As examples, Oz (2009) futher explains that applications which are made for specific tasks, like managing company payroll, are called application-specific software. According to the same author, general-purpose software is used to perform various tasks, for example, spreadsheets and word processing software. An ICT4D initiative contains applications as elements of the project system. It is imperative to properly manage applications to ensure continuous and effective running of the ICT4D project. The kind of applications that are used in an ICT4D project depend upon the function and purpose of the initiative. As an example, an e-Agriculture project can make use of Global Positioning Systems (GPS) for map making and surveying, Automatic Milking Systems (AMS), or Geographic Information Systems (GIS), among many others (Cecchini & Scott, 2003).

Below is a table showing examples of ICT4D applications that can be used in different initiatives.

Table 2.5: Examples of applications used in ICT4D initiatives *(Cecchini & Scott (2003), Chetley (2006), Kitaw (2006), Rao (2008))*

Project Type	**Examples Of Applications Used**
e-Agriculture	GPS, AMS, GIS, intergrated electronic weights
e-Health	Personal Digital Assistants (PDAs), GIS, email
e-Education	Video Conferencing, interactive learning objects
e-Governance	Multi-Media software, intranet, Web 2.0 software

Developing countries implementing ICT4D face the challenge of high applications and software maintainance costs which results in a project's financial un-sustainability (van Reijswoud, 2009). Based on this, it is crucial to develop strategies for the cost effective management of ICT4D applications to achieve sustainability. Macapagal (2010) classifies applications and software under technology and highlights that technology should not dictate project needs, but it should be used to sustain the people's needs.

For the ICT4D business process applications to run smoothly there is need for controls to be embedded within them. According to the ITGI (2007), these controls are referred to as application controls and examples of the application controls include: Completeness, Accuracy, Validity, Authorization and Segregation of duties.

The application controls fall under the domain Aqcuire and Implement (AI). According to the ITGI (2007), the setting of application controls is a mutual responsibility between business and IT, but separately the business' role is to appropriately define functional and control requirements and use automated services, whilst IT is responsible to computerize and apply business functional and control requirements and establish controls to sustain the integrity of applications controls. Applying this to ICT4D means that the ICT4D management must set the application controls and use the IT services, whilst the IT personnel automate the control requirements and launch them.

2.11.3.3.1 Application controls objectives

The application controls according to COBIT 4.1 have objectives which guide how business requirements can be met by IT (ITGI, 2007). In the ICT4D context the ICT applications are to be controlled and managed in a manner which will ensure that goals are met and sustainability is achieved. The application controls and their objectives are represented in Table 2.5 below:

Each application control has a key, for example application control 1 is labelled AC1.

Table 2.6: Application controls and their objectives (adapted from ITGI, 2007)

APPLICATION CONTROL	OBJECTIVE
AC1 Source Data Preparation and Authorization	• Source documents must be prepared by authorized and qualified personnel according to set procedures. • There must be ample segregation of duties concerning the source and approval of these documents. • Ensure good input from design to minimise errors and omissions. • Identify errors and irregularities, report and correct them.
AC2 Source Data Collection and Entry	• Data input must be done in a timely manner by authorized and qualified staff. • Correction and resubmission of data that was incorrectly input should be done without compromising original transaction authorization levels. • Preserve original source documents for a suitable period where there is need for reconstruction.
AC3 Accuracy, Completeness and Authenticity Checks	• Certify that transactions are accurate, complete and valid. • Validate input data, and edit or return for correction as close to the point of origination as possible.
AC4 Processing Integrity and Validity	• Data integrity and validity must be maintained throughout the processing cycle. • Detection of erroneous transactions must not disrupt the processing of valid transactions.
AC5 Output Review, Reconciliation and Error Handling	• Establish procedures and associated responsibilities to ensure that output is handled in an authorized manner, delivered to the appropriate recipient, and protected during transmission. • Verify, detect and correct output to ensure accuracy of output and that information provided in the output is used.
AC6 Transaction Authentication and Integrity	• Check data for proper addressing, authenticity of origin and integrity of content before passing transaction data between internal applications and business/operational functions. • Maintain authenticity and integrity during transmission or transport.

Applying the above mentioned controls in an ICT4D project will help the internal business process to run in a manner that inputs and processes authentic and accurate data to produce valid and reliable information output. The result of correctly managing applications will be success of ICT4D initiatives and eventually sustainability.

2.12 Managing People, Skills and Competencies

People are influenced by IT at all levels in an organization, as stakeholders, managers and users, or as IT specialists giving services or as customers (ISACA, 2012). Different stakeholders conduct different functions which require diverse skills (ISACA, 2012). Projects are designed, implemented and managed by people, hence the needs of the people are to be prioritized and a sense of ownership must be conveyed to the people (Macapagal, 2010). Macapagal and Macasio (2009) refer to stakeholders as 'people' in the ICT4D project and they state that stakeholders should be involved at every stage of the project. An ICT4D project's stakeholders include: project beneficiaries, project service providers, ICT developers and providers and funding entities (Tongia & Subrahmanian, 2006).

It is important to properly manage stakeholders for the sustainablity of ICT4D projects. However, there are challenges which include difficulty in identifying the stakeholders, lack of openness among the stakeholders and the subjectivity of their classification (Bailur, 2007). Bailur therefore proposes a perspective to counter these challenges. Bailur (2007), Macapagal and Macasio (2009), and Macapagal (2010) all agree with ITGI (2007) that people must be suitably managed right from the start for ICT4D projects to succeed.

Using Bailur's (2007) stakeholder perspective can aid in showing steps that can be taken in the management of people. Bailur's (2007) stakeholder perspective, which he adapted from several authors, helps organizations to iteratively identify the stakeholders, comprehend their behaviour, predict how they might collaborate, and to foresee any possible conflicts. Figure 2.9 below shows an adaptation of Bailur's (2007) stakeholder perspective to suit people management according to the ITG.

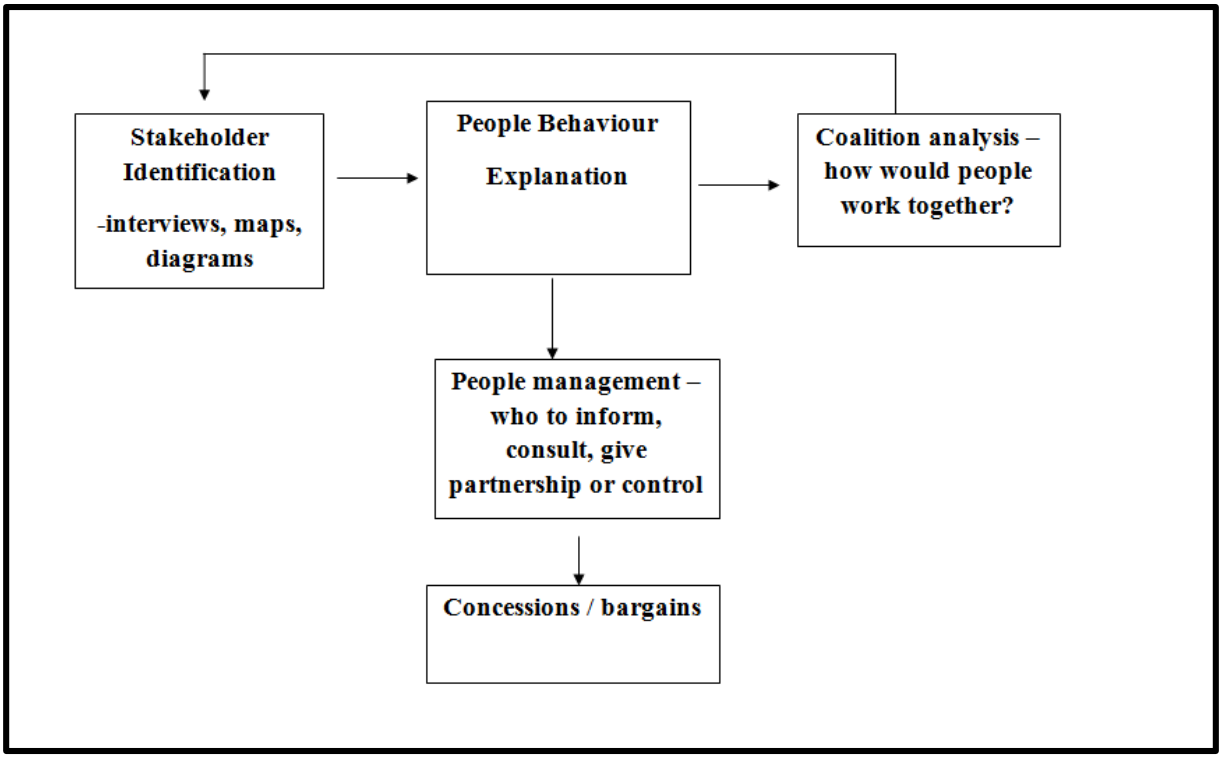


Figure 2.9: Understanding and addressing people in ICT4D, adapted from Bailur (2007)

From the figure it can be seen that initially stakeholders need to be identified then their behaviour can be understood to analyse how they can work together. This step can be severally repeated, as the figure shows. The next step will be to manage the people by determining what roles they are suitable for in the project. The last step is to establish if there will be any need for concessions if the former management methods did not work. It can thus be seen that Bailur's stakeholder perspective is of much value in assisting to understand and address people in ICT4D.

Walton and Heeks (2011) mention that user involvement helps reduce design-reality gaps, unpredicted challenges and increases the chances of project sustainability. This corresponds to Cecchini and Scott (2003) who state that user involvement in the management process for ICT4D projects contributes to successful and resilient ICT projects which are suitable for the local setting. Responsiveness to cultural differences contributes to success in cases where ICT4D projects are offshore contracts. Sensitivity to local needs ensures that project systems are usable by the local beneficiaries, otherwise they would be abandoned and thus unsustainable (van der Linden & Hengeveld, 2009).

Rural ICT project management can adopt industry approaches to solve sustainability problems (Pade-Khene, Mallinson, & Sewry, 2011). Walton and Heeks (2011, p.5) advocate for ICT4D management approaches that are “flexible and adaptive to emergent strategies”. The COBIT framework is flexible and adaptive in that it deals with available resources of any particular enterprise, thus it can be applied to solve the challenges in ICT4D sustainability.

2.13 Conclusion

ICT4D projects in developing countries ought to be managed in a systematic manner in order to avoid failure and to achieve sustainability. The ITGI’s COBIT 4.1 framework has been widely used in the commercial sector to achieve maximised benefits from investment in IT resources. The framework can be applied in ICT4D to guide the management of the critical IT resources which, according to the ITGI (2007), are: people, applications, infrastructure and information. In an ICT4D project, managing the critical IT resources will enhance project sustainability. If resources are properly managed, ICT4D projects will keep running and meeting stakeholder needs for the intended period. Sustainability of ICT4D projects will help meet the MDGs goal of trying to alleviate poverty through the use of ICTs.

Chapter 3

Sustainability of ICT4D projects in rural areas of developing countries

3.1 Introduction

The aim of the previous chapter was to help inform the primary research objective by elaborating on how rural Information Communication Technology for Development (ICT4D) projects can be managed. The chapter defined ICT4D and explained its importance, applications, challenges and controversies. Furthermore, the chapter intensely focused on the resource management of ICT4D projects and how ICT4D projects are currently managed in rural areas of developing countries.

This chapter will build upon the previous one and enlighten the factors influencing sustainability of rural ICT4D projects. Sustainability will be defined; explanation of the origins of sustainability concept will be given, together with sustainability debates and controversies. The next section will look into the significance of sustainability in ICT4D, followed by the section covering factors influencing sustainability of ICT4D. The chapter will conclude with a section investigating how the Resource Based View of the firm theory can be applied to achieve ICT4D sustainability.

3.2 Defining sustainability

Several works have been published on the sustainability of ICT4D projects in rural areas of developing countries (Best & Kumar, 2008; Bailey, 2009; Marais, 2011). The word ‘sustainability’ derives from the word ‘sustain’ which comes from the Latin ‘sustenare’ which means "to hold up" and its meaning has evolved over years to imply maintaining anything in position for an intended period to meet the required needs (Sutton, 2004). Numerous authors have attempted to trace the origins of the sustainability concept with the aim of

explaining exactly what it means and how it can be applied (Gatto, 1994; Best, 2010; Blake & Garzon, 2012). However, some authors (Lamberton, 2005; Ali & Bailur, 2007) state that there is no standard definition of sustainability and the concept is difficult to operationalize.

The majority of sustainability definitions derive from the correlation between humans and the resources they utilize (Voinov, 1998). According to Gatto (1994), the sustainability concept can be defined from three major dimensions: biological, ecological and economic. Gatto (1994) defines economic sustainability as continuous economic development that does not compromise current resources for future generations. Lamberton (2005) states that definitions of sustainable development derive from economic, ecological and social dimensions. Either way, Gatto (1994) and Lamberton (2005) both assert that the dimensional definitions of sustainablity date back from 1987 in a report by the World Commission on Environment and Development (WCED).

The WCED report of 1987 entitled 'Our Common Future' (also referred to as the Brutland Report) brought the world's attention to sustainability (Voinov, 1998; Sutton, 2004; Scoones, 2007). Its definition of sustainable development was: development that meets present needs without hindering future generations the ability to meet theirs (WCED, 1987). From this, one can conclude that sustainability involves ongoing provision and availability of services to benefit both current and future generations.

ICT4D sustainability implies that ICTs must be used in a way that promotes the sustainable development of communities (Bichler, 2008). Sustainability is the capability of a project or to continue running after its implementer has gone (Harris, Kumar, & Balaji, 2003; Rao, 2008). According to Pade-Khene, Mallinson, and Sewry (2011), sustainability has two main aspects which are ongoing rural ICT access and ICT enabled rural development. This study will draw from the mentioned definitions that ICT4D sustainability means that ICT4D initiatives and their resources must be ongoing for as long as their benefits are still crucial to the communities they are meant to serve.

3.3 Significance of sustainability in ICT4D

ICTs can empower communities by enhancing their capacity to access their valued needs, thereby promoting development - hence the importance of ICT4D sustainability (Pade-Khene, Mallinson, & Sewry, 2011). The high rate of failure in ICT4D initiatives has raised global concern for the project's sustainability (Grunfeld, 2007; Heeks, 2008; Naik, Joshi, & Basavaraj, 2010). Heeks (2002) identifies three types of sustainability failures in ICT4D: total

failure, largely unsuccessful failure and partial failure. Kumar (2007) also discovered that the majority of ICT4D projects either completely fail or partially succeed in achieving their goals. The benefits of ICTs have not yet been realised by most marginalized communities regardless of the huge investments in ICT4D projects (Thapa & Sæbø, 2011). It is vital for marginalized communities to benefit from the enormous investments made in ICT4D, otherwise project failure would mean waste of resources (Kumar, 2007). The prevalent sustainability challenges facing ICT4D projects necessitate for proper resource management methods.

Walton and Heeks (2011) suggest that sustainability in ICT4D can be achieved through change in the approaches that are used in implementing projects. Grunfeld (2007) also argues that ICT4D projects can be sustainable if they are improving peoples' livelihoods and if the infrastructure and resources are efficiently managed. This implies that there is a relationship between effective management of ICT4D resources and the achievement of maximum benefits from ICT4D investment. The more people properly manage ICT4D resources, the more they benefit from the ICT4D initiatives.

Surana, Patra, Nedevschi, and Brewer (2008) state that ICT4D initiatives start with a pilot stage and are then scaled up to a deployment stage. They further describe that pilot projects can succeed but most projetcs fail at the deployment stage due to financial, technical and institutional constraints. This concurs with Pade, Mallinson, and Sewry (2009) who express that critical success factors for ICT4D sustainablity include socio-cultural, institutional, economic, political and technological factors. Pade, Mallinson, and Sewry (2009) further elaborate that the presence or absence of a critical factor can contribute to either success or failure of a project. This indicates that there are various factors that can contribute to either success or failure of ICT4D projects. These factors need to be addressed in order to improve rural ICT4D sustainability.

3.4 Controversies to the sustainability concept

Ali and Bailur (2007) contend that sustainability is idealistic and difficult to put into practice. They call attention to bricolage, arguing that sustainability has two main challenges which are the difficulty of trying to maintain things in the same state and the difficulty of trying to prevent a community from failing to sustain ICT4D projects. They define bricolage as altering through the available resources. They support their argument by saying that there are possible unplanned consequences of ICT. An example they give is of Indian e-kiosks which are also being used for other services besides ICT4D services. Ali and Bailur (2007) point out that such alteration should be accepted as it can encourage sustainability. It is evident

from Ali and Bailur's (2007) discussion that sustainability is realistic, as they also mention that it can be achieved through bricolage.

> *"Unintended consequences may make a project more sustainable (to the extent that sustainability is possible)" (*Ali & Bailur, 2007 p. 10).

One can conclude from Ali and Bailur's (2007) article that whilst bricolage is a practical flexible concept, it cannot substitute sustainability, but rather it can be practised inherent to the activities that aim at achieving sustainability. Sustainability targets meeting current and future generations' needs. If available resources are altered to solve the problems at hand, sustainability can be achieved (Ali & Bailur, 2007). From this it is evident that resource management involves adaptation to what is available.

Tomlinson, Silberman, Patterson, Pan, and Blevis (2012) challenge the ICT4D sustainability notion by contesting for collapse informatics. The authors elaborate that collapse informatics is based on the theory that the global industrial civilisation might eventually collapse due to unforeseeable factors. One of the scenarios they foresee is that in the long-term, developing countries' infrastructure will be in the same state with that of the collapsed developed countries and there will be no transfer of ICT resources from the global North to the global South, and then ICT4D will no longer be sustainable. Tomlinson, Silberman, Patterson, Pan, and Blevis (2012) suggest that systems should be designed which are adaptable to change and collapse. In as much as preparation for collapse is critical, it is also crucial to ensure that current available resources are efficiently managed to serve both present and future generations. Paradoxically, Tomlinson, Silberman, Patterson, Pan, and Blevis (2012) yet again mention in their argument that in the event that collapse never comes, collapse informatics research will not have been wasted as it complements ICT4D sustainability work.

A limited number of works highlight that sustainability does not mean success of ICT4D initiatives. Pscheidt and van der Weide (2010) state that sustainability is not success but a means to success and that it is possible to sustain projects that are not meeting stakeholders' needs. Similarly, Walton and Heeks (2011) emphasize that success or failure of projects should not be regarded as the ultimate goal, but as a benchmark for learning. This suggests that there is need to apply resource management approaches that are context sensitive in order to achieve sustainability of rural ICT4D projects.

3.5 Factors influencing the sustainability of ICT4D projects

In attempt to identify the causes and solutions to the failure of ICT4D projects, some scholars have pointed to critical success factors (CSFs) and critical failure factors (CFFs) which influence the sustainability of ICT4D initiatives (Heeks & Bhatnagar, 1999; Kumar & Best, 2006; Best & Kumar, 2008). The CSFs and CFFs are the factors that determine either success or failure of an ICT4D initiative. Heeks and Bhatnagar (1999) outline ten critical factors which are: information, technical, people, management, process, culture, structure, strategy, politics, and environment. From these critical factors, Kumar and Best (2006) created a sustainability failure model composed of five principal modes: financial/economic, cultural/social, technological, political/institutional and environmental.

According to Kumar and Best (2006), the five principal modes of sustainability encompass the factors which affect success or failure of an ICT4D intervention. The same authors highlight that the sustainability failure model targets the main problem causes. A project's continuing goals can be met by guaranteeing sustainability across these modes (Kumar, 2007). Pade-Khene, Mallinson, and Sewry (2011) also map out 19 CSFs which relate to Kumar and Best's (2006) five principal modes of sustainability failure modes. Pade-Khene et al. (2011) allude to the CSFs as good practices that they recommend to be applied in ICT4D projects management in order to achieve sustainability.

3.5.1 Main factors influencing ICT4D projects'sustainability

The major factors that influence the usability and accessibility of ICT4D projects are their relevance and location. The sections below elaborate on the factors.

3.5.1.1 Locally relevant services

Some rural ICT4D initiatives' managers lack commitment and contribute to financial failure for the projects by failing to deliver new, relevant content. (Best & Kumar, 2008). The presence of locally relevant services can affect the sustainability of ICT4D projects in the sense that if services are meeting local needs, users could be willing use them (Colle, 2005; Clark & Gomez, 2011). Most ICT4D interventions lack locally relevant services in local languages and this can cause the community to lack interest in using the services (Colle, 2005; Heeks & Molla, 2009).

3.5.1.2 Good Locations

The locations for ICT4D centres determine whether people will be able to access them without much difficulty or change to their normal practices; the easier it is for a centre to be accessed, the higher the chances of use and success (Antin, 2005; Sey & Fellows, 2011).

The authors also states that locating ICT4D access centres in geographic sites that ensure better internet and power connectivity enables technical success, which facilitates the usability of the centres. Grunfeld, Hak, and Pin (2011) identified that people can be intimidated by the site at which ICTs are located, for example in an interview they conducted, one woman expressesed uneasiness in entering an airconditioned computer room for the fear that it was for the 'high class'. Grunfeld, Hak, and Pin (2011) also highlight that distance can be a hindering factor if the ICT access centre is located far from where, for example, women can esaily reach, citing factors like the challenge for women to walk when it gets dark and the potential difficulty for women to leave their houses.

Using the sustainability failure model to identify the root problem, sources can support in designing ICT4D project management approaches that result in projects' long-term success (Best & Kumar, 2008). Best (2010) disputes that the major problem that hinders success of ICT4D initiatives is not failure, but the inability to learn from past failures. This indicates the significance of the sustainability failure model to focus on the critical failure factors in order to eliminate them. The sustainability failure model is an elementary way to capture factors which cause the failure of ICT4D projects (Naik, Joshi, & Basavaraj, 2010). The following sub-sections will analyse the factors that influence the sustainability of ICT4D projects using the sustainability failure model.

3.5.2 Technological factors

Technological sustainability is the long-term capacity for ICTs to remain resilient, accessible and durable (Kamal, 2012; Ali & Bailur, 2007). Kamal (2012) and Ali and Bailur (2007) argue that it is difficult to achieve this kind of sustainability given the fact that technologies are ever changing thus threatening equipment obsolescence. ICT4D initiatives typically take place in regions where infrastructure is poor and limited, hence the importance of analysing technological barriers to their sustainability (Antin, 2005). Kumar and Best (2009) discovered that erratic technical support hinders progress in ICT operations in remote rural areas. The same authors cite an example of an Indian e-kiosk that had no technical support for over six months and it ended up closing down. The common constraints like high equipment costs, poor infrastructure development, low technical skills and poor technical support plague most rural areas of developing countries in Sub-Saharan Africa (Pade-Khene, Mallinson, & Sewry, 2011; Kamal, 2012).

3.5.2.1 Poor infrastructure development

Gichoya (2005) identified poor infrastructure as one of the major technological hindrances to the success of ICT4D in least developed regions. Rural areas are mostly characterized with

poor infrastructure, power shortages and poor tele-communication networks and the failure to consider this at the design stage can cause technical failure (Best & Smyth, 2011). Thapa and Sein (2010) and Thapa and Sæbø (2011) recognize that electricity shortage and poor infrastructure hinder the success of ICT4D projects and that poor internet bandwidth cripple the success of e-services in develpoing regions.

3.5.2.2 Poor technical support

A study of ICT4D projects by Best and Smyth (2011) reported that some infrastructure in an initiative was not properly handled, for instance some cables were being chewed by rats and dust covered most computers. If ICT4D projects are to be technologically sustainable, it is vital to assign competent personnel to be responsible for maintenance and repair of hardware and software (Proenza, 2002). The low ICT literacy rate in Sub-Saharan Africa contributes to the shortage of technical operators in ICT4D access centres. In most cases these centres have one operator who is expected to do everything from management, maintenance and user support (Gomez, Pather, & Dosono, 2012). Clearly this pressure on one member of staff can gradually cause deterioration in operations and eventually technological un-sustainability. Surana, Patra, Nedevschi, and Brewer (2008) say that most rural areas where ICT4D projects are located are remote, and local staff are usually not competent in hardware and software maintenace. The authors propose that there is an option to set up remote management systems as well as to train local vendors who can support the systems, though at a cost.

3.5.2.3 Obsolete equipment

Over time, the equipment donated to developing countries in ICT4D initiatives become obsolete and incompatible to fast progressing technology (Kumar, 2007). Research shows that it is often difficult for developing countries to refurbish the donated second-hand computers due to lack in expertise (Grunfeld, 2007; Kamal, 2012). It can be observed that the lack of technical skills in developing countries can hinder communities from benefiting from ICT4D projects.

3.5.2.4 Failure to design context-appropriate technology

The extent to which ICT operations respond to the community's real experiences and situations determines the initiative's social sustainability (Day, 2005). ICT4D practitioners need to understand the local context for them to be able to create a local relevancy and demand for their services (Masiero, 2011). Social sustainability is highly dependent on the ICT4D staff's response to the dynamic local needs and the formation of partnerships with other stakeholders (Bailey, 2009; Toyama, 2010b). Walton and Heeks (2011) point at the incomplete understanding of local contexts as one of the problems that result in ICT4D

projects' failure. The same authors suggest that instead of using rigid apporaches to the design of ICT4D proejcts, it would be more effective to invest time in studying the local context and continuosly adapting to the ever changing needs.

3.5.3 Financial/economic factors

Financial/economic sustainability is the continuing capability of ICT4D projects to produce sufficient proceeds to meet their running costs (Ali & Bailur, 2007; Masiero, 2011). An ICT4D project can also be viewed as financially sustainable if it can attain proceeds which equate or exceed its running expenditure and/or initial set up expenditure (Tschang, Chuladul, & Le, 2002; Madon, 2007; Masiero, 2011). Kumar and Best (2006) describe financial sustainability failure as the failure of donor funded programs to continue operating after the program funder departs. Projects initial capital costs can be funded by donors, but after that a project must be able to cover its own operating costs (Toyama, 2010). Given that ICT4D projects in developing countries lack the required management strategies that are income generating and self sustaining, there is need to establish resource management methods which will support ICT4D projects' financial sustainability.

Sey and Fellows (2011, p. 191) list some factors which affect ICT4D financial sustainability as: "good management, good locations, strong local demand, new service development, commercial orientation, locally relevant services, external linkages and networking". One can detect that lack of the factors given by Sey and Fellows (2011) can contribute to financial un-sustainability of an ICT4D initiative. Identifying the failure factors according to these dimensions can help capture and isolate the problem causes with respect to ICT4D financial un-sustainability.

3.5.3.1 High equipment costs

High equipment costs are both a technological and financial factor because the high costs affect the technicalities of operating ICT equipment in developing countries. The economic statuses of most developing countries pose to them the failure to buy new computing equipment and they can only afford to get second-hand donations from the developed countries (Richardson, 2011; Tongia & Subrahmanian, 2006). According to Richardson (2011), the used machines give problems of usage and compatibility because most users lack technical skills to repair and upgrade the machines. As previously mentioned, ICTs can gain more usability if they are provided in local language; however, it is costly to produce software in local language due to the scarcity of financial resources in developing countries (Toyama, 2010).

3.5.3.2 Good Management

For ICT4D projects to be financially sustainable, the planning process for ICT4D projects must include cost and revenue projection from the projects' initial establishment (Macapagal, 2010). Colle (2005) mentions that ICT4D managers must be trained to be able to merge ICT expertise and users' needs in order to provide services that are locally suitable. Best and Kumar (2008) and Pade, Mallinson, and Sewry (2009) agree with Colle (2005) and explain that ICT4D managers need to be trained in computing and marketing skills as this would enhance their ability to gain the community's awareness and effective use of the projects in their area. When the community becomes aware of local ICT services, the rate of access to the ICT4D centres can increase as well as revenues. It is crucial not to underestimate the project's total cost of ownership or to overestimate the revenue in order to avoid a project's financial failure in the long term (Gichoya, 2005). Marais (2011) suggests that ICT4D projects need to create financial models that are practical. It is evident from this that proper ICT4D management fundamentally contributes to the success of the projects.

3.5.3.3 Strong local demand

Naik, Joshi, and Basavaraj (2010) propose a conceptual model for cost and revenue of ICT4D access centres. In their model the authors evaluate that as the demand for services increase and is supplied, the financial sustainability of the ICT access centres improves. The same authors stress that it is important for ICT4D centres to increase local demand and ensure that they supply the services demanded for them to achieve financial sustainability. Masiero (2011) suggests that ICT4D players need in be in continuous relation with the community in order to be aware of the local needs and to maintain a strong local demand. The community needs are dynamic and it is vital for ICT4D service providers to continuously perform local demand driven needs analysis for them to ensure projects financial sustainability (van Reijswoud, 2009; Pade-Khene, Palmer, & Kavhai, 2010).

3.5.3.4 New service development

The failure of ICT4D actors to develop new services contributes to the financial sustainability failure rates (Best & Kumar, 2008). Best and Kumar (2008) recount how Chirag kiosks of the Sustainable Access in Rural India (SARI) project in Tamil Nadu, India, failed due to financial factors which included the failure to develop new services which matched the community's needs. Walton and Heeks (2011) describe how the e-Choupal, an Indian initiative of Internet based kiosks meant to provide rural farmers, introduced new services and enhanced the project's financial sustainability. Rural ICT needs are dynamic as there as

there is a continuous need to upgrade and develop new services which meet users' ever-changing needs (Antin, 2005; Best & Kumar, 2008; Sey & Fellows, 2011).

3.5.3.5 Commercial Orientation

Income generation has not been widely prioritized by ICT4D initiatives that aim at supporting development (Masiero, 2011). However, it is from the direct users that the finances to sustain ICT4D project operations must be obtained (Rao, 2008). It is very difficult to achieve profits in rural ICT4D projects; however, it is also imperative to at least achieve monthly income which covers capital investment costs (Surana, Patra, Nedevschi, & Brewer, 2008). A study of ICT4D projects in 25 countries done by Clark and Gomez (2011) pointed out that there is a wide-spread belief that user fees are a barrier to ICT access in marginalized regions. Clark and Gomez (2011) argue that the role of user fees as a barrier to ICT access in rural areas is negligible compared to that of unavailability of user-relevant content and digital illiteracy. Heeks and Molla (2009) point out that ICT4D projects ought to have good revenue sources besides user fees to become financially sustainable. Private entrepreneurs in the ICT4D field achieve financial sustainability in their operations because their main aim is to make profits and therefore they put more effort in revenue production (Naik, Joshi, & Basavaraj, 2010).

3.5.3.6 External linkages and networking

Sustaining institutional partnerships is fundamental as it allows ICT4D actors to capture users at their exact points of need and to give them ICT enabled solutions that are relevant (Pade, Mallinson, & Sewry, 2009). The failure of some managers to maintain institutional partnerships can cause people to stop using some ICT4D centres as they will not be gaining services that directly benefit them. Best and Kumar's (2008) report on the Chirag kiosks in India revealed that kiosks which failed to maintain networks with organizations like health services lost business and became financially unsustainable. Marais (2011) corresponds to this by citing that failure to partner and network with local organizations and governments contributes to ICT4D projects' failure. Partnering with local institutions helps ICT4D projects to introduce ICT enablement to the local functions and processes; in turn these organizations can even start to support the ICT projects financially. It can be concluded that failure to predict potential financial constraints will result in wastage of the invested resources.

3.5.4 Social / Cultural factors

Social sustainability is achieved when an ICT4D initiative continually meets the community's needs and promotes and advances the community's socio-economic development (Grace, Kenny, & Qiang, 2004; Bailey, 2009). Masiero (2011) defines social sustainability as the

capability of ICT4D initiatives to offer locally relevant content to potential users in a local context. According to Kumar and Best (2006), social un-sustainability occurs when there is failure due to disparity between those who benefit and those who do not benefit from an initiative.

From the time that ICTs started gaining popularity up to the present age, literature still shows that there are common causes for the failure of ICT4D social sustainability (Heeks & Bhatnagar, 1999; Proenza, 2002; Heeks, 2002; Harris, Kumar, & Balaji, 2003; Antin, 2005; Ali & Bailur, 2007; Heeks & Molla, 2009; Pade-Khene, Palmer, & Kavhai, 2010; Best & Smyth, 2011; Blake & Garzon, 2012). This proves what Naik, Joshi, and Basavaraj (2010) meant when they stated that it is failure to learn from failures that continues to cause recurrent failure in ICT4D. Among the most cited causes for social sustainability failure are failures to: create context-appropriate technology, form local partnerships, provide locally relevant services, create new services, create service awareness, involve stakeholders and stick to socio-cultural norms (Heeks, 2002; Toyama, 2010b; Grunfeld, Hak, & Pin 2011; Marais, 2011; Walton & Heeks, 2011; Abdulwahab & Zulkhairi, 2012). Some the effects of these failures were explained in the previous sections under financial sustainabilty. The next subsections will go into detail on the major causes of social sustainability failure.

3.5.4.1 Failure to involve stakeholders

Initial stakeholder involvement is an important factor that influences ICT4D projects' long-term sustainability (Bailur, 2007; Blake & Garzon, 2012). Design-reality gaps exist when the designed ICT systems do not match the stakeholders' local needs due to the fact that the system was created without capturing the real needs of the intended users (Heeks, 2002; Tongia & Subrahmanian, 2006). Tongia and Subrahmanian (2006) call attention to the fact that different stakeholders have varying objectives and incentives and it is paramount to integrate them to avoid failure. Involving all stakeholders provides to them a sense of ownership and it assists ICT designers to understand the community's important values and context (Bailur, 2007). Bailur (2007) goes on to clarify that it is important to be able to identify and classify stakeholders so as to rightfully prioritize their needs and utilize their input.

Kumar and Best (2006) report of an e-governance initiative in India that did not involve all government stakeholders and failed because they made very limited social development impact in the constituencies. They emphasize that it is important for ICT4D projects to involve all relevant stakeholders in order to know the ever-changing needs of the community. Bailur (2007) argues that the Gyandoot ICT project in India received too much praise for

success, yet the success stories were based on management reports which did not include user perspectives. It can be concluded that it is important to understand all stakeholders and their different roles and needs in order to integrate them and achieve social sustainability.

3.5.4.2 Failure to adhere to socio-cultural norms

Adhering to socio-cultural norms allows an ICT4D initiative to gain acceptance as well as to fit in to the values of the particular society (Best & Smyth, 2011; Sey & Fellows, 2011). Marais (2011) cites that it is rare for ICT4D projects that do not adhere to socio-cultural norms of the environment to make an impact. This is similar to Walton and Heeks (2011) who argue that failure to consider socio-cultural norms results in ICT4D practitioners designing self-decieving systems which will not work for the inteded users. Identifying the norms in a community targeted by ICT4D initiatives is crucial in highlighting the real needs and ensuring adoption of the technologies. Among the most cited norms are the inclusion of women in ICT use and the creation of a local champion by training a person who will be well-knowledgeable in the ICT4D project's activities and will mobilize and assist others in the community (Surana, Patra, Nedevschi, & Brewer, 2008; Rao, 2008; Bailey, 2009). This can result in increased use of ICTs and thus enhance ICT4D social sustainability.

3.5.4.3 Failure to create service awareness

Abdulwahab and Zulkhairi (2012) identified the comunities' lack of awareness of the ICT4D services as a key obstacle to successful ICT4D use. In agreement to this, Kamal (2012) points out that lack of pubilicity contributes to the lack of awareness and eventualy limited ICT use. According to Pade-Khene, Mallinson, and Sewry (2011), this lack of awareness also arises from the low education and illetarcy rates in rural communities which hinder the users' ability to understand and appreciate ICTs. Local capacity building can help improve the communities' understanding and appreciation of what ICTs can do to improve their capabilities (Macapagal, 2010). It is apparent from this that for ICTs to be of benefit to their intended users, ICT4D players need to market their services and to deliver them in a way that the local users can understand and appreciate.

The figure below summarizes the social sustainability factors according to Heeks (2009).

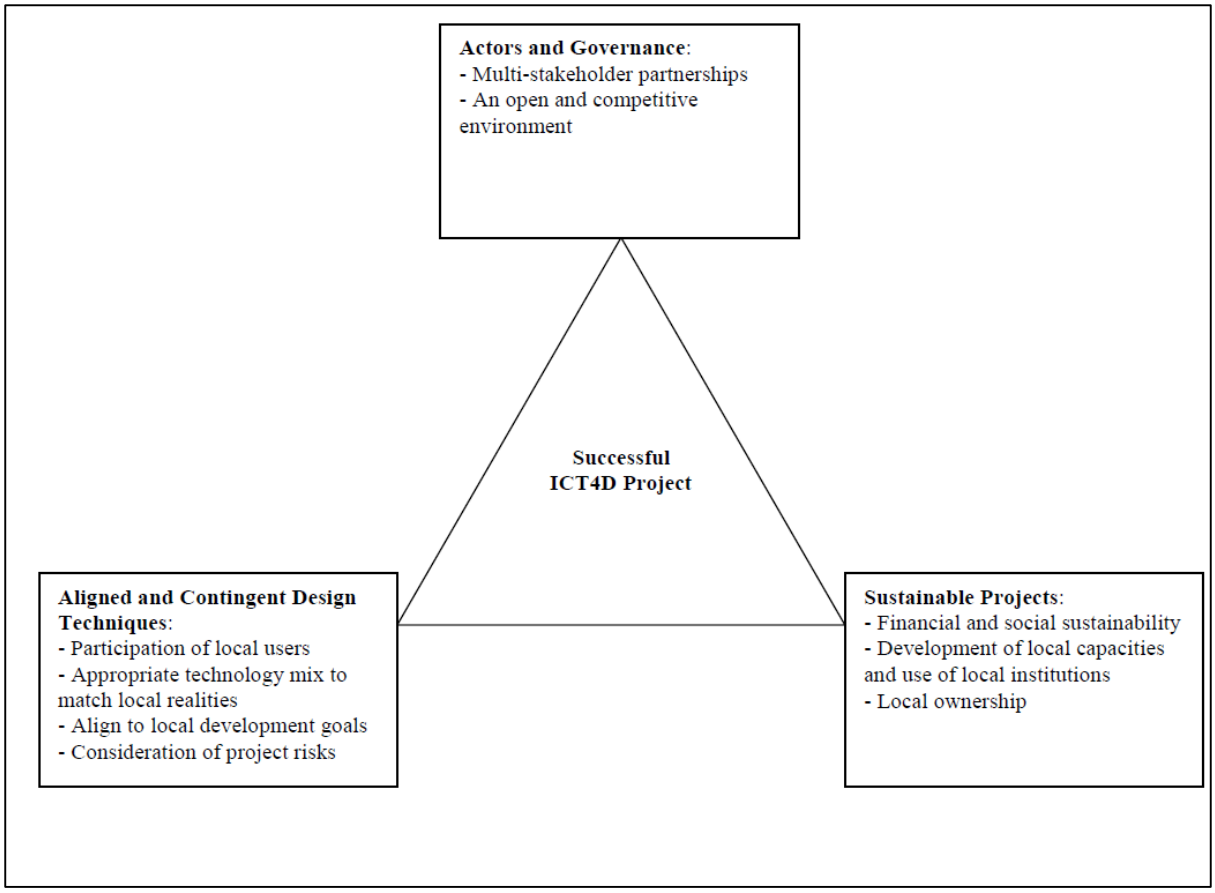


Figure 3.1: Good Practice for ICT4D 2.0 Implementation (Heeks, 2009)

In summary, Figure 3.2 above implies that successful ICT4D projects can be achieved by designing appropriate technology through local user and stakeholder involvement, which culminates social sustainability through capacity building and local ownership.

3.5.5 Political/institutional factors

Political sustainability is the ongoing support of ICT4D programmes by the governing and policy-making bodies of the community (Grace, Kenny, & Qiang, 2004). Masiero (2011) refers to political sustainability as the realm of relations between the government and ICT4D organizations. Kumar (2005) explains that political relations determine the extent of ICT4D projects' success because government bodies can choose either to support or to resist the initiatives. In order to accomplish political sustainability, ICT4D organizations must establish strong alliances with the local political bodies and maintain relationships of trust with its members (Masiero, 2011). Most developing countries face challenges of lack of freedom due to the prevalent state monopolies in the telecommunications sector (Pade-Khene, Mallinson, & Sewry, 2011). Proenza (2002) emphasizes that an ICT4D initiative must have a feasible governance structure that is compatible with the country's policy and regulatory system.

3.5.6 Environmental factors

Environmental sustainability refers to the capacity of ICT4D projects to fit into their surrounding territory and to effectively use natural resources (Caldelli & Parmigiani, 2004). Kumar and Best (2006) define environmental sustainability failure with an example of ICT4D projects that take off without disposal or reuse plans for their computers. According to Best (2010), environmental sustainability can be increased by the use of low-energy consuming equipment. This goes back to the previously mentioned definition of sustainability which is to meet current generations' needs without compromising those of future generations.

Developing countries commonly receive disposed computers from the developed countries in the form of donations, yet the rural recipients have no knowledge for recycling or disposing toxic substances that the computers contain (Baumer & Silberman, 2011). The authors further describe the irony that exists between the need to solve environmental issues using ICTs and the need to ensure environmental sustainability of the ICTs, arguing that the ICTs themselves are toxic. From this, one can see that ICTs are for the society's benefit if they are used and disposed in a manner that will not compromise the environment's sustainability.

3.6 Relationships among the ICT4D sustainability factors

Technological sustainability is linked with financial sustainability in that if technology is not user friendly, it may not be used (Ali & Bailur, 2007). Improving social sustainability through locally-relavant services draws new clientele and preserves the present ones, which enhances the financial sustainability of ICT4D projects (Masiero, 2011). Macapagal (2010) outlines that social and financial sustainability is of equal importance and they need to be considered for analysing success or failure of ICT4D interventions.

Figure 3.3 shows the relationship between ICT4D social and financial sustainability:

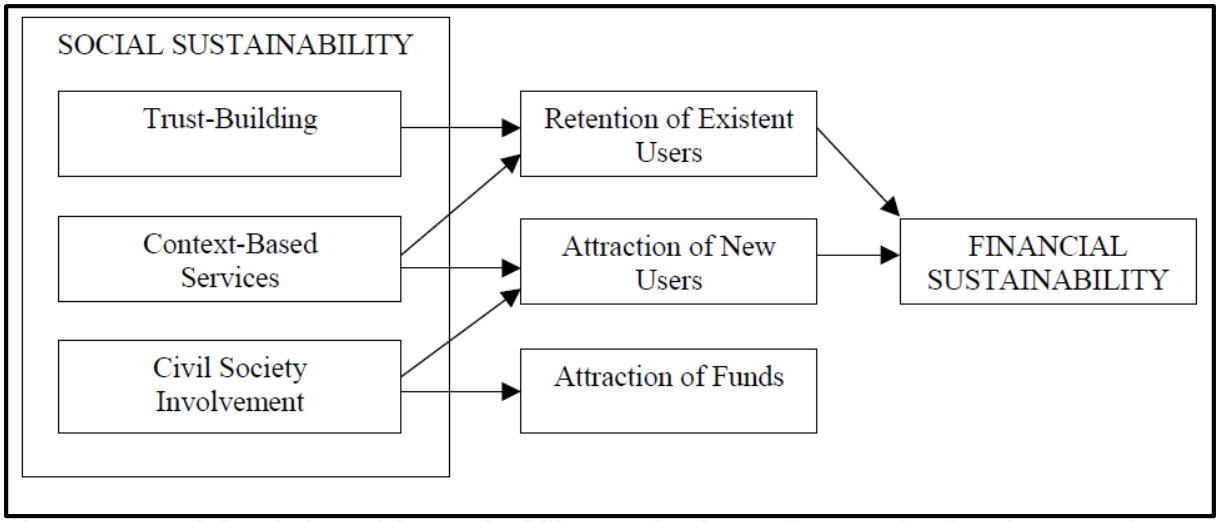


Figure 3.2: Social and Financial Sustainability: Mechanisms of Interaction (Masiero, 2011)

The above figure reveals that the social sustainability factors lead to increased use and revenue generation which results in financial sustainability of ICT4D projects.

Technological sustainability is essentially interrelated with financial sustainability as the fundamental cost usually includes equipment and technical maintenance (Kumar, 2005). Social and technical sustainability are related since the usability of equipment determines the rate of adoption and the social impact the ICTs will make (Masiero, 2011). Political sustainability and environmental sustainability affect financial sustainability in that if the community is positively influenced by ICTs, the more they are willing to support and finance the services (Best, 2010). These relationships show that all the five major sustainability failure modes are interlinked and one factor can affect another. It is therefore important to ensure that an ICT4D project is successful in all the five principal sustainability modes.

3.7 Sen's Capability Approach and ICT4D sustainability

Sen's Capability Approach is used to assess a person's capacity to attain important goals or values; the approach is also used to analyse disparities and poverty (Sugden, 1993). Blake and Garzon (2012) cite that the capability approach gives a good basis for analysing and assessing the sustainability of ICT4D initiatives that aim at alleviating poverty. An individual's capabilities are the several options of functionings which allows the person to live a particular kind of life (Nussbaum & Sen, 1993); functionings are what a person does to achieve that particular kind of life (Sen, 1993). In the context of ICT4D, Sen's Capability Approach can be used to assess how ICTs contribute to communities' sustainable development and to assess how people's capabilities can be enhanced through the use of ICTs (Kleine, 2009; Grunfeld, 2007; Blake & Garzon, 2012). If ICT4D resources are properly managed, the initiatives can be sustainable and the beneficiaries' lives can improve. For example, ICTs enhance access to education, health facilities, markets and empowerment

(Kleine, 2009). These are some of the capabilities that can improve rural livelihoods, promoting development.

Sen's Capability Approach identifies human rights as freedoms which enable people to fully live the lives that they value (Sen, 1997; Sen, 2005). Sen (2005) gives examples of such freedoms including access to health facilities, education and business success. Capability implies positive freedom, whereas being unable to do some things is termed capability failure (Qizilbash & Clark, 2005). Sen (1999) argues that in order for communities to develop there is a need to counter against challenges, like sustainability failure. Sen (1999) also calls such development problems 'unfreedoms'. This same author also states that unfreedoms are barriers that hinder a person from developing. There are many contributing unfreedoms to the un-sustainability of ICT4D initiatives. Proper ICT4D resource management could help increase capabilities and freedoms to the development of the targeted communities.

Grunfeld (2007) identified that there is a strong correlation between capabilities, empowerment, and sustainability. She illustrates this relationship through what she calls a virtuous spiral. Figure 3.1 shows the virtuous spiral of the relationship between capabilities, empowerment, and sustainability.

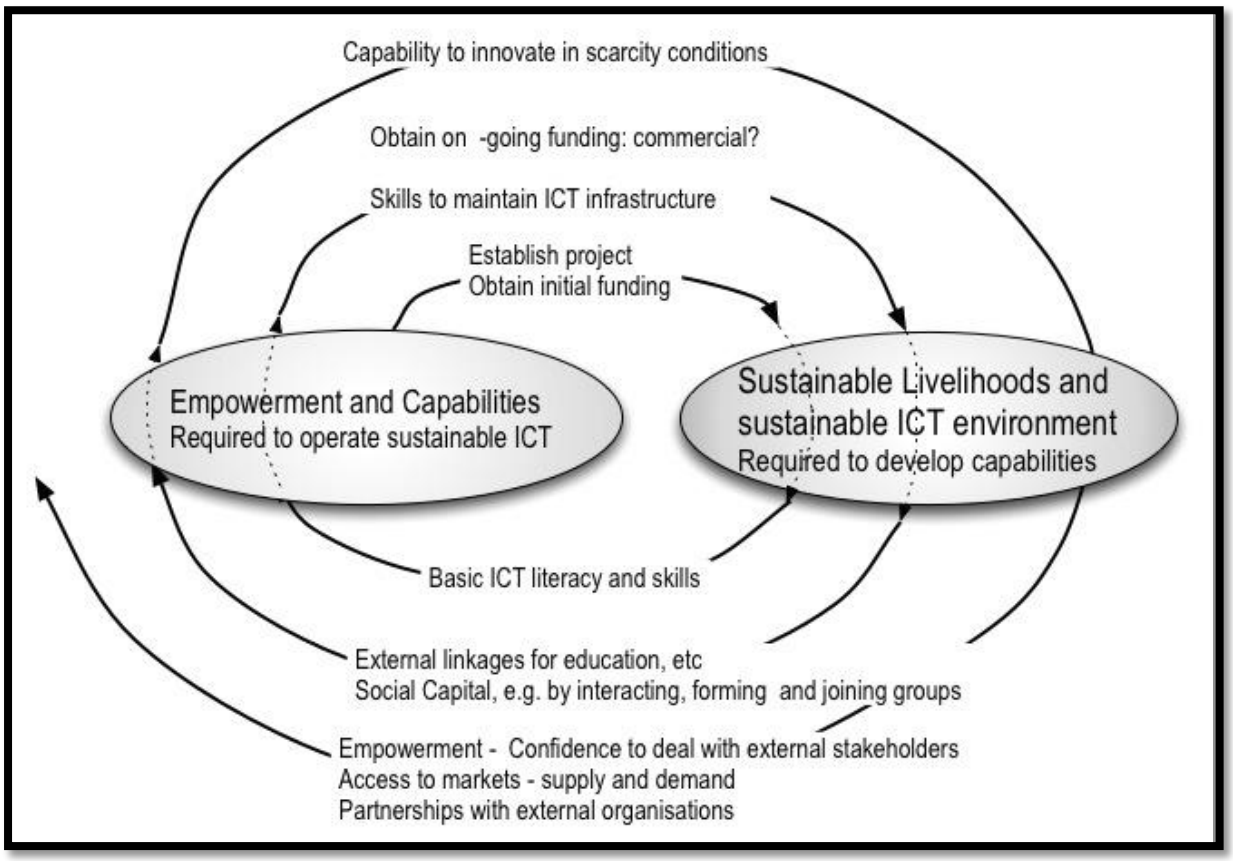


Figure 3.3: Virtuous Spiral - Capabilities/Empowerment & Sustainability (Grunfeld, 2007)

The figure portrays that the availability of ICT4D resources (e.g. funding and skills) creates a sustainable ICT environment which facilitates empowerment, capabilities and sustainable livelihoods. In turn, the empowerment and capabilities can strengthen people's skills and resources base; people can gain access to markets and become economically capable to invest in ICTs and eventually improve rural ICT skills and usage (Grunfeld, Hak, & Pin, 2011; Grunfeld, 2007).

3.8 Resource Based Theory applied to ICT4D sustainability

The Resource Based Theory (RBV) was designed to comprehend how firms can accomplish sustainable competitive advantages (Caldeira & Ward, 2001). Literature shows that the RBV has been used more in information systems (IS) research for the commercial sector (Caldeira & Ward, 2001; Wade & Hulland, 2004; Liang & You, 2009) than in ICT4D research (Chan, Hackney, Pan, & Chou, 2011). The RBV can be adapted for use in ICT4D research to aid study on properly managing resources to achieve long-term sustainability. The central concept of the Resource Based Theory is that organizational performance is dependent on its existing resources (Liang & You, 2009). According to Wade and Hulland (2004), the RBV assists organizations to gain competitive advantage and long-term success through proper resource management.

The premise that the RBV is principally oriented on resources and capabilities makes it relevant for this study. In the ICT4D context, sustainability can be prioritized as the main focus in place of competitive advantage. Using this theory, an ICT4D project is viewed as a firm with physical and social resources. The approach is functional to examine resources and operations of organizations; in this case ICT4D projects. Chan, Hackney, Pan, and Chou, (2011) suggest that the RBV can be used in the process of acquiring, managing and allocating resources to produce a central capability that meets existing needs and creates new services. They also support the notion that the application of the RBV had evolved from merely focusing on strategic resource acquisition to focus on organizational capability development. Chan et al. (2011) further stress those capabilities are dynamic and contextual, giving social capital as an example. Observably, ICT4D organizations must responsively manage resources to meet the needs of the communities they serve. Resources are defined as assets (tangible or intangible input/output to processes) and capabilities (e.g. skills, managerial abilities) that help an organization to identify and respond to market demand (Wade & Hulland, 2004).

For the purpose of this research, the Resource Based Theory will be used to analyse how resources in ICT4D projects can be properly managed for effective performance. Focus will not be put on imitability or substitutability of resources, but more on management methods. Figure 3.4 can be interpreted in ICT4D perspective as follows: productive use and management of resources leads to long-term sustainability of ICT4D projects, in this case resources being infrastructure, information, applications and people. ICT4D projects must strategically mobilize and allocate infrastructure, services, information, applications, people and skills and competences in a manner that improves capabilities for their organizations, stakeholders and beneficiaries.

3.9 Relationship of the theories

Noticeably, the COBIT explained in Chapter 2, the RBV and Sen's Capability Approach are related in some aspects. COBIT can be applied in ICT4D to guide the management of the critical IT resources, Sen's CA focuses on assessing a person's capability to attain important goals or values, whereas the RBV's concentration is on managing capabilities and assets (resources). Aspects from the theories are captured in the formulation of the proposed resource management framework. The link between the theories in informing this study lies in the fact that this research seeks to find a resource management solution for the sustainability of rural ICT4D projects. COBIT guides the resource management process, whilst Sen's CA helps to analyse social factors that contribute to sustainability challenges

and the RBV assists in identifying how proper resource management can enhance capabilities and lead to sustainability.

3.10 Conclusion

ICT4D sustainability has become an essential goal to achieve, owing to the high rate of failure in the ICT4D projects of developing countries (Bailey, 2009). In spite of few controversies to the sustainability concept (Ali & Bailur, 2007; Tomlinson, Silberman, Patterson, Pan, & Blevis, 2012), research on the subject keeps going in effort to curb the root causes of failure in ICT4D (Heeks, 2009; Kamal, 2012; Abdulwahab & Zulkhairi, 2012). Sen's Capability Approach justifies the significance of studying the sustainability of ICT4D projects because it highlights the importance of increasing human development through functionings (Nussbaum & Sen, 1993), of which ICTs are an enabler (Grunfeld, 2007). ICTs have become globally accepted tools for enhancing development and thus it is essential to establish proper methods of sustaining them. One way to achieve this is by identifying sustainability challenges across the sustainability failure model designed by Kumar and Best (2006). Literature reveals that there are five principal modes of sustainability failure which are: financial/economic, cultural/social, technological, political/institutional and environmental failure factors (Kumar & Best, 2006; Best & Kumar, 2008; Walton & Heeks, 2011). ICT4D in rural areas of developing countries can improve if organizations invest more in research, learn from previous mistakes and promote user involvement so that the designed systems benefit the targeted communities.

Chapter 4

Research Methodology

4.1 Introduction

This chapter will explain the research methodology applied to the research. According to Saunders, Lewis, and Thornhill (2009), the purpose of the research determines the approach to be used for the research. The purpose of this study is to find out how ICT4D projects in rural Zimbabwe are currently managed, factors influencing sustainability of the projects and what can be done to ensure sustainability of the ICT4D projects. An interpretive paradigm was adopted to carry out a real-life investigation of the rural ICT4D projects by means of a qualitative approach, using a case study research method.

The formulated research questions are subjective and they generate text rather than numbers, hence the study applies an interpretive paradigm and a qualitative approach. Qualitative approaches use data generating methods like interviews, document analysis and observations (Yin, 2011). The same author elaborates that these data collection methods generate data that is non-numeric (e.g. words, pictures or video clips). The project teams and the community were interviewed to gain an understanding of the challenges they encounter in the ICT4D resource management process. Observations and document analysis were used to elicit data on resource management and sustainability of the rural ICT4D projects in Zimbabwe.

4.2 The Case Study Investigation Design

This research will use multiple case study design to allow for comparison of results (Yin, 2003). Using multiple case study approach will reveal the possible application of the proposed resource management framework in different rural ICT4D project contexts.

Three case studies were selected for comparative analysis of the current resource management methods of each project.

4.2.1 The Case Study Research Questions

Three research questions were formulated to direct the case study examination, investigating 'how' and 'why' the resource management of each project is conducted in the specific methods. The research questions are:

1. How are the rural ICT4D projects in rural areas of Zimbabwe currently managed?

2. What are the factors influencing sustainability of rural ICT4D projects in Zimbabwe?

3. What can be done to ensure sustainability of rural ICT4D projects in Zimbabwe?

4.2.2 The Unit of Analysis

This study seeks to design a resource management framework for the sustainability of rural ICT4D projects. The enquiry investigates the current resource management practices for each case study taking into account the particular factors and challenges per project. The unit of analysis is the current resource management methods and how they influence the projects sustainability .

4.3 Research process

According to Kothari (2008), research methodology explains the scientific techniques used to solve a research problem. This implies that research methodology is the procedure for finding answers to the research problem. Saunders, Lewis, and Thornhill (2009) represent the research process in the form of what they term the research process onion. This study adopted Saunders, Lewis, and Thornhill's (2009) research process onion to illustrate its methodology. Figure 4.1 shows the research process onion representing the methodology for this research.

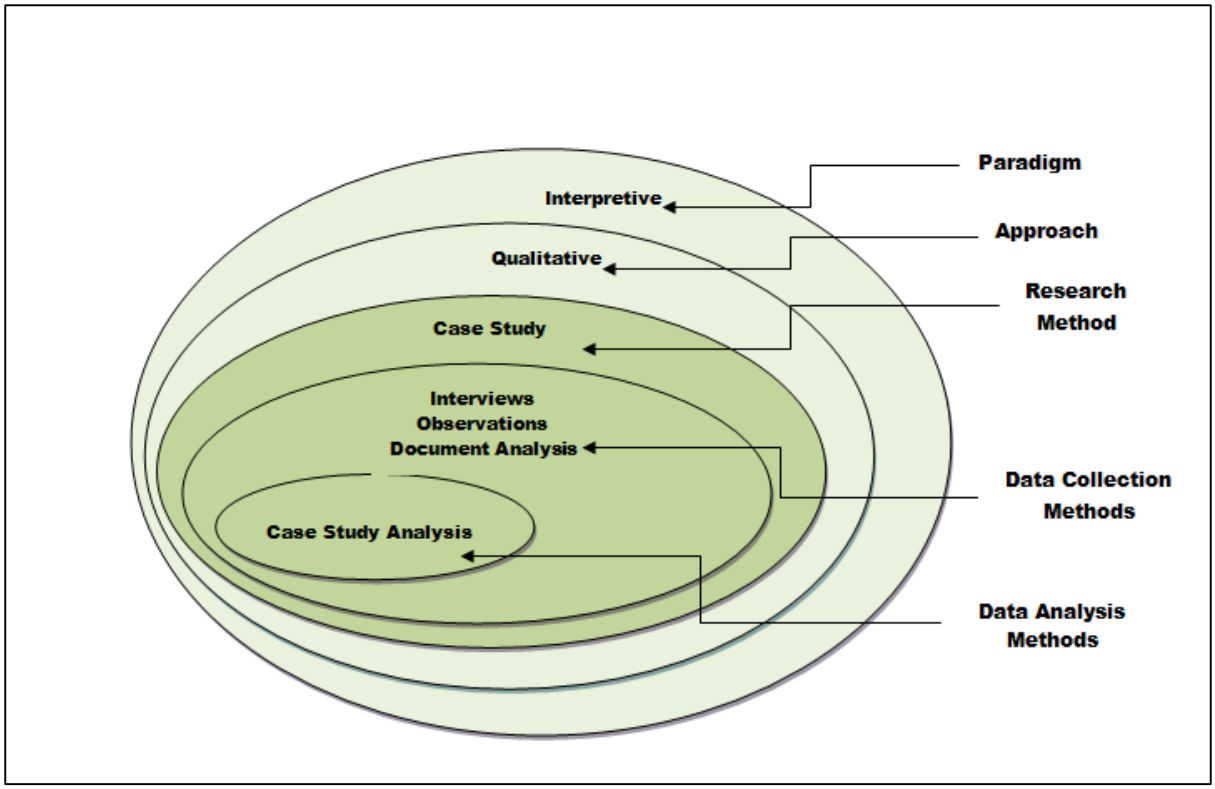


Figure 4.1: Research Process Onion, adapted from Saunders, Lewis, & Thornhill (2009)

As illustrated in the figure above, this study took an interpretive paradim. The approach for this research is qualitative as explained in the introduction. The case study research method was used, implementing data collection methods which are interviews, observations and document analysis. Case study analysis was used as the data analysis method. Details of the research process are explained in the following sections.

4.4 Research paradigm

The nature of the research questions determined the nature of enquiry. A paradigm is a set of assumptions about the nature of the world or a set of beliefs shared by researchers in a particular field (Maxwell, 2005). According to Collis and Hussey (2003), the two main research paradigms existing in research are the interpretive and the positivistic paradigms. Interpretive paradigms are based on the idea that reality is socially constructed and have been used by researchers to analyse organizational behaviour (Berg, 2000). Positivistic paradigms view reality as rigid, scientific and external to an individual (Cohen, Manion, & Morrison, 2007). Information Systems (IS) study deals with the social and organizational context in which information systems are developed and used (Oates, 2006).

Interpretivist IS researchers investigate IS development and implementation processes by analysing the experiences of the actors involved (Cecez-Manovic, 2005). ICT4D

management and sustainability situations in this research are complex and unique and they result from particular circumstances and individuals, thus this study necessitates the use of an interpretivist approach (Saunders, Lewis, & Thornhill, 2009). This research adopts an interpretive paradigm with the purpose of studying the phenomena in its context to answer its subjective research questions. In order to find out how ICT4D projects are currently managed in rural Zimbabwe, there is need for the researcher to immerse into the context to study how the involved actors' behaviour affects particular situations. The same applies to identifying the factors affecting ICT4D projects' sustainability and what can be done to improve it.

According to Saunders, Lewis, and Thornhill (2009), adopting a positivist paradigm entails that the phenomena under study is independent of contextual players and that only observable elements can give realistic data. Such a paradigm would require using theory to produce a hypothesis and employing data collection methods which generate figures and statistics. Positivistic paradigms view social phenomena as passive in the construction of reality and ignore the real-life situations which affect the context. Unlike the positivist paradigm, an interpretivist paradigm will portray the in-depth reality behind the un-sustainability of ICT4D projects in rural Zimbabwe. The interpretivist paradigm allows the researcher to immerse in the context itself and interact with the social actors, resulting in subjective, value based data that portrays real-world situations.

4.5 Research approach

The qualitative approach was chosen because the nature of phenomena analysed was subjective and inseparable from their context. According to Creswell (2003), the three approaches to research are qualitative, quantitative and mixed methods. The qualitative approach focuses on collecting and analysing non-numeric phenomena, whereas the quantitative approach focuses on numeric data. Mixed methods involve the use of both qualitative and quantitative approaches (Thomas, 2003). Collis and Hussey (2003) establish that interpretive researchers lean more towards qualitative approaches, whereas positivist researchers lean towards quantitative approaches.

This research uses qualitative techniques to collect and analyse data. Miles and Huberman (1994) state that qualitative approaches are used when the researcher seeks to gain in-depth understanding of the characteristics, causes and influences of a particular situation, unlike quantitative approaches which are used to measure quantities like percentages and rates of a phenomena. Qualitative approaches enable the researcher to obtain data on the insight of the involved people through contact with the

field, resulting in data that is in the form of non-numeric rather than numbers (Collis & Hussey, 2003). This research does not seek to measure any rates or percentages of a phenomena, rather it aims at identifying characterics, causes and effects of the phenomena under study, hence the use of qualitative approach.

4.6 Research method

Qualitative approaches use research methods like action research, case study, grounded theory and ethnographies (Creswell, 2003). The research methods used by qualitative approaches allow the researcher to relate with the real world in which events occur. Case study method was used as research method for this study. Saunders, Lewis, and Thornhill (2009) define research methods as the techniques and procedures used to obtain and analyse data. This concurs with Hofstee (2009) who explicates that 'method' refers to the general technique/s used to examine a thesis. The purpose for which information is being collected affects the method to be used (Kumar, 2005). Based upon this, a case study method was chosen to study resource management and rural ICT4D sustainability.

Collis and Hussey (2003) describe a case study as a thorough analysis of a single phenomenon of interest. The case study method is appropriate for use when the phenomenon being studied is not separable from its context, for example a project or a program under study (Yin, 2003). The phenomena in this research are best studied in their context, thus it is essential to use a case study.

Yin (1994) elucidates that case study designs can either be single or multiple case studies. Single case studies can be applied to test a theory or to study a single unique case, whereas multiple case study design uses two or more cases for comparison and generalisation (Saunders, Lewis, & Thornhill, 2009). This research applies the multiple case study design in order to compare results from diverse contexts to enable comparative analysis. Comparative analysis is a technique for increasing validity of findings through purposely seeking evidence from multiple sources and comparing findings from those various sources (Yin, 2011).

4.7 Sample and population

The research objectives and characteristics of the study population determine which and how many people to select (Oates, 2006). Kothari (2008) extrapolates that sampling is extracting part of a whole population to get information. Purposive sampling was used to select the sample for the data collection. With purposive sampling a group is selected according to the researcher's judgement that the group represents the population

(Kitchenham & Pfleeger, 2002). One of the strategies for conducting purposive sampling is heterogeneous sampling (Saunders, Lewis, & Thornhill, 2009). Saunders, Lewis, and Thornhill (2009) further express that heterogeneous sampling enables the researcher to select a small group to collect data that portrays key themes and patterns. In this regard heterogeneous sampling strategy was applied by choosing respondents from the organizations who had diverse characteristics in order to identify key themes from the collected data.

The population from which a sample was taken for data collection constitutes stakeholders of the three projects. From the population, purposive samples were taken from project managers, communal users and project staff members. This sampling method was deliberately chosen due to the differences in populations per project and the detailed information required from the interviews and observations. For the documentary analysis, only relevant documents were assessed.

Three ICT4D projects from different rural districts of Zimbabwe were used for this research. The reason for using three projects was to allow for comparison of results from the collected data. Using purposive sampling for the data collection, only relevant individuals and documents were chosen per project. This enabled the researcher to select cases that best facilitated to answer research questions and meet objectives (Saunders, Lewis, & Thornhill, 2009).

The next section outlines the data collection methods that were used to find data that answers the research questions.

4.8 Data collection methods

Case studies can use data generation methods like interviews, observations, document analysis and/or questionnaires (Oates, 2006). Semi-structured interviews, observations and documentary analysis are the data collection methods that were used. This use of two or more methods of data collection and analysis is referred to as triangulation (Cohen, Manion, & Morrison, 2007). The aim of triangulation is to compensate for any one-sidedness or distortion that may result from using only one method (Flick, von Kardorff, & Steinke, 2004).

4.9 Interviews

An interview is a data collection method that uses intentional dialogue between two or more people (Saunders, Lewis, & Thornhill, 2009). According to the same authors, there are three types of interviews; structured interviews, semi-structured interviews and unstructured or in-

depth interviews (Saunders, Lewis, & Thornhill, 2009). This study employed semi- structured interviews. With semi-structured interviews the researcher lists questions before the interview. The researcher was able to adjust the order or wording of the questions or add other questions depending on the unexpected issues that arose during the interviews (Lodico, Spaulding, & Voegtle, 2010). This enabled the researcher to gain more insight into some issues that had not been predicted, which would help reach better conclusions and results in the data analysis.

4.9.1 Interview Questions Construction

There were two sets of interview questions for each of the organizations. One set had questions for the users and the other set had questions for the project team. There were seven questions for the community and twelve questions for the project team. The interview questions were semi-structured to allow the researcher to adjust in cases where participants clarification.

4.9.1.1 Questions for the Project team and Project Users

The questions aimed at eliciting data portraying the experiences of people involved in the projects in terms of ICT4D resource management and sustainability. The questions were designed and derived from the literature study. The details of the link between the research questions are illustrated in the tables in Appendix C and Appendix D. Table 4.1 below shows the prepared questions for project team followed by an explanation of the aim of each question. The questions for the users are shown in Table 4.2. As mentioned before, there was room for clarification and adjustment in the way questions were asked during the interviews.

Table 4.1: Project team interview construction

QUESTION	AIM OF QUESTION
1. Please briefly explain the ICT for development (ICT4D) project you are currently undertaking.	To obtain detail of what the project is about and how it is carried out.
2. Explain the specific goals and objectives of the project. Describe any documentation that clarifies and explains these goals and objectives.	To elicit data concerning the motivation behind the project and to find out if there are any documents which outline the major goals and objectives (content from the documents will be explained in a later section)
3. Describe how the ICT4D project is aimed at bringing about sustainable development in the rural area.	To draw out data on the project's effort towards the community's sustainable development. The question was to help the researcher find out if the organization had any sustainability plan in place.
4. Please mention the ICT applications you use in the project and their particular uses in your project. Elaborate reasons for choosing these particular ICT applications, given in 4a (above). Is there any development activity currently taking place in the community that these applications support? Explain. What are your future plans for ICT use?	To extract data on the specific applications that the project uses in order to meet its objectives of serving rural needs and why the applications had been chosen. The question aimed at showing the researcher resource acquisition strategies that were in place.
5. In your opinion what are the barriers and challenges faced by the *community* in using the centre? How have you dealt with these challenges? Explain the barriers and challenges that you and your team have faced in implementing the project in the community?	To bring forth data to show if the project team was aware of the community's challenges in using the projects. The question also focused on eliciting what the project team was doing to alleviate the challenges as well as find out what challenges the team itself faced.
6. What are the resources available in the project?	To capture data on the currently available resources in the project
7. Explain your resource management approach and how you have adopted other ICT project resource management approaches (if any).	To draw data on the approach that the project team was using to manage the resources and if they had adopted any other ICT resource management approaches.
8. How are the resources managed in your project?	To get data on how the project team was managing the resources regardless of them using any adopted approach or not.
9. Does your resource management approach aim at promoting the project's sustainability and how?	To find out how the resource management approach that was being used was aimed at promoting sustainability of the project.
10. What resource management plans are available to accomplish the goal of the project?	To bring out data on the plans that were available in terms of project resource management and how the plans were aimed at accomplishing the project goal.
11. Is the resource management process continuously monitored and controlled? Why? How?	To identify if there was any method of continuously monitoring and controlling the current resource management, how it was being done and the reasons for doing so.
12. How would you like your existing resource management in your project to improve?	To extract data on the resource management plans and how the project team aimed at improving the existing strategy.

Table 4.2: User interviews construction

QUESTION	AIM OF QUESTION
1. What are the current services you are gaining from the computers in the project? Please explain any specific rural development activity currently taking place in the rural community that these applications support?	To investigate the available services and to assess if and how the services are promoting rural development activities.
2. In your own view, how does the ICT4D project bring about sustainable development in the community?	To find out if the project is contributing to rural sustainability and if the users have awareness and appreciation of the benefits.
3. Is the project meeting your needs? Are there any future services that you think would be of more benefit to you and other community members?	To assess if the project is meeting people's needs and to find out how new service creation would benefit them.
4. What are the other ICT resources that you use from the project, apart from the applications mentioned in 1(a)?	To examine how the users are utilizing the available resources.
5. Do you have any suggestions for improvement of the way the project's resources are managed, and shared among users?	To find out the users' perspective of the current resource management methods and their suggestions for improvement
6. Have you faced any barriers and challenges to ICT use in the project? Please explain how have you addressed these challenges?	To investigate the barriers and challenges that users face in trying to utilize the ICTs and examine how they have dealt with the challenges.
7. What do you think the community could do to keep this project sustainable?	To find out the users' suggestions towards the project's sustainability.

4.9.1.2 The interviewees

In all three case studies the researcher interviewed two groups which were the project team and the users. The project team are the people working on the projects and the users are the people who make use of the systems in the projects. These people were chosen because they have knowledge of the ICT4D projects in relation to the resource management methods applied. The project teams included the project leaders, project managers, project staff and project stakeholders. The users interviewed included community members who benefit from the projects.

Table 4.3: People interviewed per project

Project	Individuals interviewed
Mutoko World Links ICT Centre	Project Director Project Chairperson 1 Project Coordinator/ ICT teacher 2 Students 3 Teachers 3 Communal Users
Practical Action Podcasting Project, Guruve	Project Director Project Leader Project Coordinator Project Logistics manager 6 Communal Users
Plumtree Community Website Portal	Project Director Project Staff member Project Coordinator 6 Communal Users

The organizational structures for the three projects are different; this explains the differences in the number of participants engaged per project. The other factor that resulted in respondents' numbers differing is that purposive sampling was used to choose respondents who are likely to give relevant data and when the researcher started to get similar answers during the interviews, the researcher would stop interviewing (Saunders, Lewis, & Thornhill, 2009).

4.9.1.3 Interview procedures

The interviews were conducted on a one-on-one basis on all the three projects. According to Collis and Hussey (2003), the purpose for a one-to-one interview is to allow the participants to be free to say out their views without anyone else hearing. The approach also helped the interviewer to analyse body language and to probe further where there was need for clarification. There were twelve questions for the project team and seven questions for the community, leaving room for further questions that would arise during the interviews. The interviews each took between 45 to 60 minutes. The interviews with project leaders of both the Mutoko World Links ICT Centre and Practical Action podcasting project were carried out at their head offices in Harare. The interview with the project leader for Plumtree Rural ICT Project was done in Bulawayo. The rest of the other interviews were done at the rural project sites which are in Guruve at the Lower Guruve Development Association (LGDA), Mutoko Government High School and Plumtree RDC.

4.9.1.4 Equipment used for interviews

The equipment used for the interviews included the following:

- *Recorders:* Voice recording software on a laptop was used to record the interviews together with a phone voice recorder, and a digital camera was used to take pictures on site.
- *Writing pads and stationery:* Writing pads were used to take notes during the interviews. The notes were written in shorthand to save time whilst listening to participant.
- *'Thank-you' notes:* After the interviews, thank you notes were sent via email to express appreciation to the participants' support for the research.

4.9.1.5 Informed consent from the interviewees:

Letters were sent via email to the proposed participants to seek their informed consent. The informed consent forms explained details of the research aim, why their participation was necessary, how it would be used and to whom it would be reported. The letters also explained the process of the interview, detailing the type of questions to be asked and the approximate length of the interview. The proposed interview dates were given, but the interviewees were free to adjust dates to suit their schedules.

4.10 Document analysis

Document analysis was employed to gather data on the flow of information on resource management within the projects. Oates (2006) suggests that documents can be used as objects or entities in their own right to examine the production and distribution of information in an organization.

Access to the documents was upon consent of the organizations and was dependent on the documents' availability. The documents aimed at providing data for the analysis of the flow of resource management and sustainability information within the organization. The table below shows the documents collected per project for the document analysis. The researcher targeted documents which portrayed the flow of information relating to resource management of each project. However the access to documents differed per project hence the researcher worked with what was available to explore relevant data.

Table 4.4: Documents collected per project

PROJECT	**Mutoko World Links ICT Centre**	**Practical Action Podcasting Project, Guruve**	**Plumtree Rural ICT Project**
DOCUMENTS COLLECTED	Mutoko World Links ICT Centre Constitution Organization profile Vision and Mission Statement Mutoko World Links ICT Centre Objectives Services Offered ICT Lab Rules Outreach programs Report updates 2012 Stock inventory 2012 Service charges 2012 Correspondent letters with stakeholders	Practical action brochures Podcasting Annual Project Review Podcasting recorded assessment LGDA Vision and Mission Statements	Plumtree ICT Proposal Bulilima-Mangwe Community Development Program

4.11 Observations

Saunders, Lewis, and Thornhill (2009) suggest that if one's research questions seek to find out how people behave, observation can be a suitable method to investigate, record and understand people's behaviour. Observations were applied to generate data on the

current state of resource management within the projects and to observe how people behave in their ICT4D projects' operations. The observations were carried out on a non-participant basis. For all three projects the researcher visited the projects' sites and observed how operations were running. Observations are essential because they reveal what people do in reality and not what they are assumed to do (Cohen, Manion, & Morrison, 2007).

4.12 Data analysis methods

This study employed the inductive approach. The inductive approach is theory generating (Todd et al., 2009). The aim is to establish a relationship between the research objectives and the findings derived from the raw data (Thomas, 2003). The findings gathered from the data were used to create the framework.

Tesch (1990) states that procedures in qualitative data analysis are diverse and that there is no standard way of doing it. Miles and Huberman (1994) also agree with Tesch (1990) and maintain that qualitative research does not adhere to any strict rules of analysis, but is rather crafted to fit the scenario under study. The procedures to be used for analysing data from the case study are adopted from Marshall and Rossman (2006). The authors divided the process of data analysis into seven (7) procedures. The procedures were chosen due to their inductive theory generating nature. Details of how the procedures were conducted will be given in Chapter 5. The procedures are shown in the table below.

Table 4.5: Data analysis procedure (Marshall & Rossman, 2010).

STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5	STAGE 6	STAGE 7
ORGANIZING DATA	IMMERSION IN THE DATA	GENERATING CATEGORIES, THEMES & PATTERNS	CODING THE DATA	INTERPRETATION THROUGH ANALYTIC MEMOS	SEARCHING ALTERNATIVE EXPLANATIONS	WRITING THE REPORT

4.12.1 Organizing data

Marshall and Rossman (2006) describe this stage of data analysis as the phase which starts just after the data collection. They emphasize that even though the process should be on-going throughout the research, it is crucial to return to the collected data again at this stage. For this study the researcher went through the notes and recordings of the data, making

note cards and arranging the data in classes that are retrievable and manageable. Marshall and Rossman (2006) further recommend that the researcher needs to log the data according to attributes like dates, places and with whom they were collected. This helped the researcher to classify and group the data in order to retrieve meaning from it at later stages of analysis. In some cases this stage involves entering data into data analysis software programs.

4.12.2 Immersion in the data

According to Marshall and Rossman (2006), this stage this stage involves immersing oneself in the data by reading through it over and over again. Immersing in the data creates images in the researcher's mind and allows the researcher to remember and familiarize with the events experienced during the data collection. At this stage, the researcher needs to go through field notes and convert them into write-ups, but should guard against losing some of the important data (Miles & Huberman, 1994). From this, one can view that it is important to convert field notes into write-ups early and to start analysing as soon as data is collected in order to retain the valuable findings. Field notes, and audio recordings for this study, were converted into write-ups for the ease of the analysis process

4.12.3 Generating categories, themes & patterns

This stage of data analysis involves singling out prominent themes, frequent points or words and patterns of ideas that connect people to their setting and creating matrices (Marshall & Rossman, 2006). According to Marshall and Rossman (2006), these patterns and themes reveal what the researcher understands to be the perspectives of the participants; however, the researcher needs to be cautious of imposing their own world-view above that of the context. Miles and Huberman (1994) recommend that a practical method of generating categories, themes and patterns is to create contact summary sheets from the write-ups. Miles and Huberman (1994) further explain that the contact summary sheets assist the researcher to focus on salient themes from each contact by asking questions like:

- What individuals, proceedings or circumstances were involved?
- What were the core themes and matters in the contact?
- Which research question did the contact bear most on?
- What new intuitions about the field circumstances were suggested by the contact?

Contact summary sheets were made to generate categories and themes from the data that had been collected.

4.12.4 Coding the data

After generating categories and themes, the researcher applied codes to those categories and themes (Miles & Huberman, 1994; Marshall & Rossman, 2006). As described by Miles and Huberman (1994), codes are markers used to give of meaning to categories of the collected data. Marshall and Rossman (2006) express that codes can be abbreviations of salient words, coloured dots or numbers depending on the researcher. As an example, the following texts can be coded as follows:

- ICT4D projects in rural areas sustainability demonstrated through increase in ICT jobs creation – ICT. SUST.JBS
- ICT4D projects in rural areas sustainability demonstrated through increase in use of agricultural management software – ICT.SUST.AGRSW

The process of coding in not scientific or technical, it is analytic and can go through stages of modification and adjustments as the researcher keeps gaining more insight into the data meanings (Miles & Huberman, 1994; Marshall & Rossman, 2006).

4.12.5 Interpretation through analytic memos

Memoing is done throughout the analysis process by writing notes, introspective memos, opinions and insights to shift analysis from being dull to resourceful (Marshall & Rossman, 2006). This helped the researcher to connect the codes and link relationships between them to gain sensible insights from them (Miles & Huberman, 1994).

4.12.6 Searching alternative explanations

After having completed memoing, it is important that the researcher challenges their propositions by seeking alternative understandings (Rossman & Rallis, 2011). Rossman and Rallis (2011) proceed to elaborate that searching for alternative explanations can be done through asking participants what they think about one's explanations and analysing literature to find out if any theories agree or disagree with the interpretations. This process aided the researcher to test their own data's credibility, usefulness and plausibility (Marshall & Rossman, 2006).

4.12.7 Writing the report

According to Miles and Huberman (1994), there is no fixed method of writing a report from qualitative enquiry, but it is crucial to narrate it in a credible manner. The authors suggest that the nature purpose of the study, the audience and the writer determine the format that will be used to write the report (Miles & Huberman, 1994). The guidelines to consider when writing the report, according to Miles and Huberman (1994), are outlined in the table below.

Table 4.6: Guidelines for writing the report (Miles and Huberman, 1994)

1st Guideline	2nd Guideline	3rd Guideline	4th Guideline	5th Guideline
The report should explain what the study was about.	The report should give a clear social and history context of the study setting.	The report should clearly outline what was done, how it was done and by whom.	The report should make use of illustrations, like pictures, to aid reader understanding.	The researcher should articulate their conclusions and describe their broader meanings in the world they affect.

The guidelines were considered and applied in the writing of the analysis report that is given in the Chapter 5.

4.13 Conclusion

The qualitative approach was suitable for this research as it enabled the researcher to obtain data showing how the rural organizational behaviour in managing ICT resources affects the projects' sustainability. The case study research methodology was essential to help the researcher get in-depth data from the rural ICT4D context itself. Interviews, observation and document analysis assisted the researcher to engage with the people involved with the project and to see how the projects are run, as well as to view how resource management information flows within the systems. Chapter 5 will elaborate on the findings and data analysis for this study.

Chapter 5

Findings and Data Analysis

5.1 Introduction

Chapter Four gave details of the research methodology applied for this study. This chapter reports the findings from the data analysis from three rural ICT4D projects pertaining to their resource management methods aimed at advancing project sustainability. The three rural ICT4D projects from which the findings were obtained are Mutoko World Links ICT Centre, Practical Action Podcasting Project, Guruve and the Plumtree Rural ICT Project. The main focus of the findings is on the rural ICT4D projects' resource management techniques and their influence on sustainability. The three case studies were chosen to enable comparison of results from the different ICT4D resource management approaches.

5.2 Description of the cases

Mutoko World Links ICT Centre is an e-education project which is located at Mutoko Government High School. The centre offers ICT related services and training to students and teachers and the community. Its similarity to the other two projects is that it involves the community as users. Its difference with the other projects is that it serves as the school ICT Lab as well as a telecentre. It is similar to the Plumtree Rural ICT Project in that it gives services at a charge unlike the Practical Action Podcasting Project whose services are for free.

Practical Action Podcasting Project is an e-agriculture project located at the Lower Guruve District Centre (LGDC). The project offers agricultural knowledge and information to local farmers through podcasting. The project is similar to the others in that it serves the community as users of the system. However, it is different from the other two in that its services are for free to the users and it is managed by the LGDC together with Practical Action organization.

Plumtree Rural ICT Project is an indigenous knowledge and information sharing system that is hosted at the Plumtree rural district council (RDC). The project offers indigenous information and knowledge sharing platforms to all members of the community. The project's similarity to the above two projects is that it serves the rural community. Like the Guruve Podcasting Project, it is hosted at the district centre and like the Mutoko World-links project; some of its services are paid for. The following sections give the background of each project.

5.2.1 Mutoko World Links ICT Centre

World Links for Development Programme (WorLD) and the Ministry of Education Sport and Culture (MOESEC) collaborated in 2004 to establish World Links Zimbabwe (WLZ). WorLD is an international program that was designed to promote the use of ICTs to enhance teaching and learning in developing countries and it was at the close of its funding in Zimbabwe in 2004 when they established WLZ. WLZ now works with schools, educational institutions and communities in Zimbabwe to engage all learners in use of ICT in learning and development. WLZ's focus areas include the following: school connectivity, tele-collaboration, teacher professional development and technical support services. WLZ mainly supports schools and communities which are under resourced.

WLZ in partnership with MOESEC has established 45 schools and community based dual-purpose telecentres in all 10 provinces of Zimbabwe, one of which is Mutoko World Links ICT Centre. Mutoko World Links ICT Centre was launched in 2006. The centre opens to students and teachers during normal school hours and to the community after school hours and on weekends. The centre offers ICT related services and training to students and teachers with the aim of improving their educational and employment opportunities, as well as linking them with their counterparts across the world. This is done through participation in tele-collaborative email and web-based projects. The WLZ also offers programmes that promote rural development through use of ICTs such as the Virtual Reality based agricultural projects (VR).

5.2.1.1 The Project Context

Mutoko is a rural area situated within the Mashonaland East province of Zimbabwe. It is located 143 kilometres (km) from Zimbabwe's capital city, Harare. Mutoko is a mountainous region and hence a key source for granite stone in Zimbabwe.

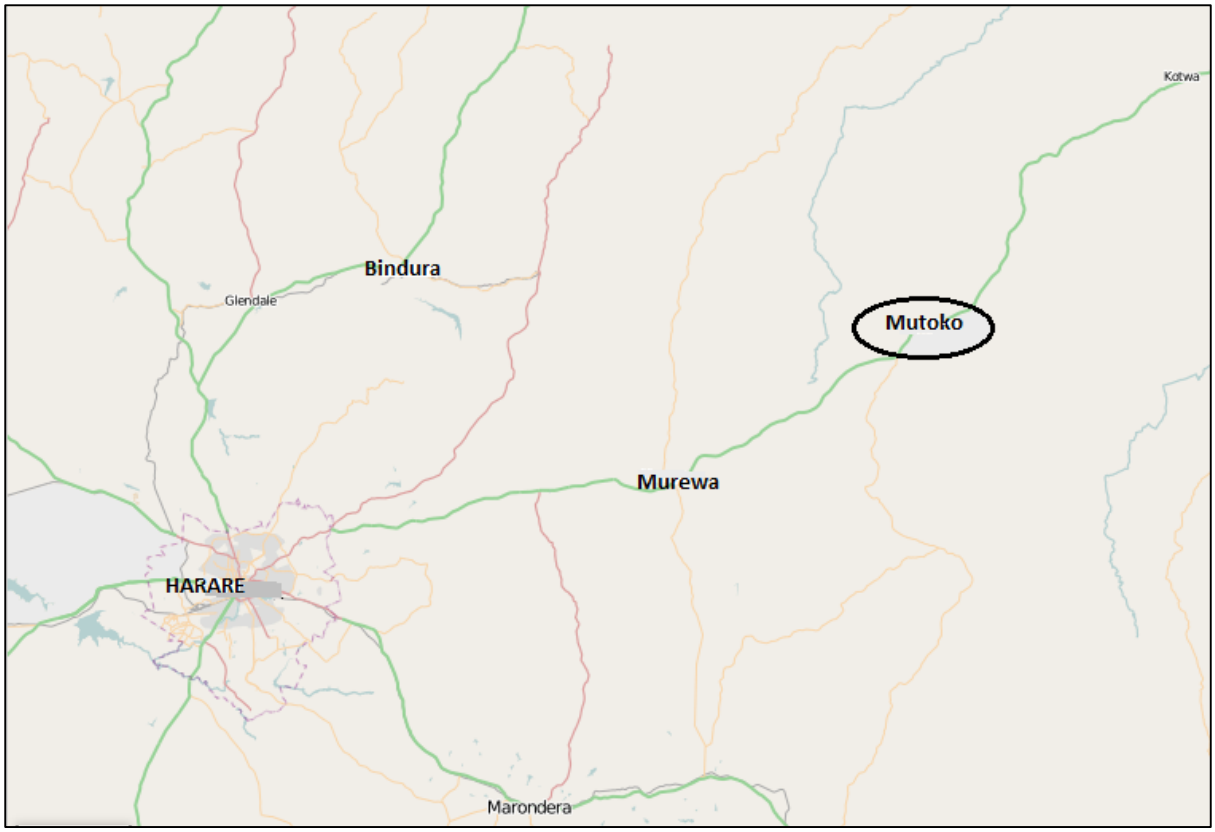


Figure 5.1: Location of Mutoko on the Mashonaland East Map (OpenStreetMap, 2012)

The Mutoko area is administered by the Mutoko RDC. The main language spoken in Mutoko is Shona and the main source of living for the people of Mutoko is agriculture. Among the major challenges they face is the unavailability of markets to sell their agricultural produce (Zunguze, 2007). According to a report by the Parliament of Zimbabwe (2011), the Mutoko North area has a population of 48,001. The same report reveals that the area has 15 secondary schools with a total enrolment of 6,180 students and 244 teachers. There are 7 health centres and 18 communal dip tanks which serve a cattle population of about 22,872. Water supply in the region is currently problematic as over 50% of boreholes and deep wells are not functioning. Out of the 11 main business centres in the area, 4 centres do not have electricity supply. Mutoko receives average rains to sustain agricultural and domestic needs and there is more economic growth potential in horticulture projects and with more funding and planning, the community can even go into fresh produce exports.

The Mutoko World Links ICT Centre is stationed at Mutoko Government High which is in the Mutoko North constituency under Mutoko District. Membership of the telecentre comprises satellite school heads, school teachers, students, school development associations (SDAs) and co-opted members of the organization.

5.2.2 Practical Action Podcasting Project, Guruve

Practical Action is an international NGO that uses technology to alleviate poverty in developing countries by investigating what people are doing and assists them to do it better. They help poor communities to build on their skills and knowledge using technology to create convenient solutions. The Podcasting Project is one of such initiatives that Practical Action has implemented in rural areas of Zimbabwe. The project runs in Guruve, Mashonaland Central Province of Zimbabwe. The project was conducted in partnership with the Lower Guruve Development Association (LGDA), a community based organization that was formed by peasant farmers residing in Lower Guruve.

Podcasting is the publishing of audio files through the Internet for users to subscribe to and access new files automatically. Podcasts can be played on any digital audio player or computer with audio-playing software. Podcasts can also be broadcast on local radio stations or can be saved onto computers at community info-centres to create audio CDs of the podcasts. The CDs can be listened to at any time and the recorded information remains constant.

The Podcasting Project in Guruve has been implemented with input from a large number of local stakeholders. It facilitates knowledge sharing among farmers in the local Shona language. Practical Action captures the knowledge of communities, extension experts and development agents about crop and livestock production and health and hygiene issues, and puts it onto MP3 devices that can record and replay any voice file using local languages.

5.2.2.1 The Project Context

Guruve is one of the seven districts in Mashonaland Central province, Zimbabwe. It is located 153 km from Harare. Most of its population are poor rural inhabitants who rely on peasant farming as a source of living. The podcasting initiative is conducted in Lower Guruve, a rural area in the Guruve district. Lower Guruve is a semi-arid remote area that has no access to electricity, or FM radio and has poor mobile phones networks with a literacy level of 50%. It is located in the partially infertile Zambezi valley, a low altitude region, typified by recurrent droughts and occasional floods (Grimshaw & Gudza, 2010). As a result the area is suitable for farming of drought tolerant crops and livestock production.

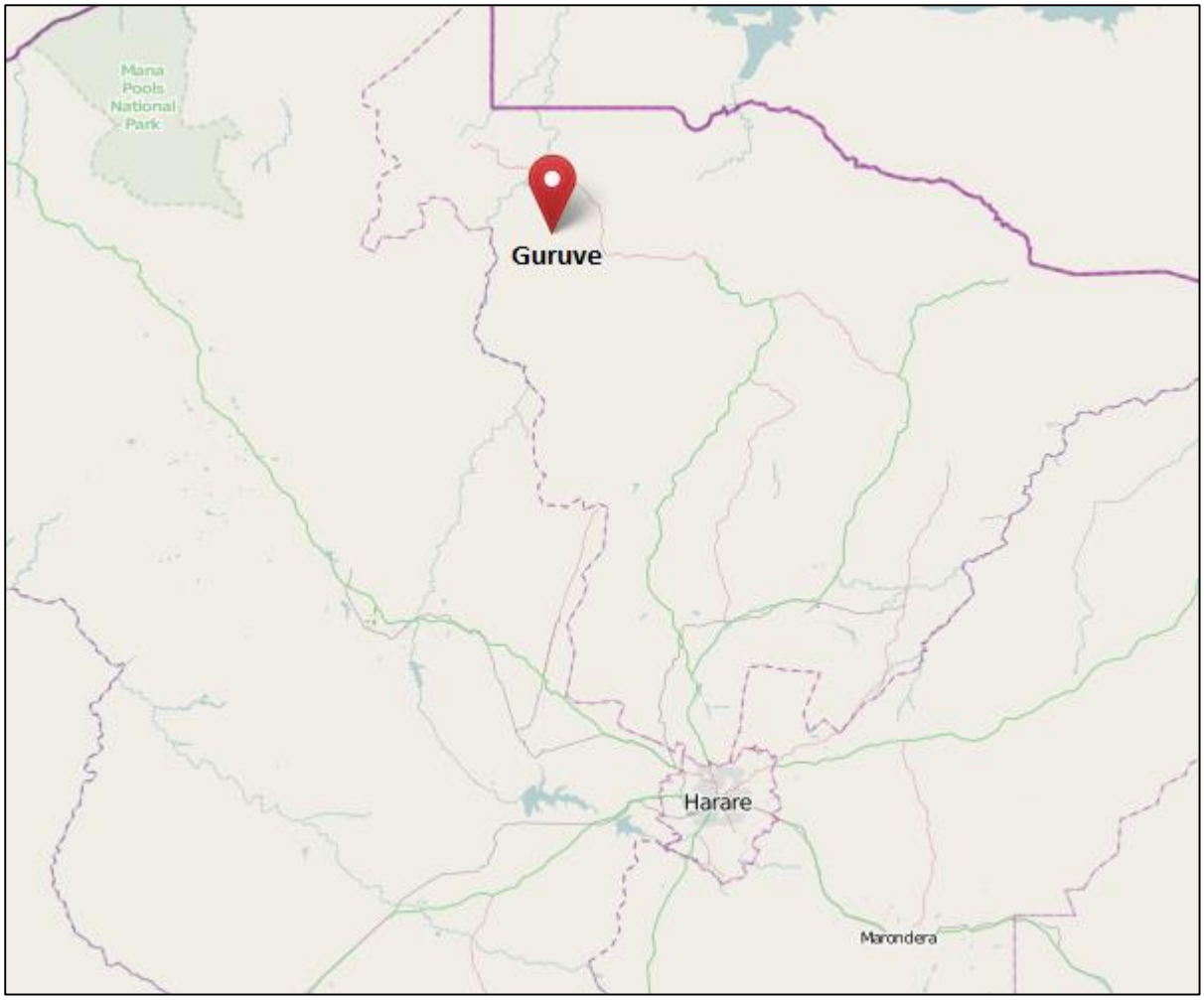


Figure 5.2: Location of Guruve on the Mashonaland Central Map (OpenStreetMap, 2012)

20% of the livestock in the area are vulnerable to trypanosome parasites transmitted by tsetse flies and most of the livestock are lost each year (Grimshaw & Gudza, 2010). Most farmers depend on animal draught power for cultivating their lands, hence the need for increased livestock production. There is possibility in improving animal draught power performance through enhanced livestock management with emphasis on improved feeding practices (Grimshaw & Gudza, 2010).

5.2.3 Plumtree Rural ICT Project

The Plumtree Rural ICT Project is a project that was implemented in 2006 under the Village Development Program; a community development initiative that was designed by the Institute for Rural Technologies through funding from the W.K. Kellogg Foundation. The initiative builds capabilities in the rural communities of Matabeleland South Province of Zimbabwe to identify their particular circumstances and facilitate their development. The Institute for Rural Technologies uses knowledge and innovations to eliminate poverty and advance the economic and social development of communities in Matabeleland South. The Plumtree Rural ICT Project is used as a portal for electronic learning, and as a community

facility for the dissemination of information. It is also a base for indigenous knowledge which allows capturing and disseminating local knowledge into sellable products on CDs and DVDs to sell nationally and internationally.

The program helps the rural community to access, obtain, share and distribute information and knowledge for empowerment and growth. ICTs are enabling the Plumtree rural community to communicate, consult and build solidarity and share their development and concerns with the relevant stakeholders and to electronically obtain, store, repackage and exchange information with other communities. Indigenous knowledge is knowledge that is unique to a particular culture or society. It is used locally by developing communities for decision making concerning fundamental activities. It is the foundation for activities like agriculture, forestry, food preparation, education and environmental conservation.

This case study was conducted at the Bulilima-Mangwe RDC offices in Plumtree town. Focus was mainly on the Indigenous Knowledge Management System sub-project which falls under the Plumtree Rural ICT Project. The initiative caters for marula production, livestock management and eco-tourism.

5.2.3.1 The Project Context

Bulilima-Mangwe is a remote rural district situated in the Matabeleland South Province of Zimbabwe. Its main town, Plumtree, is about 100km from Bulawayo, Zimbabwe's second capital city. The district has 35 wards and it shares borders with Botswana and South Africa, which accounts for the increased migration of people to the neighbouring countries to look for employment. Bulilima-Mangwe lies in a drought prone region of Zimbabwe and thus grows drought resistant crops like millet and sorghum. Economic activities in the area include livestock production, amacimbi (Mopani worms) selling, marula production, crafting and eco-tourism.

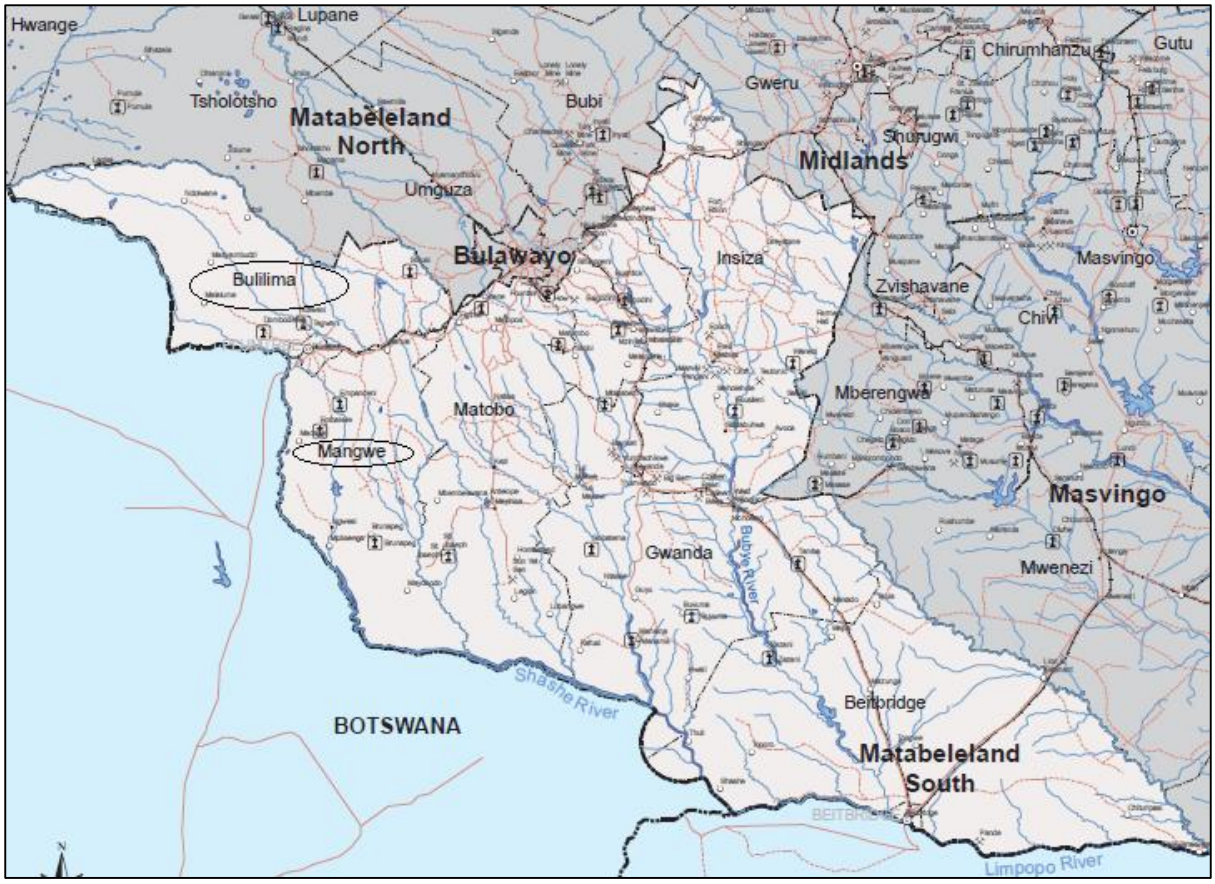


Figure 5.3: Bulilima-Mangwe Map (OCHA, 2009)

The project was created with the aim of using ICTs as a tool for enhancing communication and collaboration to support local development economic activities. Unemployment, hunger, low literacy rates and high rates of HIV infections are some of the problems characterizing the district. The project also seeks to provide a learning and knowledge sharing platform to challenge these problems.

5.3 Addressing the research questions

In order to synthesize and create meaning from the collected data, there is need to translate it into evidence through the data analysis process. An inductive approach was employed to generate the framework from the data analysis. The literature reviewed in Chapters 2 and 3 provides a baseline against which the findings of this research are assessed. The inductive approach was taken because it allows the findings of this study to be evaluated to find out how they match with theory. This will help in the formulation of the framework.

The main research question for this study is: *How can proper resource management be applied in ICT4D projects in rural Zimbabwe to improve sustainability?* To answer the main research question, the following secondary research questions were formulated and employed to collect data:

1. How are the rural ICT4D projects in rural areas of Zimbabwe currently managed?

2. What are the factors influencing sustainability of rural ICT4D projects in Zimbabwe?

3. What can be done to ensure sustainability of rural ICT4D projects in Zimbabwe?

The following instruments were used for data collection to answer these research questions:

- Interviews
- Observations
- Documentary Analysis
- Literature study

5.3.1 First research sub-question

The aim of this research sub-question is to examine how ICT4D projects in rural areas of Zimbabwe are currently managed in order to identify the resource management problems at hand.

How are the rural ICT4D projects in rural areas of Zimbabwe currently managed?

Interviews, observations and documentary analysis are the data collection methods that were used to answer this sub-question. The findings for the research sub-questions are discussed in the subsections below.

5.3.1.1 Findings for research sub-question 1

- **Interviews**

Semi-structured interviews were conducted with three rural ICT4D projects. The interview questions were in two groups. One set of interviews had 12 questions for the project team and the other 7 questions for the project users. The questions were listed and explained in Chapter 4 on Table 4.1 and Table 4.2 respectively. The aim of the sub-question was to identify the resource management methods in use in the rural ICT4D projects. Project team interview questions 4, 6, 7, 8, 9, 10, 11, 12 and Users interview question 5 addressed the first research sub-question.

- **Observations**

Observations were conducted to investigate what happens in reality at the projects sites, in terms of the resource management processes.

5.3.2 Second research sub-question

The aim of this question is to investigate the factors that influence the ICT4D projects.

What are the factors influencing sustainability of rural ICT4D projects in Zimbabwe?

The data collection instruments that were used to answer this question are interviews and documentary analysis.

5.3.2.1 Findings for research sub-question 2

- **Interviews**

The interviews conducted at the centres helped to answer research sub-question 2. Project team questions 2, 3, 5, 9, 10, 11 and the users' questions 1, 2, 3, 6 addressed the second research sub-question.

- **Documentary Analysis**

Documentary analysis was also employed as an instrument to answer research sub-question 2.

5.3.3 Third Research Sub-question

The aim of the third research sub-question is to evaluate what can be done to ensure that ICT4D projects in Zimbabwe become sustainable.

What can be done to ensure sustainability of rural ICT4D projects in Zimbabwe?

This question is answered using literature study in comparison with findings from the interviews, documentary analysis and observations. It leads to the construction of the resource management framework in Chapter 6. Therefore, the proposed resource management framework in Chapter 6 will answer the third research sub-question.

5.4 Research findings

The interview questions, observations and documents collected and the numbers of the participants per project were listed in detail in chapter 4.

5.4.1 Literature review

The proposed resource management framework will be formulated with input from the literature review conducted in Chapter 2 and Chapter 3 as well as the results obtained from the field enquiry.

5.5 Interpretation of the collected data

The next subsections will discuss the findings in detail according to the order of the research sub-questions.

5.5.1 First research sub-question

The aim of this research sub-question is to examine how ICT4D projects in rural areas of Zimbabwe are currently managed in order to identify the resource management problems at hand.

How are the rural ICT4D projects in rural areas of Zimbabwe currently managed?

Interviews, observations and documentary analysis are the data collection methods that were used to answer this sub-question. The findings for the research sub-questions are discussed in the subsections below.

5.5.1.1 ICT applications used in the projects

The findings revealed that the applications used at the project centres are mainly Windows operating system, word processing software and research software. The particular applications and services currently available are listed in the following table:

Table 5.1: Applications and services

PROJECT	APPLICATIONS	USES
Mutoko World Links	• Microsoft Windows XP • Microsoft Office 2003 • Internet Explorer • Adobe reader • Microsoft Encarta 2007	• Computer appreciation lessons • I.T Consultancy • Educational ICT related workshops to schools and community leaders • Internet and email services • Typing photocopying and printing services • Binding and lamination • Basic hardware and software installation tips and troubleshooting • Research facilitation
Guruve Podcasting Project	• Windows XP operating system • Microsoft office suite • Windows Sound Recorder • Voice recording and compressing software (open source) • Internet Explorer	• Capturing voice in local language from infomediaries • Researching new knowledge from the internet and extension officers • Documenting information for voice recording • Saving the voice recording onto computers • Compressing voice and transferring onto portable devices • Broadcasting recordings in community gatherings • Managing podcasting devices
Plumtree ICT Project	• Windows XP operating system • Microsoft office suite • Windows Sound Recorder • Adobe reader • Windows CD/DVD writer • Windows media player	• Indigenous knowledge capturing, packaging and dissemination • Computer skills training • Photocopying services • Printing services • Information and Multimedia services • Consultancy services on any issues to do with ICT • International Computer Driving License (ICDL) training

For all projects service provision is currently hampered by the lack of adequate infrastructure to facilitate internet connectivity and high processing speed required by the applications.The responses indicated that the applications in use were chosen due to the assumed needs of the intended users. The applications are the ones that are providing services for the users. Answers given showed that there are rural activities that are supported by the centres.

5.5.1.2 Resources available in the projects

The interviews, observations and documentary analysis showed that the major problem is that of inadequate infrastructure and limited finances. A considerable number of participants highlighted that if more funding was available, more resources would be acquired and better services would be provided by the centers. At Mutoko World Links it was observed that most of the available equipment has been there since 2006 and most is still functional. Though most of the computers are now outdated, the centre has managed to preserve them. The Guruve Podcasting project team's responses emphasized that their major resources are the voice recording and dissemination equipment. At Plumtree ICT project several available resources were mentioned by the team and in order to get an accurate list, documentary analysis and observations were used as well.

Figure 5.4: Computers in the Mutoko World Links ICT Lab

The roads in Mutoko are not tarred and they are sandy which makes it difficult to drive especially in rainy seasons. Electricity is supplied from the national provider Zimbabwe Electricity Supply Authority (ZESA). Nonetheless the supply is erratic and the centre relies on the generator which needs to be fuelled. There is only one ICT Lab with one burglar barred door and there are plans to build two other ICT Labs.

Figure 5.5: The ICT Lab at the Mutoko World Links ICT Centre

The infrastructure available at the centre is listed below:

Hardware

- 13 computers (*4 Pentium II, 7 Pentium III and 2 Celerons*)
- 1 laptop for the teacher
- 2 Enhanced Data rates for GSM Evolution (EDGE) technology Internet modems
- 1 power generator
- 3 printers
- 1 scanner
- 1 laminating machine

Applications

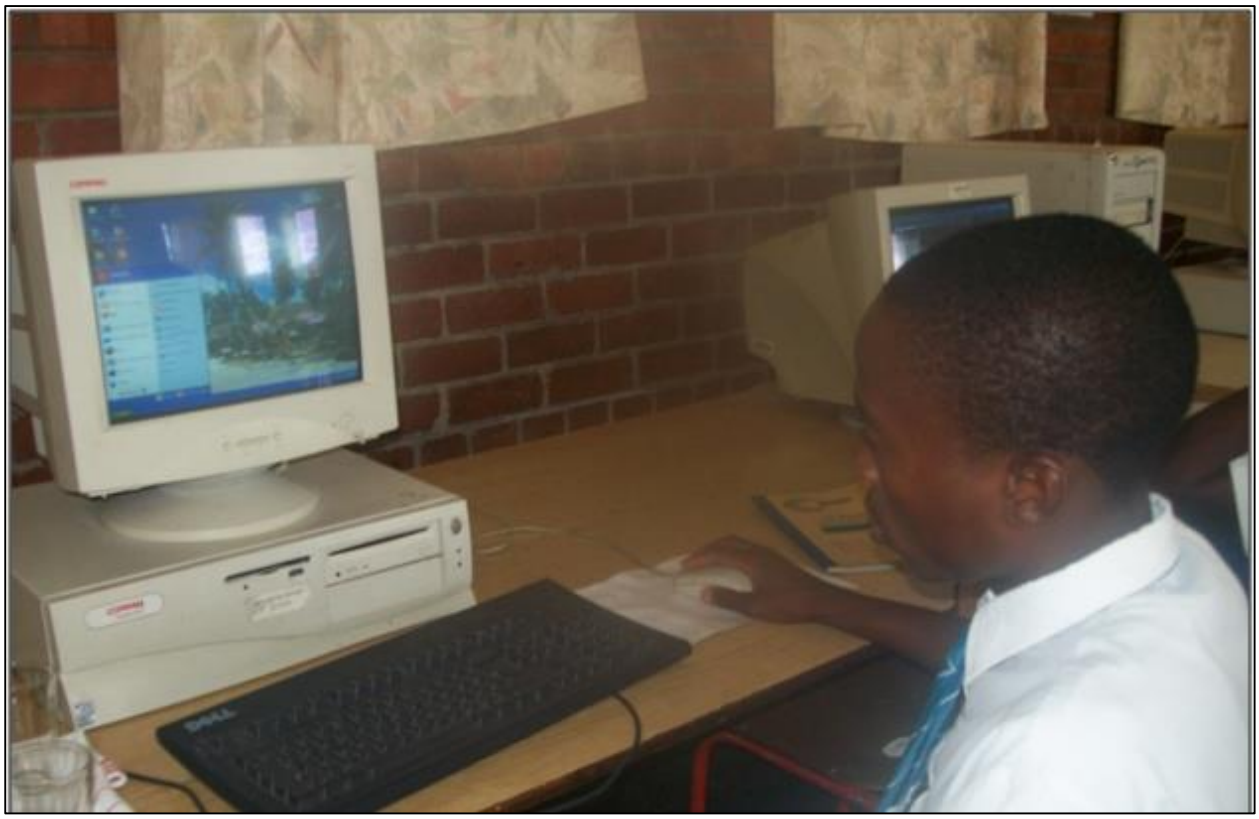


Figure 5.6: Student using computer applications in the ICT Lab

5.5.1.2.1 Services

Figure 5.7: Services provided by the project

Table 5.2: Resources observed at the Podcasting Project site

Infrastructure	*Applications*	*Services*
· LGDA offices · Training centre · Computers for voice recording · Laptop · Microphones · Broadcast speakers · 24 MP3 devices · iPods · Solar panels · Cell phones · Speakers · Charging equipment	· Windows XP operating system · Microsoft Office suite · Windows Sound Recorder · Voice recording and compressing software · Internet Explorer	· Capturing voice in local language · Broadcasting recordings in community gatherings ·

Table 5.3: Resources observed at the Plumtree ICT project site

Infrastructure	*Applications*	*Services*
· 14 Computers · 1 heavy duty printer · 1 photocopier · Local area network infrastructure	· Windows XP operating system · Microsoft office suite · Windows Sound Recorder · Adobe reader · Windows media player	· Computer skills training · Photocopying services · Printing services · Information and Multimedia services

5.5.1.3 Management of Resources in the projects

The responses of the project team at Guruve Podcasting project indicated that the resources are managed in ad hoc manner and that there are no documented specific guidelines available for the management of resources besides the emphasis on safely keeping the podcasting devices, backup of information, and physical security of the premises. The Finance department and the Board keep record of assets. All computers are numbered and recorded in the asset register. All doors and windows are lockable and there are 24 hour security guards. Quarterly development meetings are held to check the podcasting

equipment. No equipment acquisition and protection plans were identified. There is a safe for external backup of data. Cyber backup is utilized as well to save online copies of information. The team emphasized that they enforce measures to certify that the disseminated information is complete and accurate for the benefit of the farmers. Regular checks are also done to ensure that information on the devices is not altered. The team cited that software is regularly updated. There is currently no antivirus software in use. The responses revealed that only trained personnel are approved to use the podcasting equipment. However, they also responded that there is currently no management of user needs and no structure in place for the management of people involved in the project. The team indicated that there is no specific method in use for the management of services. They cited that there has not been any emphasis put on the way services are managed besides regular checking of equipment and the information saved on the devices. Training is provided for the lead farmers who keep the equipment. Other farmers operate the devices under supervision of the trained lead farmers. No measures have been taken to train everyone in the community on how to use the devices safely even without supervision.

The Mutoko World Links project teams cited that physical security is available to ICT Lab through use of locks and burglar bars. Inventory of equipment is maintained at the centre and at the World Links head office. Regular stock checks are performed. ICT Lab rules and regulations have been set to guard against misuse of equipment. No evidence equipment acquisition and maintenance plan was recognized from responses. The teams mentioned that personal information is protected by user passwords and restricted access to computers with sensitive information. No information quality controls were cited. The responses revealed that there is no application of completeness, accuracy and validity controls on the information resource. Board and committee members are bound by the constitution. Students and communal users are guided by ICT Lab rules and regulations. No specified user needs management methods were mentioned. The teams expressed that there is currently no particular method that is being used to manage the project's services. They also mentioned that they provide services that are part of the projects' objectives, though some of these services are still unavailable due to resource shortages. No particular method of managing the Skills and Competences resource was identified from the responses. The major issue highlighted was the shortage of skilled staff to assist in the running of the ICT Centre.

Responses at the Plumtree ICT project revealed that hardware is stored at the Plumtree RDC offices. All equipment is numbered and recorded in the asset register. All doors and windows are lockable and there are security guards. There are no plans for

acquisition, maintenance and protection of infrastructure. There is a safe for external backup of information, but there are no information quality and security protocols in place. There are currently controls to certify validity, authorization and completeness of applications. There are no defined methods for the management of user needs. There was no indication of specified methods of managing people who are involved in the project. The services are provided to users on needs basis and there is no approach for continuous needs assessment and new service creation. Training is provided to youth who want to become knowledge workers. The major challenge is shortage of competent staff to assist users at the computer centre.

Documentary analysis was employed to reveal the flow of information within the projects. The table below shows the documents collected per project.

Table 5.4: Documents collected

PROJECT	**Mutoko World Links ICT Centre**	**Practical Action Podcasting Project, Guruve**	**Plumtree Rural ICT Project**
DOCUMENTS COLLECTED	Mutoko World Links ICT Centre Constitution Organization profile Vision and Mission Statement Mutoko World Links ICT Centre Objectives Services Offered ICT Lab Rules Outreach programs Report updates 2012 Stock inventory 2012 Service charges 2012 Correspondent letters with stakeholders	Practical action brochures Podcasting Annual Project Review Podcasting recorded assessment LGDA Vision and Mission Statements	Plumtree ICT Proposal Bulilima-Mangwe Community Development Program

The documents were analysed to examine how management information flows within the projects. Due to the differences in organizational structures and the fact that access to the documents was only obtained with permission and availability, the number of documents analysed is different with each project. The documents also revealed the following information about how resources are managed in the projects:

- There is no documentation that gives guidelines to exactly how resources are to be managed in the projects.
- The objectives of the projects are clear, but the resource management process has not been linked to the project's sustainability goals.
- Sustainability goals of the projects have not been explicitly documented.

5.5.1.4 Adoption of other ICT project resource management approaches

It was identified at Mutoko World Links that besides ICT Lab rules and regulations, resources are managed in ad hoc manner. There are currently no defined protocols applied to guide the proper management of resources. No other resource management frameworks have been adopted. The Guruve Podcasting project team responded that there are no other external frameworks for the management of resources that have been adopted. The Plumtree ICT project team cited that there are no other frameworks that have been adopted.

5.5.2 Second research sub-question

As previously mentioned the aim of this question is to investigate the factors that influence the sustainability of the ICT4D projects.

What are the factors influencing sustainability of rural ICT4D projects in Zimbabwe?

The data collection instruments that were used to answer this question are interviews and documentary analysis.

5.5.2.1 Impact of the current resource management approaches on sustainability

The Mutoko World Links project team stressed that they aim at achieving sustainability through safeguarding the available resources so that they can be used by the current and future generations. However they cited that they have not set any measures to link their resource management approach to any sustainability goals. The Guruve Podcasting project team cited that the current resource management approach aims at ensuring that the available resources remain functional and available for the current and future generations. There is no match between how the resources are currently managed at the Plumtree ICT project and the sustainability goals of the project. Sustainability goals were set but there is no method that has been applied to ensure that resources are managed in a way that meets the goals. The management teams' answers to this question indicated that there is currently no link between the resource management approach and the sustainability goals. This reveals that their resource management is not goal driven and in such a case it is difficult for the project team to identify the aspects of the process that might lead to sustainability failure.

5.5.2.2 Resource management plans

The Mutoko team's responses showed that they are comfortable with how they are managing their resources. The major challenge they emphasized was shortage of resources. They expressed that if resources were enough, the services would improve. They also expressed discouragement due to the resource constraints and indicated that they have no plans in place for the management of resources besides the plans of acquiring more resources. There is no defined strategy that has been set to manage the present and proposed resources besides the impromptu approach. It was identified from the Podcasting project team's responses that though they would want to see the goals of the project achieved, there is no resource management planning directed towards it. The Plumtree ICT project team highlighted that a resource mobilization model has been proposed, but there are currently no steps that have been taken towards it. According to the responses given, resource management in the projects is not planned. As a result, resources are acquired on needs basis; there are no scheduled repairs and maintenance procedures for the equipment and there is no system security planning.

5.5.2.3 Monitoring and control of resource management process

All the project team cited that there is currently no monitoring and control for the methods that are being used to manage resources. The Plumtree ICT project team indicated that the resource management process is not continuously monitored and controlled because there have not been any procedures set for the monitoring and control process. However they highlighted that they think it would be important for them to start monitoring and controlling their resource management process.

5.5.2.4 Improvement plans for the resource management process

The Mutoko World Links project team highlighted that there are currently no plans set for improvement of the current resource management process, but they think that it is important to set those plans. One team member said, "*I think it would be important for us to try and improve how we manage our resources, but currently we have not done anything towards it.*" The Mutoko World Links students alluded to the fact that they find it difficult to share the ICT Lab with elder users after school hours. They mentioned that it is the only time they get to practice using the computer use after lessons. They further indicated that there is need for an extra ICT Lab to separate students and communal users. Users from the community highlighted that they want to have more time to use the ICT Lab as the time after school hours is too short for them to be able to practice using the computers.

The Podcasting project team's responses showed that they have been comfortable with the current resource management process; hence they have not made any plan to improve their

approach of resource management. The users highlighted that they would want the podcasting devices to be increased in number so that there will be lesser numbers of people sharing one device. They also indicated that since devices are kept by lead farmers, at times they fail to access help during late hours when they cannot go to collect the iPods in cases of emergency

The Plumtree ICT project plans are underway to design a resource mobilization model, but there are no specifications of the model's objectives as yet. Responses from the users showed that they have no problem with the way the currently available resources are managed and shared, but they wish there were more computers and more personnel to assist them with the use of the ICTs. Users also indicated that they need access to the Internet to improve.

5.5.2.5 Impact of the projects on sustainable development in the rural area

The Mutoko World Links project team explained that the sustainability goal of the project is to achieve the continuous running of the project for the benefit of the community. The project still offers the same services that were launched in 2006; however, it seems that no new services have been developed to capture the needs of the computer illiterate community. Users highlighted that support for agricultural activities is being given through Virtual Reality workshops whereby multimedia equipment is used to simulate agricultural processes for the training of local farmers. One such sub-project that has been conducted by the centre was beekeeping training to the community using Virtual Reality.

The Guruve Podcasting project aims to achieve sustainability approach through capacitating and collaborating with four local extension agents: The Department of Agricultural, Technical and Extension Services (AGRITEX), Health department, Tsetse Control and Veterinary Services to develop content, and to package and disseminate information on an on-going basis. This collaboration has developed diverse knowledge products that are being shared among target communities of Lower Guruve. The knowledge products include livestock and crop production and management, health issues such as cholera, malaria and rabies, and market issues include sources of seed and other inputs. A wide range of development content including indigenous knowledge can be combined and dispersed to the advantage of target communities. The Guruve Podcasting project's other sustainability goal is to build new interventions through what they call infomediaries (knowledge content developers) who collaborate to develop new content and best practices of target communities. The users expressed that they were happy that they can now access advice and knowledge on animal husbandry and farm management through the podcasting devices. They cited that the rate of livestock deaths had reduced since they started using the podcasts.

One of the stipulated goals of the Plumtree ICT project is to establish and employ a management framework for the accessibility and sustainability of the ICT initiative. However, that management framework is not yet in place. Other sustainable development goals of the project include connecting people together physically and virtually to empower the community through the promotion of local activities.

Technological sustainability goals: The aspect of technological sustainability is of major concern to the Mutoko World Links project. It was identified from the enquiry that technological sustainability has been adversely influenced by financial and environmental issues. Most of the participants highlighted that there is need for finances to enable the centre to buy more equipment to meet user needs. The specific technological sustainability goals and approaches aimed at meeting these goals have not been clearly stipulated. The aspect of technological sustainability is seemingly not a major focus of the Guruve Podcasting project as very little was revealed on these issues. The farmers do not pay for podcasting services and there is currently a challenge of lack of technological support when the devices malfunction.

Social sustainability goals: Some of the mentioned social sustainability goals of the Mutoko World Links project were to reduce mischief among the youths, to empower the rural community in ICT awareness and to provide accessible ICT services to communities with the intention of cutting transport costs and other related costs. The ICT4D project aims at bringing sustainable development by creating local champions from training teachers at cluster levels. They also conduct workshops on ICT awareness in the community. There is, however, little evidence of how the organization continuously identifies the specific needs of the community and seeks to establish services that meet these needs. One of the goals highlighted was to ‘modernize the community’; emphasis to the particular facets of the community that need to be modernized and how it will purposely benefit the community was not denoted. Social sustainability for Guruve Podcasting project is created by continual use of indigenous knowledge that was formerly not recorded or shared. Community involvement has the advantage of instilling responsibility of the content to the farmers and ensuring that their content gets documented and will be available even in future.

Political sustainability goals: the Guruve Podcasting project achieves political sustainability by altering regulatory policies which restrict broadcasting if there is need to broadcast development knowledge to a specific community.

5.5.2.6 Barriers and challenges faced by the community in using the centres

Financial Challenges: The Mutoko rural community is characterized by poor people who survive on less than 1US dollar per day. Because of this, very little proceeds are earned from the services.

Socio-cultural challenges: Users of the telecentre come from remote villages, some of which are as far as 7 km from the centre. The users have no mobile transport and they have to walk on foot to the centre. Thus it is difficult for some people who might be interested in attending classes. The ICT Lab is only open to communal users from 2 pm to 4.30 pm during weekdays and some women are not able to attend classes and travel back home due to long distances, as they will only be able to arrive after sunset. The outcome of this is the gender imbalance between males and females who are benefiting from the centre. For the Guruve Podcasting project, podcasting devices are kept by lead farmers. Some lead farmers who keep the devices are unwilling to share with others; this can pose a disadvantage for some users if they face a problem that they need to address by using the recorded content. The challenge could be eased by training farmers on the importance of sharing knowledge and empowering everyone to pass complaints of such incidents to the project leaders. There are currently proposals to enable direct transfer of the podcast's content to individual phones. The project team cited that rural people in Bulilima-Mangwe lack awareness and appreciation of the new technologies and their sustainable development benefits. Plans are underway to start actively involving them in the new technology activities to bridge the technology gap among their group. The Plumtree ICT project community started as passive recipients of technology as they were not involved in the design stage and this is now requiring a lot of work to start introducing user needs into the system. The users' need for information that directly affects their livelihoods had not been initially considered and it affected the user acceptance levels of the project.

Environmental Challenges: The lack of electricity, poor network and the absence of radio signals also fall under environmental challenges. There is not much that the organization is currently able to do besides continuously communicating their needs to the responsible government departments.

5.5.2.7 Barriers and challenges faced by projects users

Table 5.5: Barriers and challenges faced by users

	Mutoko World Links	Guruve Podcasting Project	Plumtree ICT Project
Technological challenges	• Computers are not enough to serve all the users and 3 or 4 people are sharing one computer. • The machines are too slow and it takes very long to finish some tasks. • There is only one staff member in charge of the ICT Lab who is also the ICT teacher and at times he cannot handle both maintenance and attending to user needs.	• Podcasting devices are not enough to serve all the users in the villages. • If devices malfunction it takes time for them to be repaired. • Electricity is not available in the villages and they have to travel to the centre for recharging. • Network problems make it difficult for the users to communicate with the project team in case of emergencies.	• Computers are not enough to serve all the users. • There is shortage of assistants at the ICT centre. • There is no internet connectivity at the centre
Financial Challenges	• The Internet is expensive ($1 per 10 megabytes of data) and most people survive on less than a dollar per day.	• Lack of mobile airtime makes it difficult for the users to communicate with the project team in case of emergencies.	• Most communal users cannot afford to pay for services
Socio-cultural challenges	• Technophobia discourages some community users from continuing with ICT lessons. • Some villages are over 7km from the centre and some women cannot travel late on their way back home as the Lab is only open to them from 2pm.	• Technophobia discourages some community users from using the devices. • Some lead farmers are not willing to share devices with others.	• Technophobia discourages some community users from continuing with ICT lessons.
Environmental challenges	• Electricity challenges in the area hinder users from fully utilizing the services when there is no power.	• Electricity challenges in the area hinder users from fully utilizing the services when there is no power.	• Some villages are far from the centre

5.5.2.8 Barriers and challenges faced by the project teams in implementing the projects

5.5.2.8.1 Technological challenges

Among the barriers and challenges that the projects face, technological challenges were the most cited. According to the findings, this challenge adversely affects both the project teams and the users. The technological challenges also contribute negatively to the project's financial and social sustainability. The challenges include the following:

Obsolete *hardware**:*** Out of the 13 available computers in the Mutoko World Links lab, 4 are Pentium II, 7 are Pentium III, and 2 Celerons, resulting in computers that are slow in processing. The storage capacity of 4 Gigabytes on most computers is inadequate to run the required applications. With the fast global advancement in ICT applications, there is need to upgrade to better applications if the project is to meet its goal of exposing learners to the global network. This can be done if the hardware itself is also upgraded as most applications run easier on Pentium 4 computers. Some student participants highlighted that they now need modern hardware that is interesting and easier to use. This reveals that the obsolescence of hardware is also affecting how students appreciate the use of the telecentre. Some participants also indicated that it is difficult for them to pay for the services as the computers are slow and unattractive to use. The problem could be solved by acquiring more P4 computers which are compatible to recent software versions. This will also improve processing speed and result in faster and more effective execution of tasks.

Poor Internet connectivity: At present there is no other broadband internet connectivity besides 3G mobile Internet which is expensive as well as slow due to poor network in the area. Improvement in Internet connectivity could benefit the centre by expanding the services they can provide to users. The centre's objective of connecting the rural community to the global world could be met better if there is adequate Internet connectivity. The Mutoko District has copper telephone lines connectivity and the telecentre is considering installing Asymmetric Digital Subscriber Line (ADSL) broadband. At this point in time the setback to this development is lack of funds and delays in the administrative protocols that are required to start the project. The poor internet connectivity is hindering collaborative learning as there is need for high speed Internet for students to access global interaction with other students. Students' access to online research material and freeware is limited as they cannot afford to buy 3G data bundles to use on the ICT Lab computers. Communal users who require Internet services from the centre have to buy their own data bundles since it is difficult to charge them extra for Internet access as it is already expensive for the centre itself. There is a cable link from Bulawayo to Plumtree but the internet connectivity is still not functional.

Most people can now access broadband internet through mobile phones. The challenge with the mobile Internet is that it is currently expensive and the network is unreliable. On the other hand, people with 3G enabled mobile phones now think it is better to use their phones than to go to the centre which has no Internet. The only services they find useful at the RDC are word processing and printing services.

Lack of hardware and software maintenance: There is shortage of personnel to maintain the existing hardware and software and to conduct repairs. Outsourcing is expensive as well and due to the shortage of funds, there is lack of spare parts for repairing broken down hardware. As a result, there is a number broken down equipment that lies idle in the ICT Lab store room. The project coordinator, who is also the only teacher, is the one responsible for maintenance and it is difficult for him to manage all the tasks. Technologically competent youths relocate to urban areas to seek better employment opportunities and consequently there is staff shortage. The iPods at the Guruve Podcasting project sometimes become dysfunctional and there are no technicians available to repair them. The only option available is to send them to the Practical Action technicians in Harare and usually it takes time for the devices to be repaired and returned. In other instances if the iPod fails, some users might not have airtime to call the centre or the network might be offline.

Persistent power cuts: Electricity power shortages are a national challenge in Zimbabwe and the situation is worse in rural areas like Mutoko. The only backup that the centre has for electricity is a power generator that uses petrol. The fuel is bought using proceeds from operations and at times the challenge forms a vicious cycle whereby if there is no electricity the ICT Lab cannot be used and then there will be no money to fuel the generator. The generator produces 1.2 KW and can power up a few computers at a time. Since there is only one, when it breaks down it is sent for repair and operations can be interrupted. There are plans underway to buy another generator to augment the one at hand. For the Guruve Podcasting project there is no electricity supply in the rural areas where the podcasting devices are used and the devices are powered by batteries which are recharged at the LGDA centre. Some village farmers are located far from the centre and the cost of travelling is high for them. Solar powered iPods have been designed to solve the power problems but there are few of them. There are plans to secure more solar chargers for the podcasting devices.

*Outdated and inadequate software***:** Most of the available software is now outdated and there is lack of security software. This poses a disadvantage to the users and to running of the systems.

Inadequate hardware for collaborative learning: The Mutoko World Links Lab has no projector, video camera and no online interaction software application to support functions like video conferencing for collaborative learning. Students are unable to learn from other better resourced students or to access remote resources that are available online. As pointed out by some participants from the project team, there are prospects of purchasing a projector and a video camera.

5.5.2.8.2 Financial challenges

There are several factors that are contributing to the limitation in generation of funds. Some of them are technological challenges that have been explained in the previous section. Besides the technological challenges, the failure to provide services that meet user needs services, financial constraints on the target clients' part, poor technology acceptance and limited sources of funding are some of the causal elements to the financial sustainability challenges in the project. The little income generated from services is used to buy equipment. The financial constrictions are hindering acquisition, maintenance and replacement of equipment. Podcasting services in Guruve are free of charge because most farmers cannot afford to pay. This contributes to the failure to buy more accessories like batteries or to pay for repairs if devices are damaged. The community has not created ways of generating income from the project so that it can be financially sustainable, to enhance continuous acquisition and maintenance of the needed resources. There is shortage of funds in the Plumtree ICT project and the little proceeds are not enough to pay the knowledge workers who are now resorting to seeking employment in Botswana and South Africa. This leaves a gap in the staff complement and service delivery resultantly becomes slow.

5.5.2.8.3 Socio-cultural challenges

The workload on the one present teacher at Mutoko is causing some users not to get the adequate help they need. There are a high number of contacts who stressed the need for an extra teacher to be deployed. Some individuals are intimidated by computers and they fail to adapt to the ICT centre atmosphere and quit attending classes, which has also contributed to the low enrolment rates.

5.5.2.8.4 Environmental challenges

The environmental challenges observed have a bearing to the sustainability of the initiative, but most of them are beyond the control of the organization. Challenges like bad roads, erratic electricity supply and poor telecommunications infrastructure require the intervention

of the responsible government ministries to address them. Due to national economic challenges, it has been taking long for most of the issues to be addressed. There are narrow dusty roads between the Plumtree RDC and the villages. Transport is a limited and this causes knowledge workers to travel long distances between the villages and the RDCs to collect information.

5.5.2.8.5 Political challenges

There is fear from community leaders that the iPods at the Guruve Podcasting project might be used for political information dissemination, however, caution has been exercised to avoid such use of the devices.

5.5.2.9 Impact of project on rural development

The findings pertaining to the impact of the projects on rural development are in Table 5.6 below.

Table 5.6: Impact of projects on rural development

Mutoko World Links	**Answers from community users**	**Answers from students**	**Answers from teachers**
	Personal computer owners are now able to get consultation services from the ICT centre	Parents are now able to learn how to use computers from their children who are using the ICT centre	Teachers who were not computer literate are now also getting ICT training
	Employment opportunities for the youth are increasing through the ICT Training	The community can now access and receive ICT training	Students and unemployed youth are getting occupied through the use of ICTs
	Local businesses are benefiting from the provision of ICT services and training	The ICT training is equipping the students for future employment as most jobs now require ICT skills	The community users can now gain access to the Internet from the ICT centre
Guruve Podcasting Project	Users highlighted that that their needs are being met as they can access information on demand and in the local language.	The project serves farmers in the community, there are no stakeholders classified as students.	There are no stakeholders classified as teachers in the project.
Plumtree ICT Project	Users highlighted that that their needs are being met as they can now access local knowledge via discs and tapes.	The project serves users community, there are no stakeholders classified as students.	There are no stakeholders classified as teachers in the project.

5.5.2.10 Meeting of User Needs

Community users expressed that their needs are being met though they would like to have more computers and an extra ICT Lab. The students cited that their needs are being met but they need new computers with new applications to assist their research. Teachers indicated that their needs are being met, but most of their answers revealed that there was no indication that they use the ICT Lab often. Most of the teachers' responses implied that the ICT Lab is mainly for students, the community and the ICT teacher.

5.5.2.11 New service creation

Community users pointed out that they need more services that create health awareness for the community through the use of ICTs. Students mentioned that they need more Internet access to enable collaborative learning and teachers cited that they need training lessons to equip them on how to use ICTs in the classroom. The farmers served by the Podcasting project mentioned that they would also like to listen to the information on their mobile phones for extra convenience. Plumtree ICT project users mentioned that they need access to the Internet so that they can also research what other communities are doing for development.

5.5.2.12 Addressing the challenges

The community users explained that they have communicated to the project team about their concerns and they are waiting for the issues to be addressed. The students have formed an ICT club to raise funds for buying minor computer accessories. At Guruve Podcasting Project the fear of political use of devices has been addressed by periodically monitoring the devices and assessing if the content has not been altered. As for the other challenges, there was no clarity of what has been done to mitigate them. The responses given by users of the Plumtree ICT project revealed that nothing has been done so far to deal with these challenges. The common answer was that if there was funding maybe something would be done.

5.5.2.13 Factors influencing sustainability of the projects

The results were obtained from document analysis. Listed under each project are the documents that were assessed.

Mutoko World Links ICT Centre

- Mutoko World Links ICT Centre Constitution
- Vision and Mission Statement

- Mutoko World Links ICT Centre Objectives Services Offered
- ICT Lab Rules
- Outreach programs
- Report updates 2012
- Stock inventory 2012
- Service charges 2012
- Correspondent letters with stakeholders

These documents were used to assess the factors that influence the sustainability of ICT4D projects in Zimbabwe. It was identified that the goals of the project are partially achieved due to resource constraints. Outreach programs are conducted irregularly and there is little follow-up done on the progress of the initiatives. The reports revealed that the recurrent problems of resources have not been addressed for a long time. Very few people are willing to pay service charges hence there are low enrolment numbers. Some letters to stakeholders asking for funding and collaboration still had pending responses for over a year.

Practical Action Podcasting Project, Guruve

- Practical action brochures
- Podcasting Annual Project Review
- Podcasting recorded assessment
- LGDA Vision and Mission Statements

The documents showed that there is improvement in the livestock management as the livestock death rates have reduced.

- Plumtree Rural ICT Project
- Plumtree ICT Proposal
- Bulilima-Mangwe Community Development Program

The documents showed the proposal that was done before implementation and objectives of the ICT project. Since implementation some of the objectives have been met. Of those that are not yet met it is due to resource constraints.

5.6 Third Research Sub-question

The aim of the third research sub-question is to evaluate what can be done to ensure that ICT4D projects in Zimbabwe become sustainable.

What can be done to ensure sustainability of rural ICT4D projects in Zimbabwe?

This question is answered using literature study in comparison with findings from the interviews, documentary analysis and observations. It leads to the construction of the resource management framework in Chapter 6. Therefore, the proposed resource management framework in Chapter 6 answers the third research sub-question.

5.7 Summary of key findings

The following table summarizes the key findings for the research sub-questions derived from the cross-case analysis of the three case studies. These key findings will inform the proposed resource management framework.

Table 5.7: Key findings

RESOURCE MANAGEMENT ATTRIBUTE	SUMMARY OF RESULTS
Management of applications	It was identified from the findings that there are applications in use that are common to all the three case studies as well as different application unique to each case. The way applications are currently managed has achieved the continual operations of the projects but some user needs are not completely met due to inadequacy of resources. This emanates from lack of funding as well as lack of effective procedures to guide proper acquisition and maintenance of applications.
Management of information	The rural projects are storing their information securely to some extent. There is however lack of sufficient backup for their data. Access rights are defined by the use of passwords but there are no documentations that specify access levels to ensure that people only have access to information for which they have authorization.
Management of infrastructure	The findings revealed that projects have kept most of the resources they had since they started. There is still need though for the strategic planning, acquisition, maintenance and protection of infrastructure by creating technology acquisition and maintenance plans and applying internal control, security and auditability measures.
Management of people	The rural ICT4D projects have well defined management structures for their staff. Nevertheless there is still lack of user involvement and little understanding of their behaviour to predict how they might handle roles and possible conflicts. The projects still need to adequately engage the communities in order to keep providing relevant services.
Management of services	One project was identified to be continuously assessing the needs of the stakeholders and delivering the required services. The other projects need to work on researching the dynamic stakeholders' needs and to adapt their services to the ever-changing needs. At times users do not know exactly what they need from ICTs, and services management is crucial as it allows the project team to capture the needs and formulate services that cater for those needs.

Management of skills and competences	The skill base for the projects is currently poor and there is no plan for the next period or remuneration improvement. As a result people leave the jobs in search for better jobs in the city. The lack of skills has resulted in the deterioration of services. There is need for capacity building to promote local skills and competences development for the enhancement of sustainability.
Effects of management methods on sustainability	The identified sustainability challenges were in the dimensions of technological, financial, social, environmental and political. ICT4D projects in rural areas need to identify their sustainability goals and apply resource management methods that are aimed at meeting those goals. The projects need to establish a relationship between resources management and their sustainability goals.

The findings described in the above table will inform the proposed resource management framework.

5.8 Conclusion

The study of the three projects gives a real-life representation of the resource management challenges faced by ICT4D players in rural Zimbabwe together with how the challenges affect sustainability. All three projects have been running for over five years, but the analysis shows that most of the initially intended goals are not being met due to resource management failure. The main challenges observed in all the projects were lack of defined resource management methods, lack of planning for resource management and absence of continuous monitoring and control of the existing processes.

The failure to manage infrastructure is resulting in projects that have obsolete equipment that does not fully meet user needs. Acquisition, protection and maintenance plans for infrastructure are missing. In most cases, when equipment resources are required there will be shortage of funds due to lack of strategic projection. Information management is an area that has not been prioritized in all the projects. There are no information security measures to ensure good quality, integrity and accuracy of the manual and automated data that flows in and out of the systems. Quality and security measures are not clearly stipulated to indicate measurable procedures in place to manage information. The management criterion for human resources in all three projects, especially for project teams, seems to be defined. However, the management of users of the ICTs is not clarified. It appears that users are

passive receivers of technology in all the projects and there are no specifications as to how people cooperate and how their respective needs are managed. Application controls that seek to meet standards of completeness, accuracy, validity and authorization are inadequately applied in all three projects. Applications are acquired and installed but there are no continuously monitored measures for ensuring that applications are updated to meet users' dynamic needs. These similarities indicate that procedural resource management methods need to be applied regardless of project type or location.

Apparently the financial sustainability planning of the Mutoko World Links ICT Centre is more advanced than the Practical Action Podcasting Project and the Plumtree ICT Project's. The difference portrays that context relevant services are crucial for the project to be able to generate income. All three projects face similar technological challenges that could be solved by the availability of competent staff and adequate infrastructure. Common environmental sustainability challenges that derive from national issues are affecting all the three projects. Each project has socio-cultural and political sustainability matters that are unique to it, entailing that each project could improve by formulating context sensitive methods.

Chapter 6

Building of the resource management framework

6.1 Introduction

Chapter 5 demonstrated the resource management problems that contribute to sustainability challenges faced by organizations engaging in rural ICT4D. The data analysis expounded real- life problems that characterize ICT4D in the rural areas of a developing country. The identification of these challenges together with findings from literature enlightens the design of a resource management framework. This chapter will merge the findings from the data analysis together with the findings from the review of literature to build the proposed resource management framework.

The proposed resource management framework should integrate good practices for the management of ICT resources and factors that affect ICT4D sustainability to construct a solution for rural ICT4D initiatives in Zimbabwe. The real-life experiences identified from the case studies together with the study of literature will aid in the creation of a context relevant framework. The proposed resource management will guide ICT4D players to identify and properly manage their critical resources in a manner that enhances project sustainability.

The underlying theories to this research are the COBIT framework, Sen's Capability Approach and the Resource Based Theory (RBV). The theories contain relevant attributes that will be used to inform the proposed resource management framework. The COBIT framework has explicit guidelines to the management of IT resources, the RBV elaborates on how good resource management methods can enhance ICT4D sustainability, and the Sen's Capability Approach explains how ICTs can be used as an enabler for sustainable development.

6.2 The COBIT framework

It was identified from the data analysis that ICT4D organizations lack precise methods for resource management, resulting in absence of planning for acquisition, lack of protection and poor maintenance of resources. Resources are the basic components of ICT4D enterprises, hence their major impact on the sustainability of the projects. There is need for a systematic method of managing the resources to enhance their proper investment in, protection and maintenance. This will contribute positively to the sustainability of the projects. If sustainability is to be achieved, well-defined resource management methods must be applied.

COBIT resource management methods were explained in detail in Chapter 2. COBIT emphasizes that it is crucial to identify critical IT resources and to apply good practices of management in order to achieve organizational goals. The goal to be achieved in this context is ICT4D project sustainability. The critical resources are: infrastructure, applications, information, services, people, skills and competences.

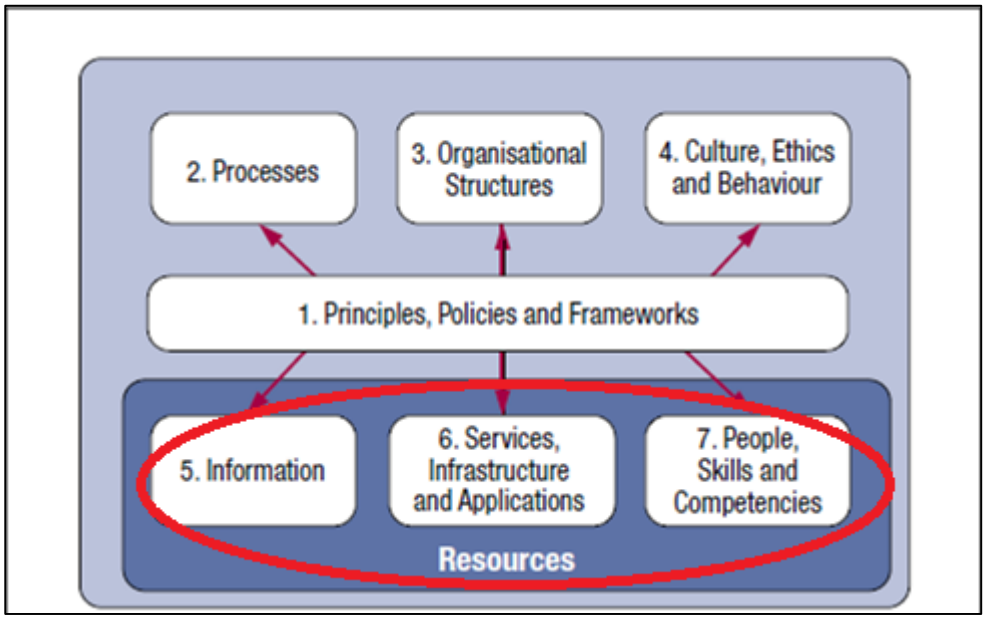


Figure 6.1: Critical resources, adapted from ISACA (2012)

6.3 Resource Management Phase

This part of the proposed framework is informed by COBIT to identify the critical resources and elaborate on how the resources must be managed to achieve sustainability.

6.3.1 Information

From the findings it was identified that the ICT4D projects lack defined information security controls and structured information codes. The data (manual and automated) that is input, processed and output of the project's system needs to be handled in a manner so as to address stakeholder needs and to achieve information quality goals. This is done by defining secure information storage, setting authentic access rights, efficiently structuring and coding information, defining information types and levels, and defining the value and usability of the information.

It is essential for rural ICT4D projects to store information securely and create sufficient backup for their data. This allows for availability of information even in the occurrence of unexpected events that may tamper with data. Defining access rights and information ensures that people only have access to information for which they have authorization.

6.3.2 Services

Services are the core functions of an ICT4D project and they determine whether a project will be sustainable or not. If users do not get the services they need, they can stop using the facilities and the project may cease. The findings indicated that the services being provided by the projects are not adequately adapting to the dynamic user needs. Literature in Chapter 2 and 3 recommends that managing services in rural ICT4D involves continuously assessing the needs of all stakeholders and delivering the required services. The stakeholders' needs are dynamic and the system must be able to adapt their services to the ever-changing needs. At times users do not know exactly what they need from ICTs, and services management is crucial as it allows the project team to capture the needs and formulate services that cater for those needs.

6.3.3 Infrastructure

It was observed from the findings that the ICT4D projects face major challenges in infrastructure acquisition, maintenance and protection due to unavailability of funds as well as lack of proper planning. Rural ICT4D players must strategically plan the acquisition, maintenance and protection of infrastructure by creating a technology acquisition and maintenance plan and applying internal control, security and auditability measures. Infrastructure that are not meeting the project's needs and standards need to be repaired or replaced. The same needs to be done to infrastructure units that are outdated and no longer

manageable. This however, is often difficult, given the financial challenges faced by most rural ICT4D projects. As highlighted in literature in Chapter 2 and Chapter 3, it is crucial for ICT4D initiatives to establish income generation methods in order to sustain their financial base for continuous infrastructure management.

Users need training to ensure proper use of ICT4D infrastructure. The shortage of skills that is common in rural areas necessitates for emphasis on user and project team training. Documentation and user manuals are also crucial for knowledge transfer among users and staff. This will ascertain that everyone using the facilities is competent or capable enough.

6.3.4 Applications

Literature conveyed that rural ICT4D managers are responsible to properly define functional and control requirements and to properly use applications, whilst the project team is responsible to automate the functional and control requirements and to establish controls to maintain the reliability of applications. To achieve this, the ICT4D applications must be managed to ensure that the following controls are met:

- Source data must be prepared by authorized personnel using approved methods.
- Data input must be done in a timely manner by authorized and qualified staff.
- Certify accuracy, completeness and authenticity of data.
- Maintain integrity and validity of data during processing.
- Establish review, reconciliation and error handling for output data.
- Maintain authenticity and integrity during transmission of data.

The findings showed that the projects do not have any defined functional and control requirements that guide the proper use of applications. There is need to apply the above mentioned controls to achieve optimum benefits through the services provided by the applications used in the ICT4D projects.

6.3.5 People

ICT4D projects are designed by people to be used by people (Macapagal, 2010). In as much as the projects have identified identify the different needs and roles of different levels of people, there is still need to improve on user involvement throughout the running of the initiatives. In an ICT4D project people can also be identified as stakeholders. These include project beneficiaries, project service providers, ICT developers and providers and funding entities. For a rural ICT4D project to succeed, people must be suitably managed right from

the beginning of the project. Properly managing people enables the project leaders to identify stakeholders, understand their behaviour and to predict how they might handle roles and possible conflicts. User involvement is a vital and on-going part of the process of managing people in an ICT4D project. It enhances the usability of the project and results in sustainability of the project over time.

6.3.6 Skills and Competences

Incompetency and lack of skills was identified from the findings as one of the major factors resulting in the deterioration of services. Literature in Chapters 2 and 3 demonstrated that ICT4D project stakeholders play different roles which require different skill sets. An ICT4D project leadership has to know its current skill base, and plan what it needs to be. In rural areas it is difficult to recruit highly skilled personnel due to the low remuneration capacity; hence skills need to be developed through training. The project leaders need to periodically assess the skill base to understand current progress and to plan for the next period. Proper skills and competencies management includes defining the need for specific skills for each role played by the various stakeholders.

The available skills and competences determine how the various stakeholders will perform the required duties. Capacity building that promotes local skills and competences development enhances sustainability of the project. Incompetency and lack of skills results in the deterioration of services and contributes to ICT4D sustainability failure.

6.4 The Resource Based Theory

Caldeira and Ward (2001) explain that the Resource Based theory (also referred to as the Resource Based View of the Firm (RBV), explained in Chapter 2, was designed to comprehend how firms can accomplish sustainable competitive advantages. This theory will be adapted to aid the formulation of the proposed resource management framework. The RBV demonstrates that in an organization, there is a competitive advantage phase that leads to sustainability over time. The element of resource management that is embedded in the RBV's competitive advantage stage is the relevant factor in the context of this study, not competitive advantage itself or uniqueness of resources. In other words, the concept of the RBV that is relevant to this study is the relationship between resources and sustainability.

The findings in Chapter 5 indicate that ICT4D project leaders need to identify and properly manage the critical resources of the project, as explained in the previous section, which is the resource management phase. Properly managing resources leads to ICT4D project success. Project success produces ICT4D sustainability over time; the sustainability phase.

6.5 The Sustainability Phase

As mentioned in the previous sub-section, properly managing ICT4D resources leads to ICT4D project sustainability. The sustainability of ICT4D projects is not an end in itself, but it is a means to an end, which is rural development. Sen's Capability Approach elaborates that human rights are freedoms which allow people to fully live the lives that they value (Sen, 2005). Grunfeld (2007) applies this to ICT4D and states that ICT projects help to create sustainable livelihoods and sustainable ICT environments.

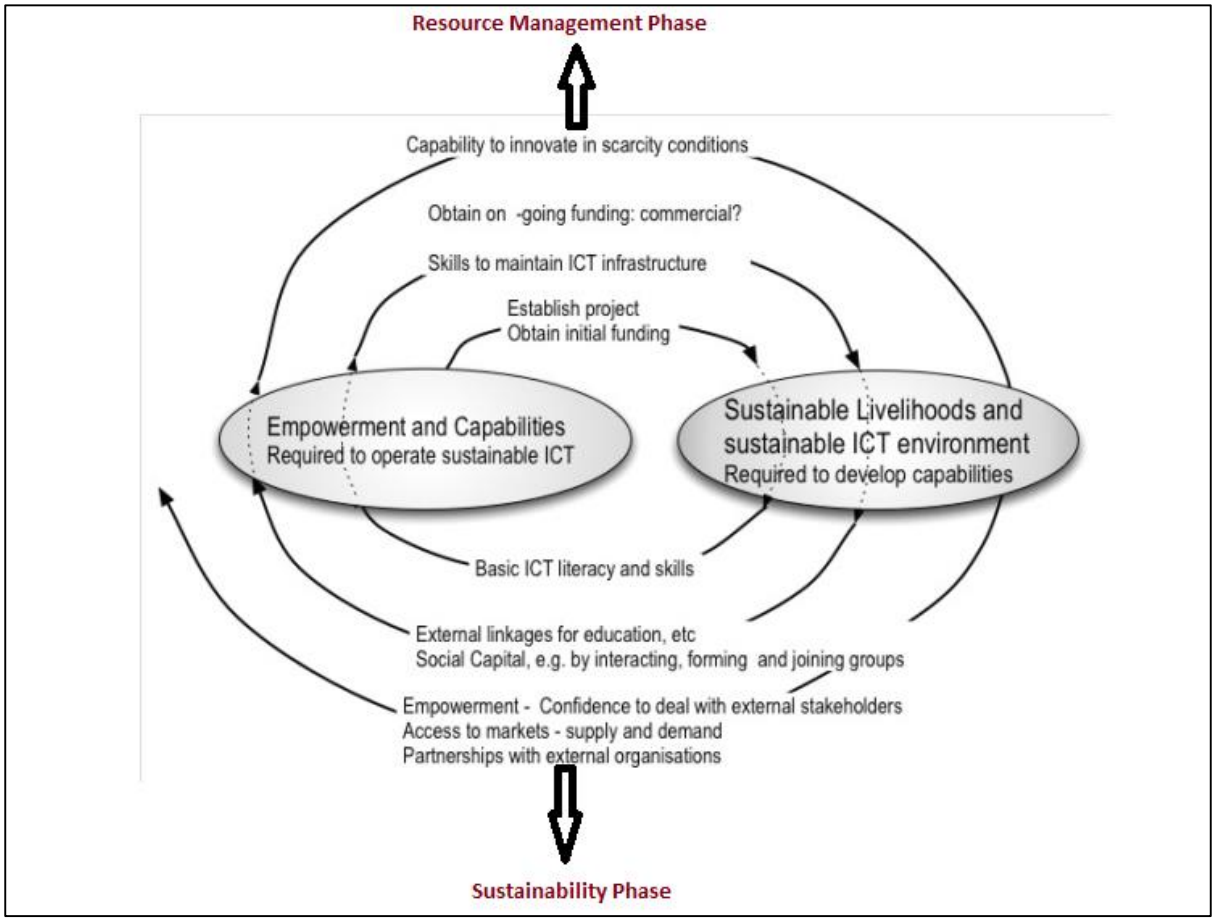


Figure 6.2: Capabilities/Empowerment & Sustainability adapted from Grunfeld (2007)

To interpret the above figure it can be said that empowerment and capabilities, which include the ability to optimize scarce resources, generation of funds and properly managing infrastructure, contribute to sustainability of ICT4D projects and the livelihoods of the communities they serve. Examples of capabilities that are obtained from ICT4D sustainability are ICT literacy and skills, social capital and economic empowerment. The process forms a virtuous cycle in which the resource management phase feeds into the sustainability phase and the sustainability benefits increase resource management capabilities.

From the findings reported in the previous chapter, the identified sustainability challenges were in the dimensions of technological, financial, social, environmental and political. ICT4D projects in rural areas need to identify their sustainability goals and apply resource management methods that are aimed at meeting those goals. Chapter 3 highlighted the relationship between sustainability dimensions and the management of particular ICT resources. The table below illustrates the ICT4D resources and the sustainability factors to which they relate.

Table 6.1: ICT4D resources and sustainability

ICT4D Resources	**Related Sustainability Factors**
Applications	Technological
Information	Technological
Infrastructure	Technological, Environmental
People	Cultural/Social, Political/Institutional, Environmental
Services	Technological, Financial
Skills and Competences	Cultural/Social, Political/Institutional, Environmental

The management of all critical resources contributes to overall sustainability of an ICT4D project. The above illustration serves to guide ICT4D players to identify causes to project un-sustainability by singling out the basic elements that need proper management. For example, if a project requires achieving technological sustainability, they need to address the management of applications, information, infrastructure and services. A particular example from the findings from the case studies is the technological sustainability failures that originate from outdated computers and software. The problem can be addressed by acquiring new computers and software and protecting maintaining the available equipment. In order to achieve social or political sustainability, emphasis must be put on the proper management of people and skills and competences. Environmental sustainability can be achieved by focusing in the good management of infrastructure, skills and competences and people.

Some sustainability factors are interlinked and addressing or failure to address one factor can affect other factors. This can be seen from the above table where a resource can be related to several sustainability factors. A practical instance from the findings was the poor management of services that led to financial un-sustainability. The lack of funds contributed to technological un-sustainability through failure to acquire new equipment and social sustainability was affected as users began to lack interest in using outdated equipment. It

can thus be seen that resource management is critical to the sustainability of rural ICT4D projects.

Having explained the underlying theories and the findings informing the formulation of the resource management framework, the next section presents the proposed framework.

6.6 The Proposed Resource Management Framework

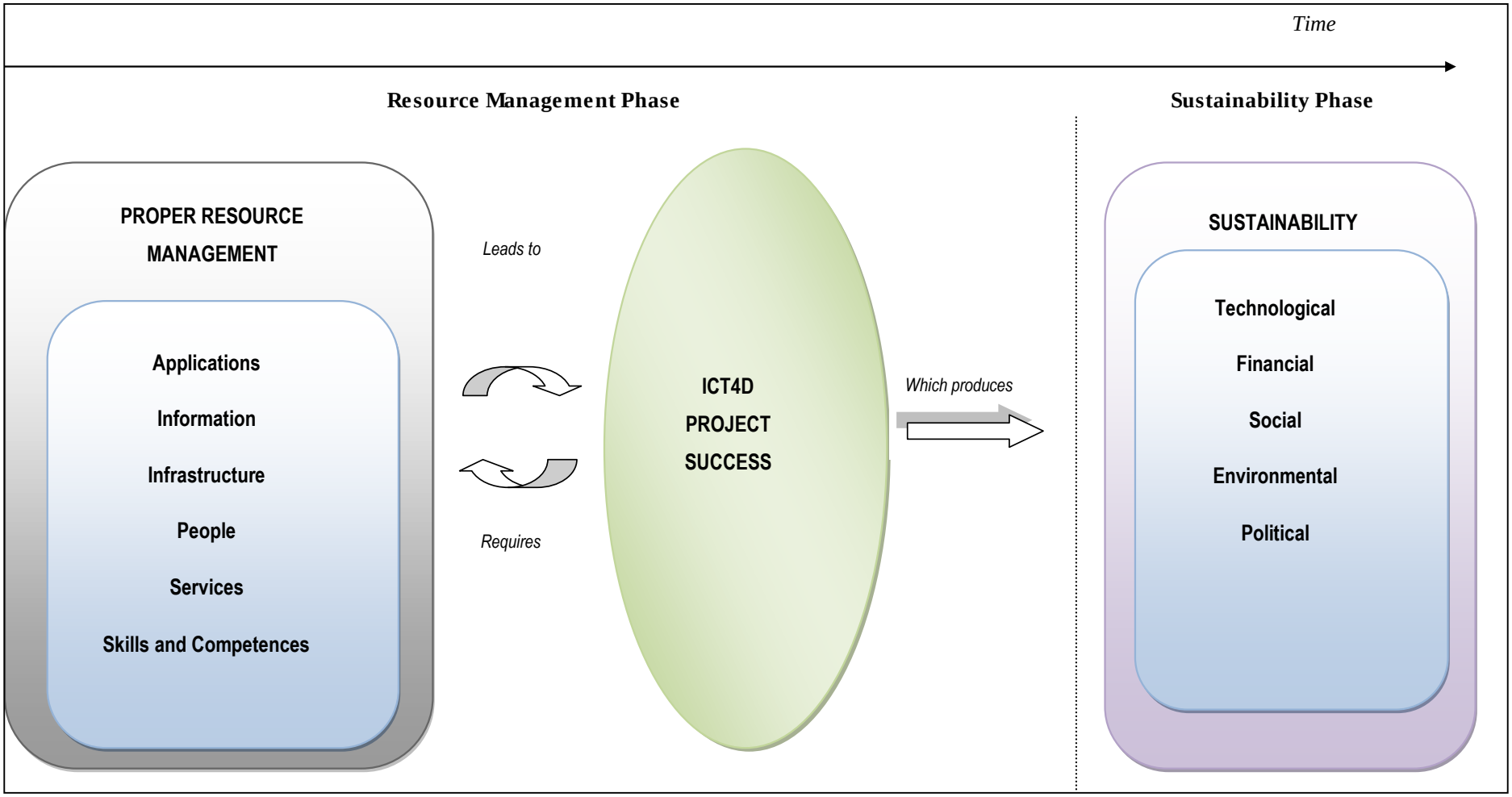


Figure 6.3: The Proposed Resource Management Framework

Proper resource management leads to ICT4D project success – the resource management phase. ICT4D project success requires continuous practicing of proper resource management measures. ICT4D project success leads to sustainability over time – the sustainability phase. Proper resource management entails that ICT4D projects need to identify their critical ICT resources which are: applications, infrastructure, information, people, services and skills and competences. Having identified the critical resources; principles and guidelines for proper management that were explained in sections 6.2 to 6.5 of this chapter must be set.

6.7 Evaluation of the framework

The framework evaluation method applied is Expert Validation method. The resource management framework was sent to ICT4D lecturers and ICT4D practitioners for validation in order to evaluate its significance to rural ICT4D sustainability. The evaluation was based on the following criteria:

6.7.1 Simplicity

This criterion was meant to evaluate if the framework can be easily understood by rural ICT4D players. The reviewers' comments indicated that the framework is simple and easy to understand.

6.7.2 Relevance

The evaluation of the framework's relevance aimed at assessing the framework's potential to improve rural ICT4D sustainability. The reviewers mentioned that the framework is informed by good review of past work in this area and tries to build upon it. They also commented that the framework might be very useful if implemented in rural areas of developing countries.

6.8 Conclusion

This chapter outlined the building of the resource management framework and its underlying theories. The assimilation of the COBIT framework, Sen's Capability Approach and the Resource Based theory were explained together with the input of findings from the case studies. The combination of literature review findings and evidence from the case study findings helped in the formation of the framework. The synergy between proper resource management and ICT4D sustainability was illustrated. It was elucidated that the proposed resource management framework can be applied to rural ICT4D in Zimbabwe and other development countries operating under similar circumstances. Finally, the expert review of the proposed framework was covered.

Chapter 7

Conclusion

7.1 Background

This research sought to explore how proper resource management can be applied to enhance the sustainability of rural ICT for Development (ICT4D) projects in Zimbabwe. A study of literature covering rural ICT4D management and sustainability in developing countries was conducted. Furthermore, a case study of three ICT4D projects in Zimbabwe was performed to identify the real-life circumstances surrounding the current management of resources and the implications to the projects' sustainability. Ultimately, a framework informed by the literature and case study findings was designed.

This chapter will evaluate the outcomes of the research to establish if the objectives of the research were achieved. Subsequently a section covering the contribution of the research is outlined. Direction for future research is suggested, followed by limitations of the study, and lastly a conclusion closes the research report.

7.2 Evaluation of the Research Outcomes

The prime objective of this study was to develop a resource management framework for ICT4D projects in rural Zimbabwe. Research questions were formulated to seek evidence to support the argument of the study. The framework, which was informed by theory from the literature review and findings from the fieldwork, was designed to assist ICT4D organizations in improving sustainability through proper resource management.

The following problem statement was identified:

The lack of proper resource management methods results in sustainability failure of ICT4D projects in rural Zimbabwe.

To address the problem and to meet the research objective, the following main research question was used:

7.2.1 Main Research Question:

How can proper resource management be applied in ICT4D projects in rural Zimbabwe to improve sustainability?

Meeting the primary objective of the research was the target of the main research question. The supposed problem and the proposed solution were encapsulated in this question to probe if the research problem was really a problem and how it could be solved. The sub-questions following were used to break down the main research question into units that would assist the researcher to search for ICT4D resource management theory from literature and to carry out a real-world investigation through a qualitative enquiry.

7.2.1.1 Secondary research question 1:

How are the rural ICT4D projects in rural areas of Zimbabwe currently managed?

This secondary question was conversed in the literature review in Chapter 2 and Chapter 5 in the research findings. Chapter 2 focuses on the management of ICT4D projects in developing countries. The semi-structured questions pertaining to this secondary question, whose findings are reported in Chapter 5, were aimed at extracting the challenges related with the resource management process.

The findings and recommendations from this secondary research question were as follows:

- Developing countries face resource management challenges that contribute to the sustainability failure of ICT4D projects. There is need for context sensitive techniques to guide the management of rural ICT4D projects.
- The resource management methods used in ICT4D in rural Zimbabwe are unstructured and undocumented; resources are managed in adhoc manner. A structured and documented resource management method is recommended to help the ICT4D project managers and their project teams to properly plan investment in resources and to effectively maintain and safeguard the resources they already have.

7.2.1.2 Secondary research question 2:

What are the factors influencing sustainability of rural ICT4D projects in Zimbabwe?

This question focused on revealing the current problems that are contributing to the sustainability failure in rural ICT4D projects in Zimbabwe. Chapter 3 reviewed literature on sustainability and its influencing factors; Chapter 4 outlined the methods that were used to collect data on sustainability, and chapter 5 narrated the findings from the data.

- Rural ICT4D projects in Zimbabwe currently lack methods that link their resource management processes with their projects' sustainability goals. It is necessary for the ICT4D players in rural Zimbabwe to link their resource management approach with their sustainability goals. This will ensure that the resource management process is not only methodical, but goal oriented as well.
- There are no monitoring and control measures for the current resource management processes. Monitoring and control of the resource management could aid the ICT4D players in Zimbabwe to continuously evaluate their resource management processes to identify areas that need to be improved. This will facilitate responsiveness to the sustainability needs of the projects.
- There are no plans for improving the current resource management process. If sustainability is to be achieved, improvement planning is required for the current resource management processes identified from the field work.
- Technological, environmental, social, financial and political challenges hinder the sustainability of ICT4D projects in Zimbabwe. These challenges are linked to the failure to manage resources. Addressing the resource management problems can help in the achievement of sustainability.

7.2.1.3 Secondary research question 3:

What can be done to ensure sustainability of rural ICT4D projects in Zimbabwe?

The question sought to find an ultimate solution to the research problem. This question was addressed by Chapter 6 with input from all the preceding chapters as well. Chapters 2 and 3 gave a theoretical background upon which the data enquiry was based. Chapters 4 and 5

explained the procedures that were used to obtain data with which to answer the research questions together with the findings from the collected data. The literature and fieldwork findings were used to make recommendations that led to the design of the framework in Chapter 6.

The literature study and the field enquiry confirmed that the problem statement was valid, as the findings revealed that the lack of proper resource management methods results in sustainability failure of ICT4D projects in rural Zimbabwe. The research objective was met by the framework which was formulated from theory and findings. The framework captures the research problem and provides a solution for the initially identified resource management problem. The research questions were all answered; this can be seen by the findings which addressed all the queries posed. A convergence between the research problem, research objectives and research question can be observed from the above narrative of the research outcomes.

7.3 Contribution Made

This study is informed by an intense review of other past work in ICT4D management and sustainability, and tries to build upon it. Sen's Capability Approach, the Resource Based Theory and the COBIT framework are the influential theories underlying the research.

Sen's Capability Approach has been used in ICT4D to assess how people's livelihoods can be improved by the use of ICTs as a tool for development. This research builds upon this and further expounds that Sen's Capability Approach can also be applied to view resource management as an enabler for the sustainability of rural ICT4D projects, thereby enhancing development - a freedom that is required by rural communities.

Additionally, the Resource Based Theory which has been widely used in economics research was applied to ICT4D research and its contextual layout guided the formation of the proposed resource management framework. Similarly, the study implemented the COBIT framework (which is commonly used in commercial IT research) to analyse how critical IT resources embedded in ICT4D institutions can be systematically managed to enhance sustainability.

7.4 Directions for Future Research

The scope of rural ICT4D sustainability and resource management is broad and comprehensive. In order to create attainable principles that guide proper resource management to improve sustainability, there is need for exploration of the following as future research:

- The adoption of resource management frameworks in a constrained environment. This research would focus on how ICT4D projects running in countries that have political and economic conditions that hinder effective acquisition and availability of crucial infrastructure can overcome resource management challenges that are beyond their control.

- Evaluating contextual sustainability of ICT4D projects in marginalized regions. The study will focus on assessing the sustainability of projects in terms of the needs and priorities of the contextual environment in which they run.

7.5 Limitation of the study

This research has presented a perspective on the sustainability of ICT4D projects through proper resource management development and was performed in a rural setting through engaging village ICT4D project teams and users. Consequently, some participants did not understand English and the researcher had to deliver some questions in the local language. This took more time – both to translate from the semi-structured question list which was written in English and to write notes in English from the participants' answers which were given in the local language. However, this did not affect the results as the interviews were recorded, and during the analysis write-ups were made in English to facilitate easy analysis.

7.6 Conclusion

The sustainability challenges faced by rural ICT4D projects running in Zimbabwe can be alleviated by the implementation of proper resource management methods. The identified problem of lack of proper resource management in rural ICT4D was examined by a study of literature on this subject together with a field study that was conducted in three rural areas of Zimbabwe. Results from the literature and field study were employed in the construction of the resource management framework, thus the research objective was achieved. The significance of the study is revealed in the framework's characteristics of being a product of findings obtained from real-life situations faced by rural ICT4D players and that it was built upon other reviewed frameworks. The framework can be useful for implementation in other ICT4D projects in developing countries that operate under conditions similar to Zimbabwe's. Applying the principles in the proposed resource management framework can assist organizations engaging in ICT4D to manage their resources properly in order to enhance sustainability.

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Appendices

The following is a list of appendices for this research.

Appendix A: Semi structured questions used in the study

Appendix B: Data Collection Letter

Appendix C: Link between Literature Review and Project Team Questions

Appendix D: Link between Literature Review and Project Users Questions

Appendix A – Semi structured interview questions

A RESOURCE MANAGEMENT FRAMEWORK FOR SUSTAINABILITY OF RURAL ICT4D PROJECTS IN ZIMBABWE

Semi structured Questionnaire

Questions for the Users

1. What are the current services you are gaining from the computers in the project?

   ……
   ……

   ……
   ……

   a. Please explain any specific rural development activity currently taking place in the rural community that these applications support? *For example:*
      i. Access to markets
      ii. Educational Access
      iii. Access to Health facilities
      iv. Rural Empowerment

2. In your own view, how does the ICT4D project bring about **sustainable development** in the community?

   ……
   ……

3. Do you think you there is room for more rural development benefits to be gained from this project?

   ……
   ……

4. What are the other ICT resources that you use from the project, apart from the applications mentioned in 1(a)? For example:
   a. Infrastructure……..
   b. Information……
   c. Human resources……..

5. Do you have any suggestions for improvement of the way the project's resources are managed, and shared among users from the community?

6. Have you faced any barriers and challenges to ICT use in the project? Please explain

   ……

   ……

   a. How have you addressed these challenges?

   Financial

   Challenges……

   ……

   Political

   Challenges……

   ……

   Social

   Challenges……

   ……

   Cultural

   Challenges……

   ……

   Technical

   Challenges……

   ……

7. What do you think the community could do to keep this project sustainable?

A RESOURCE MANAGEMENT FRAMEWORK FOR SUSTAINABILITY OF RURAL ICT4D PROJECTS IN ZIMBABWE

Semi structured Questionnaire

Project team questions

1. Please briefly explain the **ICT for development (ICT4D) project** you are currently undertaking?

……
……
……
……..

2. What are the major goals and objectives of the project? Describe any documentation that explains and describes these goals and objectives
   ……
   ……
   ……
   ……

3. Describe how these ICT4D projects are aimed at bringing about **sustainable development** in the rural area.

……
……
……
……

4. What ICT applications do you use in the project?

……
……
……
……

a. What are the current specific uses of ICT in your project?

……
……
……
……

b. Please give reasons for the choice of these specific ICT applications, given in 4a (above)?

……
……
……
……

c. Please explain any specific rural development activity currently taking place in the rural community that these applications support?

……
……
……
……

d. Please outline any further uses for ICT that you have planned for the future?

……
……
……
……

5. What are the barriers and challenges to ICT use that you think the *community* has faced?

……
……
……
……

a. What have you done to mitigate and deal with these challenges?

Financial
Challenges……
……

Political
Challenges……
……

Social
Challenges……
……

Cultural
Challenges……
……

Technical
Challenges……
……

b. What are the barriers and challenges to ICT implementation in the community that *the project team* has faced?

Financial
Challenges……
……

Political
Challenges……
……

Social
Challenges……
……

Cultural
Challenges……
……

Technical Challenges……
……

6. What are the **resources available** in the project?

    a. Infrastructure Resources (Electricity, Roads, Railway, Technology, Networking Equipment, Buildings)
    ……..……
    ……
    ……
    ……

    b. Information Resources
    ……
    ……
    ……..……
    ……

    c. Applications Resources (Software etc)
    ……..……
    ……
    ……..……
    ……

    d. People (Human resources, stakeholders)
    ……
    ……
    ……
    ……..……

7. Explain your **resource management** approach and how you have adopted other ICT project resource management approaches (if any).

8. How are the following **Resources managed** in your project?

    Applications, People, Services, Infrastructure, Skills and competences, Information
    ……

……

……..……

9. Does your resource management approach aim at promoting rural ICT project sustainability and how?

……

……..

……..……

……..……

10. What resource management plans are available to accomplish the goal of the project?

……

……..

……..……

……..……

a. What procedures did you plan for the resource management of the project?

……

……..

……..……

……..……

b. Why these procedures?

……

……..

……..……

……..……

c. How (or what) did you plan for resources to be allocated to the project?

……

……..

……..……

……..……

d. What planned procedures have you implemented?

……
……..
……..……
……..……

e. Are the resource management procedures significantly susceptible to rural constraints and activities? E.g. in terms of the challenges they face.

……
……..
……..……
……..……

11. Is the resource management process continuously monitored and controlled? Why? How?

……
…….. ……

12. How would you like your existing resource management in your project to improve?

Appendix B – Data Collection Letters

Dear Sir/Madam,

My research focuses on ICT for Development (ICT4D) resource management. I am interested in finding out more about how you manage ICT4D projects' resources. I am carrying out this research to help ICT4D projects in developing countries to become successful and sustainable through proper resource management. I am requesting to do data collection with your organization. The process will include semi-structured interviews, observations and documentary analysis.

I would like to interview a sample from your ICT4D project's following groups; project managers, communal users and project staff members. The number of people I will interview will depend upon how many you have in the above mentioned groups whom you think will be able to give relevant information. The interviews will be one on one and semi structured. The approximate length of each interview will be 45-60 minutes. I have 7 questions for the community and 12 questions for the project managers and staff. The questions for the project managers and staff will focus on sustainability and resource management challenges and suggestions for improvement. Questions for the community will be on the challenges they have experienced with regard to their needs being met and their suggestions for project improvement.

I would also like to do document analysis to gather data on the flow of information on resource management within your project together with observations to generate data on the current state of resource management within the project. These will each be approximately 45-60 minutes long. The document analysis will focus on the documents you think are relevant to depict your resource management. For the observations, I would need to observe the project site and its activities. This will help me to see how the project is running, the resources you use and the environment. My proposed dates for the data collection are …….., if possible. If you have any queries concerning the nature of the research or are unclear about any question please contact me at tarihope@gmail.com.

Finally, thank you for taking the time to help me with my research. It really is much appreciated.

Yours sincerely,

Hope Mugoni.

Appendix C – Link between Literature Review and Project Team Questions

QUESTION	LTERATURE LINK
1. Please briefly explain the ICT for development (ICT4D) project you are currently undertaking.	Section 2.4
2. Explain the specific goals and objectives of the project. Describe any documentation that clarifies and explains these goals and objectives.	Section 2.6
3. Describe how the ICT4D project is aimed at bringing about sustainable development in the rural area.	Section 3.3
4. Please mention the ICT applications you use in the project and their particular uses in your project. Elaborate reasons for choosing these particular ICT applications, given in 4a (above). Is there any development activity currently taking place in the community that these applications support? Explain. What are your future plans for ICT use?	Section 2.10, Section 3.7
5. In your opinion what are the barriers and challenges faced by the *community* in using the centre? How have you dealt with these challenges? Explain the barriers and challenges that you and your team have faced in implementing the project in the community?	Section 3.5
6. What are the resources available in the project?	Section 2.10, Section 3.8
7. Explain your resource management approach and how you have adopted other ICT project resource management approaches (if any).	Section 2.11, Section 3.8
8. How are the resources managed in your project?	Section 2.8
9. Does your resource management approach aim at promoting the project's sustainability and how?	Section 3.8
10. What resource management plans are available to accomplish the goal of the project?	Section 2.11, Section 3.8
11. Is the resource management process continuously monitored and controlled? Why? How?	Section 2.11
12. How would you like your existing resource management in your project to improve?	Section 2.11, Section 3.8

Appendix D – Link between Literature Review and Project Users Questions

QUESTION	LITERATURE LINK
1. What are the current services you are gaining from the computers in the project? Please explain any specific rural development activity currently taking place in the rural community that these applications support?	Section 2.8, Section 3.5
2. In your own view, how does the ICT4D project bring about sustainable development in the community?	Section 2.6
3. Is the project meeting your needs? Are there any future services that you think would be of more benefit to you and other community members?	Section 2.7
4. What are the other ICT resources that you use from the project, apart from the applications mentioned in 1(a)?	Section 2.11
5. Do you have any suggestions for improvement of the way the project's resources are managed, and shared among users?	Section 3.6
6. Have you faced any barriers and challenges to ICT use in the project? Please explain how have you addressed these challenges?	Section 3.7
7. What do you think the community could do to keep this project sustainable?	Section 3.8